DOCKETED	
Docket Number:	18-ALT-01
Project Title:	2019-2020 Investment Plan Update for the Alternative and Renewable Fuel and Vehicle Technology Program
TN #:	229506
Document Title:	California Sustainable Freight Action Plan
Description:	Multi-Agency report dated July 2016
Filer:	Tami Haas
Organization:	California Energy Commission
Submitter Role:	Commission Staff
Submission Date:	8/22/2019 9:32:46 AM
Docketed Date:	8/22/2019

CALIFORNIA SUSTAINABLE FREIGHT ACTION PLAN

Governor Edmund G. Brown Jr.

July 2016

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California Sustainable Freight Action Plan

DOCUMENT AVAILABILITY

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PROGRAM WEBPAGE

For more information on the Action Plan and upcoming meetings,
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QUESTIONS

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This document is the outcome of extensive collaboration between many staff members from the California Department of Transportation, the Air Resources Board, the California Energy Commission, and the Governor's Office of Business and Economic Development. Publication of this document does not constitute the approval of any particular project, but is intended to outline broad policy objectives and potential strategies to achieve them. Any potential actions, projects, or funding will undergo subsequent public process. Mention of specific entities, trade names, or commercial products does not constitute approval, endorsement, or recommendations for use.

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Executive Summary

In July 2015, Governor Brown issued Executive Order B-32-15 (see Appendix A), which provides a vision for California's transition to a more efficient, more economically competitive, and less polluting freight transport system. This transition of California's freight transport system is essential to supporting the State's economic development in coming decades while reducing harmful pollution affecting many California communities.

Improving the efficiency of California's freight transport system is vital to our State economy. Traditional routes of moving freight face increasing competition from across the globe, and California's system must anticipate and stay ahead of these changes. Currently, California is the nation's largest gateway for international trade and domestic commerce, with an interconnected system of ports, railroads, highways, and roads that allow freight from around the world to move throughout the State and nation. This system is responsible for one-third of the State's economic product and jobs, with freight-dependent industries accounting for over $740 billion in gross domestic product and over 5 million jobs in 2014. However, California's freight transport system is under pressure to serve our growing population and satisfy dynamic market demands, while other locations in the United States (U.S.) and across the world are fiercely competing for this economic activity.

At the same time, modernizing California's freight transport system in a manner that improves safety and reduces pollution is essential to improve public health and meet our environmental imperatives. Freight transportation in California generates a high portion of local pollution in parts of the State with poor air quality. Reducing these harmful pollutants is an important local, regional, and State priority, as well as a matter of compliance with the federal Clean Air Act. California has also recently set new, aggressive targets for reducing greenhouse gas emissions 40 percent below 1990 levels by 2030 in order to combat climate change. Reducing emissions in the freight sector is critical to meeting these 2030 targets.

The objectives laid out in the Governor's Executive Order to improve efficiency and reduce pollution of the freight transport system are not new. California's freight transport system has already successfully undergone major improvements toward shared efficiency and environmental objectives. Proposition 1B, passed by voters in 2006, provided almost $20 billion in funding for California's transportation infrastructure, with over $2 billion dedicated to the improvement of the State's freight network and $1 billion in funding for cleaner freight vehicles and equipment. Local and regional groups such as port commissions and metropolitan planning organizations are also taking action to improve freight operations. Large ports have adopted Clean Air Action Plans and many regional planning organizations have adopted regional freight plans that prioritize infrastructure improvements and

improve land use to better operationalize logistics activities in their region.

While California's freight transport system has already undergone extensive modernization over the last several years and will continue to leverage improvements already completed and those underway, State government must take further action in close partnership with federal, regional, local, labor, business, and environmental and community-based leaders to achieve the next step in the evolution of the freight sector. We are already beginning to see technology advances in autonomous and connected vehicles, three-dimensional printers, and drones that change the realm of possibility for this system. The pace and timing of advances in technology must involve all stakeholders to determine how best to harness their environmental and community benefits, economic and job growth potential, and gains in system efficiency. Recognizing that the freight transport system is dynamic and continuously adjusting to meet ever-changing system demands, California must take hold of opportunities within this active system to help achieve the objectives in the Governor's Executive Order.

This will involve strategic partnerships and well-planned investments around deployment of new technologies and major infrastructure upgrades. Near-term efforts must integrate new technologies that are commercially viable, help promising technologies become commercially viable through tools like purchase incentives and aggregated group purchasing, as well as provide supportive infrastructure upgrades. New federal funding for freight projects, the State budget, and other sources of revenue, present new opportunities for leveraging additional federal, State, local, and private investment for these freight transport system improvements.

State government must take further action in close partnership with federal, regional, local, labor, business, and environmental and community-based leaders to achieve the next step in the evolution of the freight sector.

At the same time, working with community partners who live and work near major freight corridors and facilities that have localized impacts will be vital to realize the "three e's" of sustainability – environment, economy, and equity. State agencies recognize that it is essential to more effectively seek and integrate community input into development of freight air quality and energy strategies, as well as all stages of freight infrastructure and facility planning, including mitigation relative to future freight projects.

As a key first step, the Governor's Executive Order directs the California State Transportation Agency, California Environmental Protection Agency, Natural Resources Agency, California Air Resources Board, California Department of Transportation, California Energy Commission, and Governor's Office of Business and Economic Development to develop a California Sustainable Freight Action Plan (Action Plan), by July 2016. This Action Plan is an unprecedented effort, intended

to integrate investments, policies, and programs across several State agencies to help realize a singular vision for California's freight transport system. This Action Plan provides a recommendation on a high-level vision and broad direction to the Governor to consider for State agencies to utilize when developing specific investments, policies, and programs related to the freight transport system that serves our State's transportation, environmental, and economic interests.

This integrated approach will serve to coordinate State agency priorities and timing on actions to influence freight transportation and energy infrastructure, vehicle and equipment technologies, and facility and operations efficiency, rather than the traditional and separate planning efforts for transportation, environment, and energy. The Action Plan includes recommendations on:

- A long-term 2050 Vision and Guiding Principles for California's future freight transport system.
- Targets for 2030 to guide the State toward meeting the Vision.
- Opportunities to leverage State freight transport system investments.
- Actions to initiate over the next five years to make progress towards the Targets and the Vision.
- Pilot projects to achieve on-the-ground progress in the near-term.
- Additional concepts for further exploration and development, if viable.

The Action Plan is the beginning of a process, and signals State government's interest in collaborating with stakeholders on defining the actions necessary to make the vision for a sustainable freight transport system a reality. This Action Plan is not intended to replace other planning processes and documents such as the California Freight Mobility Plan or regional goods movement plans, but rather is intended to inform those efforts by providing a new perspective regarding the sustainability of the freight system and framework for ongoing collaborative processes. State agencies are committed to assessing the impacts of the Action Plan's recommended actions. Deeper analysis of certain actions can take place over time if and when the recommendations are being developed into specific proposals.

The Action Plan is the beginning of a process, and signals State government's interest in collaborating with stakeholders on defining the actions necessary to make the vision for a sustainable freight transport system a reality.

Moving forward, success will require government, industry, labor, and environmental and community leaders to stand together on this vision, as well as on a process to refine, build on, and prioritize actions that will attract needed funding (federal, State, local, private), and facilitate necessary legislative action.

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I. California's Freight Transport System in 2030 and Beyond

Executive Order B-32-15 (see Appendix A) identifies the need for a broader and more unified approach between State agencies and with stakeholders to improve the efficiency, transition to zero emission technologies, and increase the competitiveness of California's freight transport system. It also recognizes that a long-term outlook is necessary to plan for and develop a sustainable freight transport system. This section describes the current policy drivers, provides the State's Vision and Guiding Principles for a sustainable freight transport system, and Targets to track California's progress toward the Vision.

A. Current Policy Drivers

Challenges confronting policymakers in the freight transport sector are similar to those in the broader transportation sector generally, including how to modernize existing systems to support economic growth and ensure a healthy, livable environment. In response to this challenge, federal, State, regional, and local leaders need to more effectively partner with stakeholders including industry, labor, environmental and community-based organizations on devising broad strategies to ensure regions and the State can meet economic, environmental, public health, livability, and mobility goals in the era of climate change, and then aligning investments toward these objectives.

Executive Order B-32-15 emphasizes the need to accelerate California's transition to a more efficient and less polluting freight transport system. The objectives laid out in the Governor's Executive Order represent a continuation of the State's priorities on an array of transportation, environmental, energy, and economic goals and objectives.

- Preserving and enhancing freight infrastructure: Sustaining the roadway and bridge system in a state-of-good-repair as it ages to ensure proper preservation, enhancement, and maintenance into the future is critical to the smooth operation and reliability of the freight transport system. It is a challenge that will require dedicated and permanent funding necessary to ensure today's infrastructure is sufficient to meet the current and growing demands from modern and future freight equipment.

- Increasing system efficiency and capacity: Anticipated freight and population growth coupled with a reduction in available and compatible land near traffic-congested areas create the urgency to increase system capacity with limited room for infrastructure expansion.

Case Study

Freight Facility Modernization — San Pedro Bay Ports

Increased congestion and wait times are driving technological changes and expansions at the Ports of Los Angeles and Long Beach. Both Pasha and Long Beach Container Terminal have invested billions of dollars in advanced technology to improve efficiency, competitiveness, and air quality at west coast seaports. Some of the improvements include automated overhead cantilever cranes, deeper berths, expanded on-dock rail, a solar-powered microgrid, and zero and near-zero emission vehicles and cargo handling equipment. These changes will increase the capacity and throughput of terminals, reduce truck trips, and improve air quality near the ports. At the same time, these transitions in technology require targeted investments in job creation, retention, and training for skilled labor needed to operate and service modernizing facilities.

- Improving safety and security: Reducing freight-related injuries and fatalities remains of utmost importance requiring continuous improvement to accommodate current and anticipated future vehicles and technology. It is necessary to increase awareness, prevention, and protection while allowing commerce to flow.

- Reducing exposure to air toxics: Despite substantial progress over the last decade, the diesel equipment operating in and around freight hubs continues to be a significant source of air toxics that can cause localized risks of cancer and other adverse health effects. New health science tells us that infants and children are 1.5 to 3 times more sensitive to the harmful effects of exposure to air toxics than we previously understood, which heightens the need for further risk reduction.

- More protective air quality standards: The federal Clean Air Act requires the State and local air districts to prepare State Implementation Plans demonstrating how the State will attain the national 8-hour ozone and fine particulate matter standards, with plans due in 2016. Attaining the current standards for the 2023 to 2032 timeframes will require broad deployment of zero and near-zero emission technologies in the South Coast and San Joaquin Valley air basins. Currently, freight equipment accounts for about half of the statewide diesel particulate matter emissions, and approximately 45 percent of the statewide nitrogen oxides emissions. Emission reductions from the freight transport system need to be part of the solution.

- Climate change goals: In April 2015, Governor Brown signed Executive Order B-30-15 establishing a 2030 greenhouse gas emissions reduction target of 40 percent below 1990 levels, addressing the need for climate adaptation, and directing State government to:

- Incorporate climate change impacts into the State's Five-Year Infrastructure Plan.
- Update the State's comprehensive strategy for safeguarding against climate impacts.
- Factor climate change from a lifecycle perspective into State agency planning and investment decisions.
- Implement measures under existing agency and departmental authority to reduce greenhouse gas emissions.

Governor Brown further identified five key climate change strategy pillars for California to help achieve the 2030 emissions reduction target:

- Reducing petroleum use in cars and trucks by up to 50 percent.
- Increasing the amount of electricity derived from renewable sources to 50 percent.
- Doubling the efficiency savings achieved at existing buildings.
- Reducing emissions of short-lived climate pollutants.
- Managing natural and working lands so they can store carbon.

Meeting the targets and strategy pillars will require additional actions to decarbonize California's freight transport system. Currently, the system generates six percent of the State's greenhouse gas emissions, with total freight greenhouse gas emissions anticipated to increase without further action.

- Supporting economic competitiveness: The freight industry is a major economic engine for our State and supporting the competitiveness of the freight transport system will be key to the continuing prosperity of California.

- Workforce development: Freight-dependent industries are critical to supporting California's workforce, accounting for over 5 million jobs in 2014. A skilled and nimble workforce will be one key factor in competitiveness as firms continue to adjust to rapidly evolving markets. Expanding well-paid job opportunities in the trade sector will improve the State's overall economic health and support the transition to a sustainable freight transport system.

- Completing economic analysis: Assessing the impacts of actions, including the distribution of potential costs and benefits on California businesses, consumers, and the economy with public input is a critical part of the regulatory development process. Full economic impact analyses are required for all regulatory actions adopted by the Office of Administrative Law.

B. Vision and Guiding Principles

Affecting the future freight transport system in a way that supports meeting the State's multiple goals and objectives will take consistent, concentrated effort by both public and private interests over decades. To help frame this effort, the State agencies developed and recommend the following Vision statement and Guiding Principles for California's sustainable freight transport system. The intent of the Vision and Guiding Principles is to inform ongoing and future planning documents, project selection, and investment processes as they relate to the sustainability of the freight transport system.

Vision for a Sustainable Freight Transport System

Utilize a partnership of federal, State, regional, local, community, and industry stakeholders to move freight in California on a modern, safe, integrated, and resilient system that continues to support California's economy, jobs, and healthy, livable communities. Transporting freight reliably and efficiently by zero emission equipment everywhere feasible, and near-zero emission equipment powered by clean, low-carbon renewable fuels everywhere else.

Guiding Principles

In the coming years, the California freight system should achieve all of the following through public, industry, and stakeholder collaboration to make progress toward the long-term vision:

- Support local and regional efforts to improve trade facilities and corridors that achieve regional environmental, public health, transportation, and economic objectives consistent with statewide policy goals.
- Grow the economic competitiveness of California's freight sector.
- Grow the number of well-paying employment opportunities in the freight sector.
- Reduce freight-related deaths and injuries, and security threats.
- Reduce or eliminate health, safety, and quality of life impacts on communities that are disproportionately affected by operations at major freight corridors and facilities. This includes reducing toxic hot spots from freight sources and facilities, and ensuring continued net reductions in regional freight pollution.
- Improve the state-of-good-repair of the multi-modal freight transportation system.
- Invest strategically to improve travel time reliability and to achieve sustainable congestion reduction on key bottlenecks on primary trade corridors.
- Apply innovative and green technology, along with accompanying infrastructure and applicable practices, to optimize the efficiency of the freight transportation system.
- Invest strategically to accelerate the transition to zero and near-zero emission equipment powered by renewable energy sources, including supportive infrastructure.
- Improve system resilience by addressing infrastructure vulnerabilities associated with expected climate change impacts and natural disasters, which may include exploring opportunities to utilize natural systems to improve water quality, reduce ecosystem damage, prevent flooding, and create a cooling effect.
- Site freight projects to avoid greenfield development by enhancing existing freight infrastructure or targeting infill development near compatible land uses.

C. Freight Targets

Executive Order B-32-15 directed the State agencies to establish targets to improve freight efficiency, transition to zero emission technologies, and increase the competitiveness of California's freight transport system. Below are the Targets to meet this direction and track California's progress toward meeting the Vision and Guiding Principles. Measurable targets will help the State agencies evaluate and adapt implementation of the Action Plan over time. The Targets are not mandates, but rather aspirational measures of progress toward sustainability for the State to meet and try to exceed. The State agencies will measure and report progress on the following statewide Targets, and will evaluate the Targets to determine necessary adjustments in 2019.

System Efficiency Target
Improve freight system efficiency 25 percent by increasing the value of goods and services produced from the freight sector, relative to the amount of carbon that it produces by 2030.

Transition to Zero Emission Technology Target
Deploy over 100,000 freight vehicles and equipment capable of zero emission operation and maximize near-zero emission freight vehicles and equipment powered by renewable energy by 2030.

Increased Competitiveness and Economic Growth Targets
Establish a target or targets for increased State competitiveness and future economic growth within the freight and goods movement industry based on a suite of common-sense economic competitiveness and growth metrics and models developed by a working group comprised of economists, experts, and industry. These targets and tools will support flexibility, efficiency, investment, and best business practices through State policies and programs that create a positive environment for growing freight volumes and jobs, while working with industry to mitigate potential negative economic impacts. The targets and tools will also help evaluate the strategies proposed under the Action Plan to ensure consideration of the impacts of actions on economic growth and competitiveness throughout the development and implementation process.

See Appendix B for further discussion of the Targets.

II. Investing in California's Freight Transport System

Improving California's freight transport system is a smart investment, with benefits to the economy and environment, as demonstrated through the State's experience with the freight programs funded by Proposition 1B over the last decade. Through the $3 billion Proposition 1B Trade Corridors Improvement Fund and Goods Movement Emission Reduction Program, the State was able to leverage over $5.5 billion dollars from other sources to deliver over 90 transportation projects and more than 13,000 clean truck, locomotive, and marine vessel technology projects in California. The State's investment approach in these programs, committing a two to one dollar investment to freight corridor infrastructure and clean equipment, enabled it to simultaneously reduce harmful air pollution from freight-related activity and provide improvements to California's transportation infrastructure.

With the federal Fixing America's Surface Transportation Act providing a new source of freight funding for California's existing programs, and the Governor's current transportation funding proposal offering potential revenues for trade corridor investments, the State needs to build on the momentum of California's success in these earlier programs. By positioning itself to implement a similar magnitude of public and private partnering, significant benefits can be achieved for both public and private partners, as well as communities. Prudent public and private investments present the opportunity to move more freight faster and with less emissions, benefiting cargo owners, shippers, distributors, manufacturers, processors, and producers, while at the same time resulting in broader public benefits such as substantially reduced health and environmental impacts on local communities, and reduced greenhouse gas emissions. New public investments in the freight transport system should help a thriving freight based economy by supporting economic development and employment growth.

Ongoing public funding will be a fundamental need to advance progress towards meeting the Targets and Vision. The freight industry as a whole will need to continue to position itself through effective collaborative partnerships to attract new private sector, federal, State, and local agency investments. This can be accomplished by joining successful elements and procedures of past freight programs under Proposition 1B with new public freight funding and continuing to provide public support of private investment through avenues such as matching grants, financing assistance, and bulk purchasing power.

A. Potential Freight Funding

This section discusses new and proposed public freight funding source options for

new investments in California's freight transport system, both the infrastructure and the vehicles and equipment that move cargo. See Appendix G for additional details on the programs below and discussion of current freight funding programs.

1. Fixing America's Surface Transportation Act

On December 4, 2015, President Obama signed into law a new five year, $305 billion surface transportation bill, the "Fixing America's Surface Transportation (FAST) Act," which authorizes funding for existing core highway and transit programs and created two new freight programs funded by the Highway Trust Fund. These include the National Highway Freight Program, from which California will receive an annual average of approximately $117 million per year by formula, and the Nationally Significant Freight and Highway Projects Program that is funded at approximately $900 million per year nationwide and subject to discretionary competitive awards. Prior to the FAST Act, the U.S. did not have a coordinated freight investment program. By establishing a dedicated, committed funding source, the FAST Act significantly advances public policy for freight and sends the underlying message to all of the importance of freight movement and freight supporting infrastructure to the California and U.S. economies.[1]

2. Governor Brown's Funding Proposal

On January 7, 2016, the Governor released his proposed 10-year funding plan that will provide a total of $36 billion for transportation, with an emphasis on repairing and maintaining the existing transportation infrastructure. The Governor's proposal also includes a significant commitment to improving infrastructure on the State's trade corridors, with approximately $2 billion slated for freight infrastructure investments. The package includes a combination of new revenues, additional investments of Cap-and-Trade auction proceeds, accelerated loan repayments, the California Department of Transportation's (Caltrans) efficiencies and streamlined project delivery, accountability measures, and constitutional protections for the new revenues.[2]

The Governor's funding proposal also includes a one-year appropriation of funding for cleaner vehicles, equipment, and fuels used to transport passengers and freight, as well as off-road equipment used in agriculture and other applications.

As discussed in the Air Resources Board's (ARB) *Proposed 2016 State Strategy for the State Implementation Plan*, securing additional funding to support incentive-based and other innovative funding programs will be critical to achieve our air quality and climate goals, including the specific zero emission technology Target

[1] See https://www.fhwa.dot.gov/fastact/legislation.cfm.
[2] See Governor's Budget Summary 2016-2017, http://www.ebudget.ca.gov/FullBudgetSummary.pdf.

in this Action Plan.[3] ARB is also working with its local partners to identify funding needs and mechanisms to support the scale of zero and near-zero emission mobile sources that is essential for attainment of federal air quality standards. The freight industry will continue to need incentives for early adopters of new technologies and to help accelerate the widespread transition to those technologies.

B. Approach to Ongoing Freight Investments

Building on the partnerships established in the course of developing this document, the State agencies must work together to achieve complementary goals to improve the effectiveness of freight-related funding programs and projects. All of the agencies involved in funding freight transport system improvements should promote the Action Plan goals by investing to support the State's economy and freight related jobs, seeking opportunities to promote clean fuels and transition to zero emission technologies, and investing in the State's critical freight infrastructure needs. In addition to statutory requirements, the Guiding Principles discussed earlier characterize priorities for future investments made by the State's freight funding programs. Keeping in mind the desire to leverage the broadest array of public and private financing available, additional coordination is necessary to meet the goals of individual agencies while achieving the Action Plan's Targets and Vision.

In addition to statutory requirements, the Guiding Principles discussed earlier characterize priorities for future investments made by the State's freight funding programs.

The Administration will seek to quickly direct existing freight money such as federal FAST Act funds to improve freight transportation infrastructure. For new ongoing State funds, the process of coordinating freight investments will best be facilitated by the creation of an integrated, statewide funding strategy. For this strategy to be successful, it must address the role played by all investors in the funding and financing of freight infrastructure and equipment. It must also include the identification and support of measures that will maintain such funding and financing on an ongoing basis. Coordination between State agencies and local partners is paramount since there is a strong link between the issues of economy, infrastructure, energy, and air quality investments. The Administration's investments should invoke coordination between State agencies involved in development of the Action Plan, and the State should harness multi-agency collaboration where relevant.

[3] See ARB Proposed 2016 State Strategy for the State Implementation Plan, May 2016, http://www.arb.ca.gov/planning/sip/2016sip/2016statesip.pdf.

One example of this coordination and possibility for expanding new freight funds is a second phase of the Trade Corridors Improvement Fund/Goods Movement Emission Reduction Program.

1. Trade Corridors Improvement Fund/Goods Movement Emission Reduction Program – Phase II

Building upon the successful model of Proposition 1B, Phase II of these programs could combine State and federal transportation funding to support the development of freight infrastructure and clean equipment projects that address the three goals of the Governor's Executive Order B-32-15. As occurred during the previous Proposition 1B process, the Trade Corridors Improvement Fund/Goods Movement Emission Reduction Program-Phase II should improve the freight transport system through complementary programs that commit investments to freight corridor infrastructure and clean equipment simultaneously. The California Transportation Commission, in collaboration with Caltrans and regional planning agencies, would oversee Phase II of the Trade Corridors Improvement Fund and ARB would oversee Phase II of the Goods Movement Emission Reduction Program in coordination with local air districts. ARB and the California Transportation Commission should coordinate the two programs to maximize investments to the greatest extent possible.

Through ongoing collaboration between State, regional, and local governments, the freight industry, and communities, the State would establish criteria to evaluate projects proposed by local agencies and the State. The selection process should involve both a regional selection process and a State selection process to result in interregional and regional priority investments. Potential criteria for consideration include:

- Using performance-based criteria: Using both new and existing data and tools, California monitors both the performance of the State freight transportation network and projected emissions. Multiple metrics measure the effectiveness of State investment programs related to energy, fuels, and freight equipment. These performance targets should serve as a tool for evaluating the positive and negative impacts of freight infrastructure projects, especially as they relate to surrounding communities. They should also serve as a guide when California freight partners collaborate on funding decisions to ensure that investments support mutually desired outcomes, and allow for continued economic competitiveness and growth.

- Targeting National and State priority corridors: Community and roadway system impacts are concentrated more heavily on the freight corridors with the highest volumes. While acknowledging regional equity and the unique freight issues that rural areas face, focusing investments on the State's primary trade corridors and the National Multimodal Freight Network will achieve the greatest benefit.

- Increasing freight system efficiency: Consistent with the Executive Order, the State's investments should include technologies and systems to improve the efficiency of freight operations at specific facilities and along freight corridors such that more cargo can be moved with less emissions. Funding should support innovations such as new technology, operational efficiencies, building multi-modal capacity with advanced technology into freight hubs (e.g. zero emission rail spur at major distribution center), and smart logistics projects that provide a business, transportation, and environmental benefit.

- Prioritization for zero and near-zero emissions: Zero and near-zero emissions equipment have the potential to greatly reduce impacts from freight on nearby communities and regional air quality, as well as climate change. Collaborative funding efforts moving forward should continue to focus on promoting the development and adoption of new, cleaner equipment and supporting infrastructure where technology is most viable and modernizes the system without stranded assets.

- Improving energy use in freight facilities: Reducing energy consumption at freight facilities makes strong business sense and can provide low cost options with short payback periods. Collaborative funding efforts should focus on incorporating energy resiliency through installation of renewable energy generation (e.g., photovoltaic systems) and micro grid deployments where technologies help improve the resiliency of freight facilities, are most viable, and include consideration of costs and benefits.

- Building new fuel and energy infrastructure: Providing low carbon, renewable fuels is critical to a sustainable freight transport system. Collaborative funding efforts should keep in mind the potential to add to the existing network of renewable fuels, electric charging capacity, and alternative energy production facilities. Funding efforts to support the production of alternative and renewable fuels should prioritize leveraging of existing infrastructure when possible. If no opportunities to improve existing infrastructure exist, then efforts should help develop needed additional energy capacity to support the expansion of alternative fuels.

- Utilization of existing transportation infrastructure: Collaborative funding efforts should seek to build upon critical investments already made by the State, regional and local governments, and private industry to better utilize system capacity and make freight transportation cleaner.

- Investing in sustainable communities: As a result of increased attention to sustainable communities in the State, funding should be directed to the extent possible to measures that support the realization of regional long-term greenhouse gas emissions goals in jurisdictions that have adopted rules, regulations, incentives, and operating agreements that will provide for higher levels of environmental and public health benefits.

- Reduce or eliminate air toxic hot spots: Collaborative funding efforts should also seek to avoid, reduce, or eliminate adverse localized impacts of freight projects on surrounding communities. Incorporation of mitigation measures developed in partnership with communities and consistency with existing community land use plans should be prioritized.

The positive aspects of the existing Trade Corridors Improvement Fund and Goods Movement Emission Reduction Program guidelines should be built upon to incorporate the Guiding Principles and listed Actions, and to provide a unified set of screening criteria that may be utilized by all parties investing public funds into the freight system.

III. State Agency Actions and Pilot Projects

All levels of government, industry, and stakeholders need to coordinate efforts to achieve the Targets and realize the Vision. Included in this Action Plan are recommended State agency Actions to support this effort over the next five years, as well as pilot projects to be further developed and considered for shared investment and implementation over the next three years.

In the immediate term, the State agencies directly involved in the development of this Action Plan, along with others, must continue building on the successful partnerships with the legislature, industry, labor, environmental and community groups, federal, regional and local partners. These partnerships have been instrumental to the success of the system so far, helping to develop and execute a combination of adopted Clean Air Action Plans and regional freight plans, regulations, and strategic investments. The Actions and pilot project concepts included in this section represent what is needed to help advance all of these essential elements to the next level.

To plan for the long-term, further consultation and partnership is necessary between State government, freight industry, regional, local, labor, and environmental and community partners who are thinking about the future of business and logistics in California. Achieving the Vision will require big ideas and forward thinking that anticipates how freight, consumers, and manufacturing will change into the future. New technology, infrastructure, and investment concepts must be identified, planned for, and implemented. As a starting place for discussion, this section also identifies transformational concepts for further exploration and potential future action.

A. State Agency Actions

The following State agency Actions are for consideration to support improvement of California's freight transport system over the next five years:

1. Work with the Legislature to enact a freight transport system funding package that enables new investment for transportation assets and advanced vehicles and equipment that move freight in California's freight corridors and is consistent with the long-term Vision and Guiding Principles presented in this document.

2. Work with the Legislature to enact legislation that enables distribution of federal Fixing America's Surface Transportation Act funds based on high-priority State and regional improvements to California's freight corridors as identified in transportation plans and programs.

3. Focus freight infrastructure planning and investments on providing modern freight corridors. Future freight planning and programming documents should identify high-priority projects with multiple benefits for future funding, and establish performance criteria.

4. Accelerate use of clean vehicle and equipment technologies and fuels for freight through targeted introduction of zero and near-zero emission technologies, and continued development of renewable fuels.

5. Convene a freight think tank of experts to provide insight into the demands on the future freight transport system and then identify the transformative technologies, solutions, partnerships, and critical steps to meet those demands, consistent with the Guiding Principles.

6. Convene industry stakeholder working groups to identify a target or targets and deploy strategies that consider commercial viability and promote the competitiveness of California's statewide and local freight transport system. Develop economic growth and competitiveness metrics, models, and other tools and data to analyze benefits and impacts of actions, including costs, and develop and implement a suite of quantitative metrics to track progress in order to ensure that the impacts of actions on economic growth and competitiveness are considered throughout the development and implementation process.

7. Work with the freight efficiency development group to refine its work to identify and deploy strategies to improve the efficiency of freight transport in California now and in the coming years, consistent with the objectives of this Action Plan.

8. Convene stakeholders and the California Workforce Development Board to identify and implement steps to ensure that the existing and future workforce meets the needs of the California sustainable freight transport system and sufficiently skilled labor is available to meet the needs of an expanding freight-related job market.

9. Develop a process involving federal, regional and local agencies, industry, environmental, and community stakeholders, to identify regulatory or permitting process improvements to expedite the delivery of projects identified as meeting the objectives of this plan, while upholding public participation and assessment of environmental, community, and health impacts as part of the process.

The State agencies anticipate beginning development of the above Actions for Board or Commission consideration (if applicable) through appropriate processes within the next five years. To the extent feasible, the State agencies considered planning and development timelines, developed associated implementation steps,

developed estimates of potential direct costs and benefits, and described impacted sectors for these actions in Appendix C.

B. Pilot Projects

The State agencies will also continue working with stakeholders to develop the following three freight pilot project concepts into shared investment opportunities within the next three years. The purpose of these projects will be to demonstrate on-the-ground progress toward a sustainable freight transport system in the near future. Successful demonstrations will serve as launching points for much broader application with the potential to address significant barriers and yield multiple benefits to California's freight transport system.

- Dairy Biomethane for Freight Vehicles (San Joaquin Valley): Work with State and local partners to advance a commercial-scale, dairy biogas sourced, biomethane fueling facility for use in freight and other vehicles. The pilot may focus on implementation of pipeline injection, and the construction of the fueling station.

- Advanced Technology for Truck Corridors (Southern California): Work with partners to promote new technologies that increase efficiencies and encourage zero and near-zero emission vehicles on primary freight corridors. Multiple partners can explore options for intelligent transportation systems, connected and semi-autonomous vehicles technologies, collaborative logistics, and potential incentives for zero and near-zero emission trucks. The pilot may focus on freight signal priority, traveler information systems, and communication systems infrastructure on arterial roads, as well as integrated corridor management on highways.

- Advanced Technology Corridors at Border Ports of Entry (California-Mexico Border): Work with partners to implement information technology management systems, innovative operation techniques, and enhanced traffic management technology. In addition, partner with federal and local stakeholders to incent zero and near-zero emission truck crossings at international ports of entry facilities. The pilot may focus on building capacity for technological means of traffic management, such as Bluetooth sensors in the roadway, Global Positioning System readers, variable messaging, and a specialized border wait time application.

See Appendix D for further discussion of these pilot project concepts.

Successful implementation of each project concept will depend on a number of factors, some within and others outside the control of the State agencies' collective efforts and authority. While the State agencies do not have designated funding for these projects and cannot guarantee eventual implementation of the pilot project concepts, the State Agencies are committed to convening focused efforts around

each concept toward that goal. The State agencies will continue to gather more details on the pilot project concepts described here. As the State agencies move forward, the pilot projects may change or be adjusted. Implementation of these pilot projects will also be conditional based on the successful completion of applicable public processes, identification of project funding through current funding options or new funding, and assessment of economic and environmental impacts.

C. Discussion Concepts for Potential Future Action

In addition to the Actions and pilot project concepts identified above, the State agencies also identified concepts for further exploration and potential future action. These concepts include complex, big picture ideas that are promising, but will require further discussion with experts and stakeholders to determine their feasibility for effective implementation. Concepts include further development of inland marine corridors, non-traditional transport methodologies, packaging optimization, supply chain consolidation in the agriculture industry, local sourcing for local markets, system efficiency improvements like receiver-led consolidation, full integration of chassis pool systems, virtual container yards, and load tracking systems, as well as a programmatic environmental review process to help accelerate freight project construction and operation.

Case Study

Connected Vehicle Technology — I-10 Connected Vehicle Corridor

Connected vehicle technology is a growing innovation that promises expanded capacity and improved vehicle and system efficiencies. Truck platooning allows trucks to virtually connect to one another to form a platoon. Studies show that when trucks platoon, there are a number of aerodynamic benefits realized through reduced drag and improvement of fuel efficiency. Peloton is one of several companies exploring the benefits of truck platooning. Their system uses an advanced cloud communication system to connect braking and acceleration between trucks. The lead truck can control both acceleration and braking of the entire connected platoon. The State is also working to deploy connected vehicle technology. The California Department of Transportation recently entered into a multi-state coalition with Texas and New Mexico to safely develop the Interstate 10 corridor as a connected vehicle corridor.

In addition, there are a few large transformational infrastructure projects either currently proposed or being discussed that could be critical to the development of a sustainable freight transport system: the Interstate 710 Corridor, the State Route 11/Otay Mesa East Port of Entry Projects, and Southern California On-dock Rail. These projects have the potential to provide lessons learned for future actions and a platform for innovative strategies. The State agencies will continue to track project developments and seek opportunities for partnership where appropriate.

See Appendix E for further discussion of these concepts and projects.

IV. Process and Next Steps

This document is an unprecedented step that builds on a strong foundation of research, technical, and stakeholder work. To develop this integrated State agency Action Plan, the State agencies considered technical and stakeholder work associated with the *California Freight Mobility Plan*, the *2014 Integrated Energy Policy Report Update*, the *Sustainable Freight Pathways to Zero and Near-Zero Emissions Discussion Document*, the *Heavy-Duty Technology and Fuels Assessments*, and the *Safeguarding California: Implementation Action Plans Report*. From July 2015 through spring 2016, the State agencies held a series of public workshops and webinars, regular meetings with the California Freight Advisory Committee, as well as numerous meetings with individuals and stakeholder groups such as industry associations, labor, environmental and community groups, California Native American Tribes, and small businesses.

The State agencies released a draft document for public comment on May 3, 2016, and collected comments on the draft through July 6, 2016. A broad range of stakeholders representing industry, regional and local government, labor, and community and environmental groups submitted over 85 comments on the draft Action Plan for consideration. Many of the comments submitted fit into a few major themes, requesting: continued development of work between the State and industry partners on data, metrics, and tools to help increase efficiency and competitiveness of the freight transport system; further commitment and prioritization by the State agencies to address localized community and health impacts in the State's infrastructure and regulatory programs; further clarification in the Action Plan on its role and relationship to existing State and regional plans, State funding activities, and regulatory development; as well as consideration of specific partnerships, technologies, and other concepts as the State agencies proceed with the identified State Agency Actions and supporting implementation steps. The Action Plan incorporates changes throughout the document and appendices to help address these comments and others, with key additions on:

- Next steps for convening and working with an industry stakeholder workgroup on a suite of metrics to support economic growth and competitiveness.

- Priorities for considering community concerns, with direction to avoid, reduce, or eliminate air toxic hot spots and adverse localized impacts of freight projects on surrounding communities.

- A new task to collaborate with stakeholders on developing a statewide, freight funding strategy to help support investments consistent with the long-term Vision and Guiding Principles presented in this document.

- Next step milestones and engagement opportunities to ensure continuity with our partners on Action Plan implementation.

All written comments received by the State agencies can be viewed at http://www.casustainablefreight.org/. See Appendix G for more detail on context, information considered, and public process for developing the Action Plan and Appendix H for a list of organizations that provided comments on the draft Action Plan.

Upcoming activities for the State agencies will include continued work with federal, State, industry, regional, local, labor, and environmental and community-based partners to inform, refine, and prioritize the strategies and actions identified in the Action Plan. The State agencies will seek to engage stakeholders through multiple forums, including: the formation of collaborative stakeholder working groups on competitiveness, system efficiency, workforce development, and regulatory and permitting process improvements, and continued engagement through each State agency's regular planning and regulatory development processes, as well as through periodic updates on implementation efforts at California Freight Advisory Committee meetings.

As the State agencies move forward gathering additional information and developing the Actions, pilot project, and other Action Plan concepts further, the concepts may change, be adjusted, or new concepts may be added. Implementation of the concepts will also be conditional based on the successful completion of applicable public processes, necessary financing approvals, technical analysis, and economic and environmental reviews. It is important to note that full economic impact analyses are required of regulatory actions developed by the Air Resources Board before the Board considers such actions.

The State agencies anticipate the following implementation milestones.

- Late summer 2016: The State agencies will host meetings of both the competitiveness and efficiency stakeholder workgroups.

- September 2016: The State agencies will discuss Action Plan implementation at a meeting of the California Freight Advisory Committee, and anticipate providing additional periodic updates at future California Freight Advisory Committee meetings.

- By January 2017: The State agencies will work on actions to enact a freight transport funding package and distribute federal Fixing America's Surface Transportation Act funds dedicated to addressing key State and regional improvements to freight corridors in California.

- By January 2017: Initiate work to collaborate with industry, regional and local agencies, and others on developing a statewide funding strategy to help support investments in transportation assets and advanced vehicles and equipment consistent with the long-term Vision and Guiding Principles presented in this document.

- Early 2017: The State agencies will host a meeting of the sustainable freight think tank.

- By July 2017: The State agencies will establish work plans for the workgroups on competitiveness, system efficiency, workforce development, and regulatory and permitting process improvements. For pilot projects, the State agencies will prepare work plans for the three project concepts identifying scope, partners, timelines, and funding options.

- By July 2018: The State agencies anticipate providing a full progress report on Action Plan efforts.

- By 2019: The State agencies will evaluate the Action Plan Targets to determine if adjustments are needed.

- By 2019: Statute requires Caltrans to have completed an update of the 2014 *California Freight Mobility Plan*.

Moving forward, the State agencies will also develop ad hoc groups and hold additional stakeholder meetings as necessary to discuss other issues that develop during the Action Plan implementation process.

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Appendix A: Executive Order B-32-15

Executive Department
State of California

EXECUTIVE ORDER B-32-15

WHEREAS California's vast transportation system connects 38 million residents and supports a vibrant economy with $2.2 trillion in annual gross domestic product; and

WHEREAS California's complex freight transportation system is responsible for one-third of the State's economy and jobs, with freight-dependent industries accounting for over $700 billion in revenue and over 5 million jobs in 2013; and

WHEREAS California is the largest gateway for international trade and domestic commerce in the nation, with an interconnected system of ports, railroads, highways, and roads that allow goods from around the world to move throughout the state; and

WHEREAS significant investments in freight infrastructure are necessary to ensure the continued economic competitiveness of our state; and

WHEREAS California has recently set new, aggressive targets for reducing pollution, including decreasing greenhouse gas emissions 40% below 1990 levels by 2030 and cutting petroleum use in cars and trucks by up to half from current levels by 2030 and established strategies to prepare for climate change; and

WHEREAS freight transportation in California generates a high portion of local pollution in parts of the state with poor air quality and an increasing contribution of greenhouse gas emissions; and

WHEREAS the policies and investments of state transportation and environmental agencies can influence California's freight system to become more efficient, competitive, and environmentally sustainable; and

WHEREAS future investments to upgrade freight vehicles and infrastructure should utilize technologies, energy sources, and fuels that enable greater transportation efficiency while reducing community and environmental impacts.

NOW, THEREFORE, I, EDMUND G. BROWN JR., Governor of the State of California, by the authority vested in me by the Constitution and statutes of the State of California, do hereby order the following, effective immediately:

IT IS HEREBY ORDERED that the Secretary of the California State Transportation Agency, the Secretary of the California Environmental Protection Agency, and the Secretary of the Natural Resources Agency lead other relevant state departments including the California Air Resources Board, the California Department of Transportation, the California Energy Commission, and the Governor's Office of Business and Economic Development to develop an integrated action plan by July 2016 that establishes clear targets to improve freight efficiency, transition to zero-emission technologies, and increase competitiveness of California's freight system.

IT IS FURTHER ORDERED that this action plan identify state policies, programs, and investments to achieve these targets, and that the plan be informed by existing state agency strategies, including the California Freight Mobility Plan, Sustainable Freight Pathways to Zero and Near-Zero Emissions, Integrated Energy Policy Report, as well as broad stakeholder input.

IT IS FURTHER ORDERED that to ensure progress towards a sustainable freight system, these entities initiate work this year on corridor-level freight pilot projects within the State's primary trade corridors that integrate advanced technologies, alternative fuels, freight and fuel infrastructure, and local economic development opportunities.

IT IS FURTHER ORDERED that agencies under my direct executive authority cooperate in the implementation of this Order, and it is requested that other public and private entities assist in its development and implementation as appropriate.

This Executive Order is not intended to create, and does not create, any rights or benefits, whether substantive or procedural, or enforceable at law or in equity, against the State of California or its agencies, departments, entities, officers, employees, or any other person.

I FURTHER DIRECT that as soon as hereafter possible, this Order shall be filed with the Office of the Secretary of State and that widespread publicity and notice be given to this Order.

IN WITNESS WHEREOF I have hereunto set my hand and caused the Great Seal of the State of California to be affixed this 16th day of July 2015.

Edmund G. Brown Jr.

EDMUND G. BROWN JR.
Governor of California

ATTEST:

Alex Padilla

ALEX PADILLA
Secretary of State

Appendix B: Freight Targets

Executive Order B-32-15 (see Appendix A) directed the State agencies to establish targets to improve freight efficiency, transition to zero emission technologies, and increase the competitiveness of California's freight system. Below are the Targets to meet this direction. The State agencies will evaluate the targets for necessary adjustments in 2019.

A. System Efficiency

Target: Improve freight system efficiency 25 percent by increasing the value of goods and services produced from the freight sector, relative to the amount of carbon that it produces by 2030.

This target will indicate overall statewide success toward the goal of improving freight transport system efficiency while simultaneously reducing greenhouse gas emissions. Caltrans' Strategic Management Plan, released in 2015, set the target of a 10 percent increase in freight transport system efficiency by 2020. This 2030 target represents further progress from Caltrans' 2020 target.

Traditional measures of system efficiency and performance will also continue to be used to measure progress such as system throughput, reliability, speed, and delay among others. The target and its associated metric are intended to capture overall system-wide efficiency under a single measure. More work is necessary to refine the inputs and to provide a broader basis of comparison with national data where feasible.

To measure progress toward the 25 percent system efficiency target, the State agencies have developed a metric that compares the value of goods and services produced from the freight sector, relative to the amount of carbon that it produces. The metric acknowledges the role of business profit margins while promoting low carbon economic growth in alignment with the State's climate goals and policies.

The metric is the relationship between California freight transportation sector gross domestic product, identified by the North American Industry Classification System codes (NAICS 48-49 minus passenger components), and carbon dioxide emissions equivalent for the same sector. The following represents freight system efficiency:

$$\frac{\text{Gross Domestic Product (NAICS 48-49 minus passenger components)}}{\text{Carbon Dioxide Emissions Equivalent (from California freight movement)}}$$

The use of gross domestic product as a metric is consistent with industry practice. The U.S. Department of Commerce's Bureau of Economic Analysis defines gross domestic product as the sum of consumer, business, and government spending on final goods and services, plus investment and net foreign trade. For California,

gross domestic product represents the portion of national gross domestic product across all industries in the State.

To measure progress towards meeting the efficiency target in the Action Plan, the Transportation and Warehouse Sector, identified by the North American Industry Classification System Codes (NAICS 48-49) minus transit and ground passenger transportation, populates gross domestic product estimates. This sector comprises establishments primarily engaged in: air transportation, rail transportation, water transportation, truck transportation, pipeline transportation, other transportation and support activities, and warehousing and storage. This sector excludes transit and ground passenger transportation, as they do not relate to freight.[1]

The other element of the efficiency equation is carbon dioxide emissions equivalent. Greenhouse gas emission values are derived by ARB as part of the California Greenhouse Gas Emission Inventory Program.[2] Values used in the freight system efficiency metric represent carbon dioxide emissions equivalent from the movement of freight and the use of freight transport equipment (e.g., aircraft, trains, ships, trucks, cargo handling equipment, etc.) as discussed in the *Sustainable Freight Pathways to Zero and Near-Zero Emissions Discussion Document*.[3]

Using 2014 as the base year for analysis, gross domestic product totaled $43.9 billion for the California freight sector and the estimated carbon dioxide emissions equivalent amount totaled 28.35 million metric tons. The resultant freight system efficiency equates to $1,550 of economic output per ton of carbon dioxide emissions equivalent produced.

Table B-1 depicts, for illustrative purposes only, historic and projected future gross domestic product and carbon dioxide emissions equivalent levels and the resultant efficiency calculation. While both gross domestic product and carbon dioxide emissions equivalents may vary significantly in the coming years, using the assumptions for future projections indicates the need for more work to meet the State's target of a 25 percent efficiency improvement.

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[1] U.S. Department of Commerce's Bureau of Economic Analysis, Regional Gross Domestic Product Data, http://www.bea.gov/iTable/index_regional.cfm, accessed February 2015.

[2] ARB, California Greenhouse Gas Emission Inventory Program, http://www.arb.ca.gov/cc/inventory/inventory.htm.

[3] ARB, "Sustainable Freight Pathways to Zero and Near-Zero Emissions Discussion Document", April 2014, http://www.arb.ca.gov/gmp/sfti/sustainable-freight-pathways-to-zero-and-near-zero-emissions-discussion-document.pdf.

Table B-1. Freight Transport System Efficiency Metric 2000-2050

Year	Transportation & Warehousing Gross Domestic Product (GDP) (Millions $) [4] [5]	Carbon Dioxide Emissions Equivalent (CO_2e) (Million Metric Tons) [6]	GDP/CO_2e ($/Metric Ton)	GDP/CO_2e % Change from 2014 Base Year
2000	$36,731	28.63	$1,283	-
2005	$41,934	31.26	$1,341	-
2010	$41,497	26.55	$1,563	-
2012	$42,262	26.97	$1,567	-
2013	$43,581	27.66	$1,576	-
2014	**$43,950**	**28.35**	**$1,550**	-
2015	$44,829	29.03	$1,544	-0.4%
2020	$49,495	31.97	$1,548	-0.1%
2030	$60,334	37.48	$1,610	3.8%
2040	$73,547	44.63	$1,648	6.3%
2050	$89,653	52.50	$1,708	10.2%

B. Transition to Zero Emission Technologies

Target: Deploy over 100,000 freight vehicles and equipment capable of zero emission operation and maximize near-zero emission freight vehicles and equipment powered by renewable energy by 2030.

The State agencies developed this target to support the transition of freight vehicles and equipment to zero emissions technologies. ARB staff undertook a bottom-up analysis of what may be possible between now and 2030 for zero emission operations of freight vehicles and equipment. The analysis considered how far current and near-term regulations incentive programs, market demand and turnover, expected technology development, and potential future policies will advance freight vehicle and equipment technologies by 2030. ARB's analysis anticipates the population of both zero and near-zero emission freight vehicles and equipment to grow through the 2030 timeframe. To measure progress toward the technology

[4] U.S. Department of Commerce's Bureau of Economic Analysis, Regional Gross Domestic Product Data, http://www.bea.gov/iTable/index_regional.cfm, accessed February 2015.
[5] 2015–2050 gross domestic product estimated assuming a two percent average increase in gross domestic product for the period.
[6] 2000-2050 carbon dioxide emissions equivalent estimated using ARB 2015 California Greenhouse Gas Emissions Inventory.

target, staff will use vehicle and equipment counts; tracking zero emission freight technologies as they are introduced into service.

The 100,000 figure anticipates that regulatory requirements, incentives, research programs, industry initiatives, and other programs will contribute to the availability of multiple types of vehicles and equipment that are capable of operating with zero emissions in California's fleet by 2030, along with the associated fueling and energy infrastructure. From a technology perspective, the equipment categories with the greatest potential for zero emission technology and/or zero emission operation include: trucks, locomotives, transport refrigeration units, cargo equipment, commercial harbor craft, and airport ground service equipment.

C. Increased Competitiveness and Economic Growth

Target: Establish a target or targets for increased State competitiveness and future economic growth within the freight and goods movement industry based on a suite of common-sense economic competitiveness and growth metrics and models developed by a working group comprised of economists, experts, and industry. These targets and tools will support flexibility, efficiency, investment, and best business practices through State policies and programs that create a positive environment for growing freight volumes and jobs, while working with industry to mitigate potential negative economic impacts. The targets and tools will also help evaluate the strategies proposed under the Action Plan to ensure consideration of the impacts of actions on economic growth and competitiveness throughout the development and implementation process.

Competitiveness targets will be developed in conjunction with an economic competitiveness working group comprised of State agency representatives, economists, industry representatives, and subject matter experts. As there is no single definition, application, or metric which applies to the concept of economic competitiveness across the many different modes, markets, and impacts associated with the freight sector, the targets will need to be based on a multi-pronged suite of metrics and models, which will indicate overall statewide progress in improving California's economic competitiveness. Given the dynamic nature of the freight industry economy, the working group will need to continuously monitor and update these metrics.

These metrics may help analyze individual decisions made by State agencies when implementing actions. Functional metrics may support evaluation of cumulative economic impacts of freight projects, incentives, regulatory requirements, and efficiency measures.

Appendix C: State Agency Actions

The State agency Actions in this Action Plan are the result of a new integrated approach, in which the State agencies implemented a more comprehensive look across the State's policies, programs, and investments. The State agencies sought to identify opportunities to innovate and work together to help achieve the Action Plan Targets and incorporate actions that would simultaneously advance multiple State goals and objectives. To gather additional ideas, the State agencies also initiated new multi-agency stakeholder outreach efforts as discussed in Appendix G.

The following Actions are recommendations to support progress over the next five years:

1. Work with the Legislature to enact a freight transport system funding package that enables new investment for transportation assets and advanced vehicles and equipment that move freight in California's freight corridors and is consistent with the long-term Vision and Guiding Principles presented in this document.

2. Work with the Legislature to enact legislation that enables distribution of federal Fixing America's Surface Transportation Act funds based on high-priority State and regional improvements to California's freight corridors as identified in transportation plans and programs.

3. Focus freight infrastructure planning and investments on providing modern freight corridors. Future freight planning and programming documents should identify high-priority projects with multiple benefits for future funding, and establish performance criteria.

4. Accelerate use of clean vehicle and equipment technologies and fuels for freight through targeted introduction of zero and near-zero emission technologies, and continued development of renewable fuels.

5. Convene a freight think tank of experts to provide insight into the demands on the future freight transport system and then identify the transformative technologies, solutions, partnerships, and critical steps to meet those demands, consistent with the Guiding Principles.

6. Convene industry stakeholder working groups to identify a target or targets and deploy strategies that consider commercial viability and promote the competitiveness of California's statewide and local freight transport system. Develop economic growth and competitiveness metrics, models, and other tools and data to analyze benefits and impacts of actions, including costs, and develop and implement a suite of quantitative metrics to track progress in order to ensure that the impacts of actions on economic growth and

competitiveness are considered throughout the development and implementation process.

7. Work with the freight efficiency development group to refine its work to identify and deploy strategies to improve the efficiency of freight transport in California now and in the coming years, consistent with the objectives of this Action Plan.

8. Convene stakeholders and the California Workforce Development Board to identify and implement steps to ensure that the existing and future workforce meets the needs of the California sustainable freight transport system and sufficiently skilled labor is available to meet the needs of an expanding freight-related job market.

9. Develop a process involving federal, regional and local agencies, industry, environmental, and community stakeholders, to identify regulatory or permitting process improvements to expedite the delivery of projects identified as meeting the objectives of this plan, while upholding public participation and assessment of environmental, community, and health impacts as part of the process.

To the extent feasible, the State agencies considered planning and development timelines, developed associated implementation steps and estimates of potential direct costs and benefits, as well as described impacted sectors for the Actions in this Appendix.

For Actions 1 and 2, stakeholders have expressed broad support for efforts to grow the levels of investment in the freight transport system to achieve the objectives outlined in the Action Plan, including securing additional public investment from local and State sources, as well as leveraging freight funding provided by the federal government. To help implement these actions, the State agencies will collaborate with industry, regional and local agencies, and others on developing an integrated, statewide funding strategy to help support investments in transportation assets and advanced vehicles and equipment consistent with the long-term Vision and Guiding Principles presented in this document. For this strategy to be successful, it must address the role played by all investors in the funding and financing of freight infrastructure and equipment. It must also include the identification and support of measures that will maintain such funding and financing on an ongoing basis. The process for funding strategy development should include discussion of the Trade Corridors Improvement Fund/Goods Movement Emission Reduction Program – Phase II approach for providing State funding for freight system investments, the role of regional transportation and freight investment plans with committed local funding, local self-help funds, development of financing and underwriting tools to incentivize and leverage new private sector and non-state public sector investments, as well as requirements under the federal Fixing America's Surface Transportation Act related to expenditure of federal funds, among other topics.

The State agencies have also identified associated implementation steps for Actions 3, 4, 5, 6, 7, and 8, which the State agencies intend to develop further in conjunction with industry, other agencies, labor, environmental and community stakeholders, and subject matter experts. The depth and qualitative versus quantitative nature of the additional information, including the cost and benefit estimations presented in this Appendix, vary depending on stage of development, the availability of appropriate data, and the implementing agency. Estimates may include potential capital costs for equipment, and infrastructure, plus changes in operations and maintenance costs. Benefits are described where possible. Those may include improvements in efficiency, reliability, mobility, energy consumption, air quality, and safety of freight operations.

For Action 9, the Office of Planning and Research will convene State agencies, federal, regional and local partners, and industry, labor, environmental, and community stakeholders, to identify and evaluate specific implementation barriers faced by sustainable freight projects and determine what specific regulatory or permitting process improvements would expedite the delivery of these projects in a manner that is in keeping with this Action Plan.

The State agencies anticipate beginning development of the actions and associated implementation steps described for Board or Commission consideration (if applicable) through applicable processes within the next few years. The State agencies plan to continue developing these actions and implementation steps through separate public processes, retaining the discretion to add to, change, or commit to any of the actions and implementation steps. Subsequent implementation will be conditional on successful completion of applicable public processes, necessary financing approvals, economic competitiveness,[1] and environmental reviews.

The following section provides the additional detail for the implementation steps associated with Actions 3, 4, 5, 6, 7, and 8.

[1] In addition to the economic modeling process of regulatory programs, the potential impacts on employment, production, personal income and wages, as well as other indicators of economic health in California will be quantified upon the development of the suite of metrics and models by the State agencies and the competitiveness working group.

Contents

ACTION 3: Focus freight infrastructure planning and investments on providing modern freight corridors. Future freight planning and programming documents should identify high-priority projects with multiple benefits for future funding, and establish performance criteria.

A. Medium- and Heavy-Duty Vehicle Charging and Hydrogen Fueling Infrastructure Assessments, Planning, and Incentives

1. Electric Charging Infrastructure for Parked Trucks

Overview: During mandatory rest periods and long wait times, trucks can idle (engine running, but vehicle is not moving) for periods of several hours, especially when air conditioning and/or refrigeration is needed. Idling can emit significant amounts of pollution and poses health risks to drivers. Having electricity available and accessible at truck parking facilities would provide plug-in options for necessary systems such as heating and air conditioning, as well as cold chain truck convenience without creating additional emissions. This action can help shift vehicles to zero emission technologies and should be included when considering potential truck parking locations (also see Truck Parking discussion in this Appendix).

Implementing Agency: Caltrans

Type of Action: Feasibility assessment and coordination

Timing:
Begin Development: 2016-2020
Implementation: 2020

Proposed Actions: Encourage investment in electric charging infrastructure for public truck parking facilities along the freight network. Strategies for this action may involve:

- Identifying current or future locations for potential electric charging stations.
- Investigating in-motion (wireless) charging.
- Coordinating efforts and resources to fund a demonstration project.
- Assessing use and cost benefits for potential future projects.

Estimated Cost: Alternating current chargers cost roughly $15,000 to $18,000 per station and direct current chargers are roughly $50,000 to $100,000 per station. Multiplying the charger cost by the number of stations per corridor would

provide a very rough cost approximation. Additional costs for land, other materials, and labor for construction. Program incentives might be required.[2]

Benefits: Reduced emissions and fuel use reductions.

2. Transportation Electrification Planning

Overview: The California Public Utilities Commission is working with the Energy Commission, ARB, and utilities to better plan for the electrification of the transportation sector.

Implementing Agency: Energy Commission and ARB

Type of Action: Policy development

Timing:
Agency Development Work: 2016-2017
Implementation: Ongoing

Proposed Actions: The Energy Commission and ARB will provide analytical support to the California Public Utilities Commission's development of transportation infrastructure planning. These groups will coordinate on how the State can move closer towards its zero emission vehicle deployment goals. These plans may include recommended policies, regulations, incentives, and resource planning that will promote the widespread electrification of the transportation sector.

Estimated Cost: Because these proposed activities consist of unknown future actions, estimated costs are not identified at this time.

Benefits: Transportation electrification planning will allow electrical corporations to incorporate transportation electrification in their resource planning, provide opportunities to expand the usage of renewable energy, and transition fleets to zero emission technologies.

3. Regional and Statewide Energy Resource Planning

Overview: As California's fleet transitions to zero emission technologies, the deployment and fueling of a significant number of plug-in electric vehicle/plug-in hybrid electric vehicles in heavily populated portions of the State will require comprehensive planning in order to maintain a stable electrical grid. The State will need to assess impacts that vehicle electrification in the freight sector will

[2] U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, "Plug-In Electric Vehicle Handbook for Public Charging Station Hosts DOE/GO-102012 -3275", April 2012.

have on California's electricity generation, distribution, and transmission networks to ensure the ongoing reliability of California's energy system.

Implementing Agency: Energy Commission

Type of Action: Data collection and analysis

Timing:
Agency Development Work: 2016-2017
Implementation: 2017+

Proposed Actions: The Energy Commission would analyze regional and statewide impacts that large-scale electric vehicle deployments may have on available energy resources. With the changing mix of energy resources in California, this analysis will consider energy generation, distribution, and demand throughout the State.

Estimated Cost: These planning efforts will help reduce additional costs associated with the need for additional power generation and distribution in California, associated with the increased electricity demand from plug-in vehicles.

Benefits: This action will help promote grid stability, electric vehicle deployment, and renewable energy utilization.

4. Hydrogen Fueling Infrastructure

Overview: With many efforts underway to support the deployment of battery plug-in electric vehicle/plug-in hybrid electric vehicles, a need for similar research, demonstration, and deployment of fuel cell electric vehicles is needed. As the Energy Commission funds the construction of the initial network of hydrogen fueling stations to serve the light-duty market, planning and lessons learned can help promote the development of medium- and heavy-duty fueling as those vehicle options become available.

Implementing Agency: Energy Commission

Type of Action: Policy development

Timing:
Agency Development Work: 2016-2018
Implementation: 2018+

Proposed Actions: The Energy Commission would identify the needs and opportunities for assessing a network of hydrogen fueling stations, which can support the deployment of fuel cell electric vehicle medium- and heavy-duty vehicles and equipment in the freight sector. As part of this assessment, the Energy Commission would identify opportunities for expanding the hydrogen

fueling network to accommodate medium- and heavy-duty applications in connector site stations (stations along major routes that connect distinct areas of high potential for fuel cell electric vehicle adoption), and identify barriers and solutions to the complexities that will arise from comingling duty-specific fueling requirements at single facilities. The Energy Commission would consider opportunities for the integration of fueling options for all vehicle types into future hydrogen fueling planning efforts and will work with ARB, as well as hydrogen fuel cell stakeholder groups efforts to establish roadmaps and plans for vehicle and infrastructure development.

Estimated Cost: To establishing a hydrogen fueling network that provides the coverage and capacity to fuel vehicles requiring hydrogen fuel that are being placed into operation in the State, the Energy Commission will annually allocate $20,000,000 or up to 20 percent of the moneys, appropriated by the Legislature to the Alternative and Renewable Fuel and Vehicle Technology Program, until there are at least 100 publicly available hydrogen fueling stations in operation in California. If the Energy Commission, in consultation with the ARB, determines that the full funding amount is not needed for the development of this network of stations, the funding may be reallocated to other projects under the Alternative and Renewable Fuel and Vehicle Technology Program.

Benefits: Deployment of medium- and heavy-duty zero emission vehicle technologies such as fuel cell electric trucks have the potential to help reduce the air quality and climate impacts associated with freight transport. These activities will identify ways to develop hydrogen fueling infrastructure for fuel cell electric vehicles, while not disrupting the fueling of the emerging fuel cell electric light-duty vehicle industry.

5. Electric Charging Infrastructure Incentives

Overview: With significant investments already made to support light-duty plug-in electric vehicle/plug-in hybrid electric vehicles, the opportunity exists to take similar actions to support the deployment of plug-in electric vehicle/plug-in hybrid electric vehicles in the freight sector. As additional options for medium- and heavy-duty vehicles come online, the opportunity to build facilities that meet all vehicle sizes and needs would be beneficial.

Implementing Agency: Energy Commission

Type of Action: Policy development, Funding/incentive

Timing:

Agency Development Work:	Ongoing
Implementation:	Ongoing

Proposed Actions: The Energy Commission would identify opportunities for expanding the electric fueling network to accommodate medium- and heavy-duty applications, as well as barriers and solutions to the complexities that will arise from comingling duty-specific fueling requirements at single facilities. The Energy Commission would also provide recommendations on where public funding may play an important role in the development of this infrastructure through the Alternative and Renewable Fuel and Vehicle Technology Program, and will consider funding projects for seaports, terminal operators, and last mile delivery companies to install electric vehicle charging stations for medium- and heavy-duty vehicles and equipment.

Estimated Cost: Through July 2016, the Alternative and Renewable Fuel and Vehicle Technology Program has provided approximately $50 million towards infrastructure projects that will support the development of a comprehensive plug-in electric vehicle charging network throughout California.

Benefits: Projects funded through this program will:

- Reduce the use and dependence on petroleum transportation fuels and increase the use of alternative and renewable fuels and advanced vehicle technologies.
- Expand alternative fueling infrastructure and fueling stations available to the public, existing fleets, public transit, and transportation corridors.
- Improve the efficiency, performance, and market viability of alternative light-, medium-, and heavy-duty vehicle technologies.
- Support local and regional planning efforts for zero emission vehicle and fueling infrastructure deployment.

B. Coordination with Local and Regional Partners on Freight Facilities, Siting, Design, and Operations

1. Freight Transportation and Land Use Coordination

Overview: Technology such as geographic information systems 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 in close proximity to large freight generators can influence the efficient flow of freight. There should be a balance in order to meet local development, community, and freight business needs.

Implementing Agency: Caltrans

Type of Action: Encourage freight transportation and land use planning coordination

Timing:
Begin Development: 2018-Ongoing
Implementation: Ongoing

Proposed Actions:
Coordinate with local land use agencies to ensure compatibility between existing and proposed major freight facilities and surrounding land use. Strategies may include:

- Collaborating with local and regional agencies on strategies for compatible development of new and existing freight facilities with existing and future land uses.
- Integrate "responsible agency" consultation and coordination requirements of the California Environmental Quality Act, and the National Environmental Policy Act to avoid adverse impacts and implement mitigation obligations at the beginning of the first design process.
- Encourage the use of "best practices" from the Governor's Office of Planning and Research General Plan Guidelines.
- Coordinate with public and private entities to increase the availability and dispersion of freight transportation data that would support decision-making on freight improvements.
- Explore infrastructure needs for energy efficiency improvements at freight facilities to reduce emission impacts on nearby communities.

Estimated Cost: Coordinating land use compatibility will likely include right-of-way costs, unforeseeable litigation costs, zoning and California Environmental Quality Act mitigation costs, compatible infrastructure costs, appurtenant multi-modal transportation facilities, barriers to small business (e.g., zoning restrictions), and social equity opportunity costs.

Benefits: Promoting good project design helps avoid community concerns and lengthy and potentially contentious approval processes for new and expanded freight facilities. Work with local agencies helps to avoid the establishment of incompatible land uses and transportation alternatives that conflict with existing or future freight facilities.

2. Freight Handbook for Freight Facility Siting, Design, and Operations

Overview: Develop a freight handbook document that identifies best practices for the siting, design, and operation of freight facilities that minimizes exposure to air toxics, incorporates the use of clean technologies and alternative fueling infrastructure, and maximizes the capacity of transportation infrastructure.

Implementing Agency: Caltrans, ARB, and Energy Commission

Type of Action: Local guidance document

Timing:
Begin Development: 2016
Availability: by 2018

Proposed Actions: Develop a freight handbook that identifies and recommends the use of the cleanest available engine and equipment technologies for the construction and maintenance of freight facilities, as well as assists in determining associated infrastructure needs and recommended air quality mitigation measures for new freight infrastructure and facility projects. Developing such a handbook may include:

- Identifying community impacts information for certain facility types that should be considered before siting, design, and operation of new freight facilities and improvements to existing facilities, including the connection between proximity and health risk.
- Identifying modeling and other tools for potential use in analyzing the economic impacts of various types of freight hubs and facilities.
- Identifying building and other energy use efficiency strategies, and the cleanest available technologies available for use in various types of freight hubs and facilities.
- Developing best practices for incorporating alternative fueling infrastructure at new proposed freight hubs.
- Reviewing and incorporating best practices regarding implementation and integration of freight considerations into local land use policy and decision-making.
- Working with regional agencies to determine actions needed to integrate freight into their regional land use policies and plans.
- Collaborating with local agencies to identify outstanding policy and information needs.

Estimated Cost: This proposed action may use existing and potentially new staffing resources, depending on agency capacity.

Benefits: Leveraging these partnerships between State, regional, and local planning entities and developing this proposed handbook can help optimize land use and minimize community exposure and related impacts to health from freight pollution, maximize freight efficiency, and minimize impacts on existing freight infrastructure.

3. Regional Zero Emission Vehicle Readiness Plans

Overview: The Energy Commission has funded regional readiness projects that prepare permitting and planning entities for the introduction of these vehicles to their regions to support the deployment of light-duty zero emission vehicles in California. These plans have allowed streamlined processes to be created, removing delays in the permitting and construction of vehicle fueling infrastructure. There are several considerations shared between light-, medium-,

and heavy-duty applications that will enable regional entities to use information from previous efforts to develop a comprehensive plan for all vehicle types that will be deployed in their region.

Implementing Agency: Energy Commission

Type of Action: Planning

Timing:
Agency Development Work: 2016-2017
Implementation: 2017+

Proposed Actions: The Energy Commission would leverage previous Regional Zero Emission Vehicle Readiness Plans to apply lessons learned for the deployment of zero emission vehicle infrastructure for medium- and heavy-duty vehicles and equipment. By leveraging these efforts, similar activities can be taken to prepare regions for the deployment of advanced vehicle technologies in the freight sector.

Estimated Cost: Public funding will be provided to regional planning entities for the development of plans to enable a smooth transition to zero emission vehicles.

Benefits: These State funded plans will support local and regional planning efforts for zero emission vehicle and fueling infrastructure deployment.

4. Regional Medium- and Heavy-Duty Zero Emission Vehicle Infrastructure

Overview: Regional planning entities have taken significant steps to plan for the initial rollout of zero emission vehicle fueling infrastructures in California. These plans have primarily been focused on the deployment of light-duty and transit vehicles. This information will provide a reference for all statewide entities to have a coordinated vision for the further deployment of zero emission vehicles and equipment by public and private fleets.

Implementing Agency: Energy Commission

Type of Action: Planning

Timing:
Agency Development Work: 2016-2017
Implementation: 2018+

Proposed Actions: The Energy Commission would support metropolitan planning organizations and regional transportation planning agencies to develop and adopt regional zero emission vehicle and equipment infrastructure plans and policies as part of their transportation planning requirements, that will support the adoption of infrastructure for medium- and heavy-duty vehicles that could refuel

along major freight corridors. By integrating freight fleets into these plans, a path for the construction of a coordinated network of infrastructure can be developed.

Estimated Cost: Because these proposed activities consist of unknown future actions, estimated costs are not identified at this time.

Benefits: By supporting regional planning efforts, the Energy Commission and Governor's Office of Planning and Research can provide information that will prevent the need for regional planning entities to duplicate efforts on establishing a strategic network of zero emission vehicle fueling and charging facilities in key areas.

C. Research Efforts to Support Sustainable Freight Transport System Development

Overview: The State agencies can support freight research by collaborating with various universities, developing preliminary investigations (e.g., literature searches) and research documents, funding demonstration projects, coordinating National and State research funding efforts, distributing research funds, and providing technical expertise. The State agencies will collaborate with industry to leverage resources for research and to develop innovative solutions to improve all facets of the freight transport system.

Implementing Agency: Caltrans, ARB, and Energy Commission

Type of Action: Support for freight research

Timing:
Begin Development: Ongoing
Implementation: Ongoing

Proposed Actions: Support research efforts to improve the freight transport system. Activities may include:

- Recommending freight topics for preliminary investigations or research projects.
- Funding research efforts and demonstration projects.
- Participating in or leading research efforts.
- Reviewing and commenting on interim and final documents.

Estimated Cost: The cost for various types of research will depend on the type and extent of the topic.

Benefits: Benefits will vary depending on the focus of the research topic. State agency coordination on research efforts will help to leverage funds and resources.

D. Freight Data Collection and Modeling Tool Development to Enhance Knowledge and Planning for Freight Corridor Improvement and State Investments

Overview: An unequivocal need exists at the local, State, and national levels for accurate and timely freight data. The rise in importance of public accountability and transparency through performance measurement to help gauge achievement of goals and objectives heightens the need for data that accurately reflects current conditions. However, many data gaps exist. In particular, there is an increasing need for private sector freight data that does not compromise proprietary rights. The intent of this effort is to collect data to inform State freight transport system planning andanalysis related to evaluating impacts of State infrastructure enhancements and other investments. To achieve this, advanced technology tools to improve freight data collection, analysis, modeling capabilities, and mapping for all elements of the system, including freight economic and operations analysis, are also needed.

Implementing Agency: Caltrans, ARB, Energy Commission, and GO-Biz

Type of Action: Assessing needs, coordination, implementing procedures, and tool development

Timing:
Begin Development: 2016-2018
Implementation: 2018+

Proposed Actions: Develop tools for freight data collection, analysis, and modeling to enhance knowledge and planning for freight improvements. Strategies may include:

- Completing, calibrating, and using the California Statewide Freight Forecasting Model.
- Research and development of freight system analytical tools to capture origin/destination, multi-modal, operational, and economic characteristics of the integrated freight system.
- Working with governmental and other stakeholder partners to develop systems to collect complete, accurate, and timely statewide freight data on an ongoing basis.
- Seizing opportunities to use federal and other data resources, when appropriate.
- Recommending the creation of a national geographic information systems standard that supports and ensures consistent data points and mapping.
- Monitoring State and partner performance measures to assist with planning decision making and reporting.
- Ensuring that a diverse group of users can operate freight models and that outputs can be easily understood.

- Completing the California Vehicle Inventory and Use Survey, which focuses on freight related vehicles operating in California, designed to obtain annual freight truck activities, operation, and physical characteristics, and type of commodities carried at the state level.
- Integration of Weigh-in-Motion and Inductive Signature Technology for truck monitoring to provide a better truck travel behavior insight and enable Caltrans to provide more accurate estimates of greenhouse gas emission, better management of infrastructure, and enhance freight forecasting capabilities.

Estimated Cost: The costs for the various data collection and analytical tool development efforts will vary. The total estimated costs for the California Statewide Freight Forecasting Model is $1.5 million, plus annual operating costs. The cost for the California Vehicle Inventory and Use Survey and Inductive Signature Technology program is approximately $8 million. The State agencies will pursue co-funding opportunities where possible.

Benefits: Development of enhanced freight analytical tools will allow the State to better predict freight movements and evaluate the impacts of infrastructure enhancements and other related projects on traffic congestion, mobility, air quality, emissions analysis, public health, climate change, and their relationship to the economy. This information would help to influence policy development and direct investments to achieve the following benefits: improving economic efficiency, productivity, and competitiveness; reducing congestion; improving safety, security, and resilience; improving the state of good repair; increasing use of advanced technologies; and reducing adverse environmental and community impacts.

E. Highway Freight Network Design, Planning, Maintenance and Operations Improvements

1. Freight Highway System Preservation through Asset Management

Overview: Caltrans will adapt the current asset management approach to focus on key freight corridors. California's economy relies on the efficient movement of freight along sustainable, well-maintained freight transportation infrastructure. Preservation of our invaluable freight infrastructure requires creation and adherence to a freight asset management plan supported by policy and programming, as well as supporting services. This approach ensures that maintenance and preservation of the existing freight infrastructure system ranks high on spending priority, reduces more expensive future rehabilitation costs, and supports existing communities along current infrastructure. The focus of targeted improvements should be in key congested areas where recurring traffic bottlenecks and gridlock exists along key freight corridors.

Implementing Agency: Caltrans

Type of Action: Develop and implement a freight asset management plan

Timing:
Begin Development: 2016-Ongoing
Implementation: 2018+

Proposed Actions: Expand adopted fix-it-first approach for highways along key freight corridors using asset management strategies. Activities may include:

- Securing an inventory of existing road and bridge conditions along the entire highway freight network, including all intelligent transportation systems, and verifying accuracy of all current asset conditions.
- Developing a freight focused system repair and preventative maintenance plan employing an asset management approach, setting targets for roadway and technology equipment conditions.
- Conducting ongoing periodic assessments to measure and ensure progress.

Estimated Cost: For the 2016 State Highway Operation and Protection Program, Caltrans is proposing to implement $10 billion on projects to maintain the entire highway system over four years from 2016-2017 through 2019-2020. These projects include pavement, bridge, culvert, and intelligent transportation systems improvements. Of the total amount, $3.1 billion is slated for pavement maintenance.[3]

Benefits: Actions will be able to address specific types of issues and inefficiencies based on expected benefits. Benefits include reduced congestion, cost savings due to preventive instead of deferred maintenance, increased environmental sustainability, improved ride quality, and enhanced safety. Reduction in roadway user cost is also a benefit.[4]

2. Bridge Performance through Asset Management

Overview: Caltrans will adapt the current bridge asset management program by focusing 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

[3] Caltrans, "2016 Caltrans Proposed State Highway Operation and Protection Program", http://www.dot.ca.gov/hq/transprog/SHOPP/2016%20SHOPP/proposed_2016_SHOPP_01-29-16.pdf.

[4] Miguel Jaller, "Strategies to Maximize Asset Utilization in the California Freight System: Part II – Strategies", Freight Efficiency Strategy Development Group, January 2016.

movement. Implement plan to reduce and eliminate barriers caused by bridge conditions. This action supports the fix-it-first approach to preserve existing assets to avoid expensive replacement costs.

Implementing Agency: Caltrans

Type of Action: Develop and implement freight bridge asset management plan

Timing:
Begin Development: 2016-Ongoing
Implementation: 2019+

Proposed Actions: Identify areas where inadequate bridge infrastructure leads to freight bottlenecks and address bridge maintenance issues.

- Assessing bridge conditions and potential freight design constraints by freight network categories.
- Developing a bridge asset management system with geographic information system components focused on freight.
- Performing an economic and risk-based evaluation to help prioritize projects for funding.
- Implementing the plan, reducing barriers caused by bridges.

Estimated Cost: Of the entire 2016 State Highway Operation and Protection Program expenditure program of $10 billion, nearly $1.5 billion was programed for bridge preservation projects. Bridge projects along key freight corridors are imbedded within that amount.[5]

Benefits: Addressing and making improvements to bridge and safety barriers would result in improved pavement and bridge conditions along with condition related project selections, programming, and policy choices. Preservation of investments is key. Fewer permits would need to be issued as well as savings due to fewer rerouting delays. Accountability, transparency, consistency in reporting of bridge conditions, and achievement progress are also benefits.[6]

[5] Caltrans, "California Performance Action Plan, Highway Asset Management Target Setting – Bridges", http://www.dot.ca.gov/hq/transprog/map21/Action%20Plans/Highway%20Asset%20Management%20Target%20Setting-%20Bridges.pdf.

[6] Caltrans, MAP-21 Data Assessment Workshop Presentation, August 24, 2015, http://www.dot.ca.gov/hq/transprog/map21/forums_and_workshops/map21_data-asmt/bridge_presentation.pdf.

3. Pavement Technology

Overview: The 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. New, longer-lasting materials and improved technologies are regularly being developed internally and externally. Pavement technological advances to increase durability, safety, and 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 system.

Implementing Agency: Caltrans

Type of Action: Develop and implement improved pavement technology

Timing:
Begin Development: 2016-Ongoing
Implementation: Ongoing

Proposed Actions: Use technology, innovative techniques, and new materials to improve pavement quality along the primary freight network. Strategies may include:

- Researching and/or monitoring new pavement technologies.
- Testing materials in lab and sampling on roadways.
- Implementing proven and promising materials and technology.

Estimated Cost: Cost is variable depending upon research necessary to discover newer, more advanced materials and software. Caltrans pavement related divisions, including Design, Construction, Maintenance, and Engineering Services achieve improvements and cost savings by implementing innovations and by working with researchers in pursuing, developing or acquiring, and implementing new and advanced pavement technologies and materials.

Benefits: Implementation of new pavement technology will yield reductions in pavement maintenance and related costs. In addition, potential benefits in labor cost savings due to improved designs, construction practices, maintenance techniques, pavement management, as well as probable cost savings related to newer, more advanced materials. Lower life cycle costs and longer pavement service life is likely due to newer, more durable pavements with less damage to equipment, vehicles (trucks and passenger), and cargo due to improved pavements.

4. Bottleneck Relief

Overview: Major impediments to vehicle free flow are mainly caused by traffic interruption (signals/signs, railway crossings, etc.), lane/track reduction, merging,

and distraction when facilities are nearing capacity. Traffic queuing, one of the sources of emissions, poor reliability, delay, and cost increases in the freight industry causes congestion throughout the multi-modal system. An analytical approach is needed to identify and classify, in order of magnitude, the top freight transport system bottlenecks, as well as develop the possible improvements needed to relieve congestion. Likely improvements could include information technology systems as well as targeted operational and capacity improvements.

Implementing Agency: Caltrans

Type of Action: Identifying, planning, and recommending projects

Timing:
Begin Development: 2016-Ongoing
Implementation: Ongoing

Proposed Actions: Promote investments to create congestion relief along critical highway freight facilities to improve interregional freight efficiency and reduce auto/truck conflict points. Some undertakings may include:

- Create a multimodal freight bottleneck list for priority corridors and prioritize for correction.
- Identify most-congested freight corridor facilities and prioritize for improvement through individual projects or transportation demand management strategies.
- Construct grade separations at high-volume railroad and roadway crossings.
- Add mainline track and sidings to accommodate demand for freight and passenger rail services.
- Improve rail and marine transportation infrastructure and services to make these modes more competitive with trucking.
- Implement system management and expand freight travel information availability with a focus on freight corridors.
- Expand freight travel information availability to the entire truck fleet.

Estimated Cost: Congestion not only leads to a decrease in traffic flow, which has an economic cost itself, but also leads to delays in shipments, increased air pollution due to idling vehicles, and wasted fuel. Strategic investment to ensure consistent highway capacity will provide benefits for local and interregional freight movement.

Benefits: Benefits of bottleneck relief strategies include reduced congestion, fuel cost savings, economic benefits due to more consistent and reliable travel time and deliveries, greenhouse gas reduction in some cases, increased access to businesses, and decreased commute costs for employees. These actions would also improve cross-median and cross-roadway agricultural equipment movement

safety, and improve interregional commercial vehicle and automobile travel times between regions.

5. Expand Truck Scale Technology Use

Overview: 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 out of and back into traffic at truck scale locations. Delays occur as trucks often queue at the scales and need to wait for weighing and verification. Technologies that allow trucks to bypass additional stops create a more efficient system. Currently, weigh-in-motion systems are lacking near many port locations and in some areas where new corridors are growing.

Implementing Agency: Caltrans

Type of Action: Deploy truck scale technologies statewide

Timing:
Begin Development: 2016-Ongoing
Implementation: Ongoing

Proposed Actions: Apply current state-of-the-art truck scale technologies, such as weigh-in-motion, where feasible throughout the State to improve truck throughput and reduce congestion. Strategies may include:

- Identifying new locations to install truck scale technologies.
- Prioritizing locations with stakeholders and securing resources.
- Planning, programming, and installing devices.

Estimated Cost: Depending on the requirements and type of weighting device, annual maintenance costs for a truck scale run anywhere from $2,000 to $3,000 per lane. Other costs include scale installation, calibration, and maintenance.[7]

Benefits: 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. Data gathered through weigh-in-motion systems has been instrumental in structural bridge loading factor calculations and pavement design. Enhanced instrumentation can possibly allow for further anonymous vehicle identification.

[7] Transportation Research Board, "Collecting and Using Weigh-in-Motion Data in LRD Bridge Design", February 2010, http://trid.trb.org/view.aspx?id=912737.

F. Feasibility Assessment of Developing Dedicated Freight Lanes Along High Capacity Corridors

Overview: Dedicated freight lanes include truck-only toll or truck bypass lanes. Separating truck from automobile traffic will 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.

Implementing Agency: Caltrans

Type of Action: Project demonstration and assessment

Timing:
Begin Development: 2016
Implementation: 2018+

Proposed Actions: Assess the feasibility of developing dedicated freight lanes along high capacity corridors. Strategies may include:

- Assessing success of other State and local dedicated lane projects.
- Demonstrating a pilot project on an identified freight corridor.
- Assessing impacts on freight businesses and system.
- Considering expanding dedicated lane systems, if successful.

Estimated Cost: Costs for dedicated freight lanes include right-of-way and property acquisition, engineering and design, paving and road/bridge construction, tolling and other electronics equipment, and operations and maintenance.

Benefits: Dedicated freight lanes would 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.

G. Inland Facility, Short-haul Rail Shuttle, and Inland Seaports Utilization with Less Impact on Nearby Communities

Overview: California has two inland seaports—one in Stockton and the other in West Sacramento. Oceangoing vessels and barges can use waterways to transport freight directly to these inland seaports. Opportunities also exist for use of short haul rail shuttles to haul to inland distribution hubs.

Implementing Agency: Caltrans

Type of Action: Project identification and feasibility assessment

Timing:
Begin Development: 2019-2021
Implementation: 2021+

Proposed Actions: 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. Strategies may include:

- Identifying inland locations and industries that could benefit from waterway or short-line rail use.
- Assessing the feasibility of identified projects.
- Locating potential funding sources.

Estimated Cost: The State may be able to help accelerate the adoption of this concept through capital cost grants for terminal improvements, as well as operating subsidies where reduction in congestion and emissions provide appropriate levels of public benefit.

Benefits: This action would explore and provide support for using rail shuttles to serve seaports. Both seaports and Class 1 railroads have expressed interest in service that would increase mode share and improve the efficiency of California seaports. Changes in operating practices, such as mixing domestic and international operations to serve transload markets, and on-dock terminals to more efficiently serve concentrated load centers, would move freight more efficiently, reducing congestion and environmental impacts, and improving safety.[8]

H. Freight Rail Network Improvements

1. Short Line Rail Improvements Through Infrastructure Upgrades and Advanced Technologies

Overview: Many times short line rail is overlooked as a transport solution. At seaports, on-dock and near-dock rail alleviates truck congestion and provides direct access to facilities. This action would develop a short line rail improvement plan to encourage track upgrades, industrial rail access improvements, advanced technologies, and clean alternative energy consideration to improve system efficiency (increase speeds, reduce emission), and to promote cost-effective shifts of truck to rail.

Implementing Agency: Caltrans

[8] Cambridge Systematics, “The Role of Rail in Achieving Freight Efficiency Goals”, December 2015.

Type of Action: Project identification and coordination

Timing:
Begin Development: 2016-Ongoing
Implementation: Ongoing

Proposed Actions: Encourage and explore funding opportunities for short line rail track upgrades to improve system efficiency. Strategies may involve:

- Developing a short line rail improvement plan.
- Identifying locations where increased use of current or abandoned short line rail and advanced technologies could create system efficiencies.
- Exploring funding resources for short line improvements.
- Coordinating efforts to fund promising improvements.

Estimated Cost: Grants and loans to short lines to improve and upgrade track to current standards. While many short lines in the State can generate sufficient revenue and profit to cover costs of ongoing operations and routine maintenance, they may not generate sufficient revenue to cover costs of major upgrades such as track and infrastructure upgrades necessary to maintain long-term viability. Many other states have short line rail assistance grant and loan programs to enhance service and capacity of short line railroads. Amounts range from several million to $40 million.

Benefits: This program would assist short lines to upgrade their physical infrastructure and develop innovative services that could increase rail mode share. It would also assist shippers in obtaining access and improved services through development of new rail spurs and innovative cargo consolidation models. It could also divert truck trips to rail service and incorporate advanced technologies that help create related environmental, pavement preservation, reliability, safety, congestion, and emissions benefits.

2. Freight Rail Efficiencies

Overview: Work with seaports, terminal operators, rail carriers, shippers, regional agencies, and communities to support efforts to improve rail operational efficiency through practices such as handling transloaded international containers at on-dock rail facilities, use of longer trains, and slotted scheduling in shared-use corridors. Support public-private investment with Class 1 railroads and seaports to develop on-dock rail intermodal terminals with advanced technology to reduce truck trips to off-dock terminals.

Implementing Agency: Caltrans

Type of Action: Departmental coordination and support

Timing:
Begin Development: 2016-Ongoing
Implementation: Ongoing

Proposed Actions: Improve flow of freight movement by rail at and near seaports. Actions may include:

- Supporting the handling of transloaded international containers at on-dock and near-dock rail facilities.
- Developing on-dock and near-dock rail intermodal terminals to reduce truck trips to off-dock terminals.
- Encouraging and exploring funding opportunities for adding additional tracks and supporting infrastructure where appropriate to improve system efficiency.

Estimated Cost: Some broadly defined expected costs for these strategies could include, but are not limited to, new freight infrastructure (transloading, intermodal terminals, track), and enabling technology costs.

Benefits: This action will support investment leveraging and is suitable for public private partnerships. In addition, these actions would improve seaport efficiency, lessen transit time (increasing throughput and turnaround times), ease congestion, and improve port competitiveness.

3. Freight/Passenger Rail Conflicts

Overview: Both freight rail and passenger traffic along shared lines are forecast to increase along some corridors. Private railroads own most shared track and therefore right-of-way is theirs. Freight railroads are required to share trackage with passenger service for a fee. As both operations increase, passenger rail will become less reliable and timely if infrastructure remains status quo. Mutual solutions such as double tracking in key areas may create win-win scenarios. Focus should be to minimize conflicts and delay in high priority corridors. Discussion of freight and passenger rail conflicts and opportunities is included in the California State Rail Plan.

Implementing Agency: Caltrans

Type of Action: Needs identification and collaboration

Timing:
Begin Development: 2016-Ongoing
Implementation: 2020+

Proposed Actions: Reduce track capacity conflicts between freight rail and passenger rail operating on the same tracks along identified high priority freight corridors. The following activities may be pursued:

- Identifying, categorizing, and prioritizing freight rail corridors with passenger rail conflicts.
- Inventorying and reviewing freight and passenger plans and project proposals along identified routes.
- Coordinating with intercity rail providers and Class I railroads to identify potential solutions.
- Identifying funding resources available to match/leverage public and private funding.
- Encouraging public/private partnerships to fund improvement projects.

Estimated Cost: This program would focus investments and take actions in partnership with the Class 1 railroads to protect capacity without degrading performance and improve safety in critical trade corridors and change operations in ways that improve network fluidity.

Benefits: The program would seek to reduce freight/passenger conflicts in shared track corridors. It would also work with other program elements to ensure there is sufficient capacity and efficiency of operations to allow cost-effective use of rail services as much as possible to help reduce highway congestion and improve overall freight system safety, reliability, efficiency, and competitiveness. By using existing track and bridge right-of-way, less land needs to be acquired, and likely, a lower degree of environmental review.

4. Positive Train Control

Overview: Positive Train Control is a set of highly advanced technologies designed to make freight rail transportation safer by automatically stopping a train before certain types of accidents occur. Required under federal law by December 31, 2018, for freight railroad lines carrying certain toxic materials, and passenger railroads and by the Fixing America's Surface Transportation Act, Caltrans will monitor and facilitate Positive Train Control implementation.
Implementing Agency: Caltrans

Type of Action: Monitor and facilitate implementation

Timing:
Begin Development: 2016-2019
Implementation: 2019

Proposed Actions: Monitor and facilitate the implementation of positive train control for freight railroad lines carrying certain materials and passengers. Strategies may include:

- Monitoring current legal requirements and deadlines.
- Periodically contacting railroads regarding Positive Train Control deployment status.
- Availing staff to relay issues regarding equipment standardization and other issues.
- Encouraging prompt deployment with high freight/passenger interaction areas a priority.

Estimated Cost: Metrolink estimates it will cost $210.9 million, Union Pacific estimates Positive Train Control to cost approximately $2.5 billion total, nationally. BNSF Railway estimates its cost at nearly $1.5 billion. Caltrain is spending $231 million for its system. Ongoing budget for operations and maintenance is estimated to be in excess of $300 million per year, nationally.[9]

Benefits: The primary benefit is the safety of all freight and passenger rail operators, crews, and passengers. In addition, benefits include reduction in lives lost, equipment, track, and property damage. Environmental damage averted due to more precise, real time control over trains. Community impacts will be reduced from accidents averted, yielding financial savings to the rail industry over time.

I. Aviation Efficiencies: National Satellite-Based Air Traffic Management System

Overview: Monitor and support Federal Aviation Administration roll out of the Next Generation Air Transportation System. The Next Generation Air Transportation System will increase efficiency of both passenger and freight air travel by transitioning from radar based control systems to satellite/global positioning system based controls. Elements of the Next Generation Air Transportation System include providing comprehensive and accurate knowledge of weather and traffic conditions in flight time. Caltrans will provide support for eligible match funds to upgrade and distribute Automated Weather/Surface Observing Systems in California. These critical aspects of the State aviation system and elements of the Next Generation Air Transportation System, benefit both commercial and general aviation operations. In addition, staff will monitor deployment of Automatic Dependent Surveillance-Broadcast in California (that enhances situational awareness and air traffic control surveillance) and support publication of enhanced fuel and timesaving precision navigation procedures for many busy airports and air routes.

[9] Cambridge Systematics, “The Role of Rail in Achieving Freight Efficiency Goals”, December 2015.

Implementing Agency: Caltrans

Type of Action: Monitor and support activities

Timing:
Begin Development: Ongoing
Implementation: Ongoing

Proposed Actions: Support development and deployment of national satellite based air traffic management systems and associated elements. Strategic activities may include:

- Keeping abreast of new traffic management system deployment status.
- Tracking airports with airport weather and broadcast systems.
- Providing funding for projects in support of aviation efficiencies.

Estimated Cost: The Caltrans Division of Aeronautics staff tracks the above activities and provides match funding for eligible airport projects. Avionics cost per general aviation aircraft range from $8,000 to $15,000 for the least expensive Automatic Dependent Surveillance–Broadcast Out unit and between $130,000 and $260,000 for the required navigation performance 0.3 with radius to fix legs units (which allows aircraft to fly a specific path between two three-dimensional points in space). Commercial aircraft avionics costs range between $70,000 to $135,000 for the Automatic Dependent Surveillance–Broadcast Out and between $260,000 and $525,000 per unit for the required navigation performance 0.3 with radius to fix legs. Between 2013 and 2030 the Next Generation Air Transportation System will cost $29 billion ($14 billion for Federal Aviation Administration and $15 billion for aircraft operators).

Benefits: According to the Federal Aviation Administration, Next Generation Air Transportation System will generate an estimated $133 billion in benefits to National Airspace System users between 2013 and 2030. By 2030, Next Generation Air Transportation System's improvements will yield $3.40 in benefits for every $1 invested. Next Generation Air Transportation System will allow planes to fly closer together (optimize approaches), take more direct paths (improve navigation and route planning), and avoid "stacking" on the runways resulting in shortened routes. These enhancements increase time and fuel efficiency, reduce traffic delays and community noise impacts, increase capacity, safety, and traveler comfort, and improve air quality.

J. Freight Network Safety Improvements

1. Freight Safety Enhancements

Overview: Safety technology is constantly advancing. A need exists to research and deploy infrastructure-based detection and warning safety systems. Vehicle

manufacturers should also be encouraged to continue development and deployment of vehicle-based safety systems.

Implementing Agency: Caltrans

Type of Action: Research and deployment of freight safety enhancements

Timing:
Begin Development: Ongoing
Implementation: Ongoing

Proposed Actions: Continue to deploy and promote the use of advanced systems and other strategies that enhance multimodal transportation safety. Strategies may include:

- Researching and identifying safety equipment and devices for all freight modes.
- Developing and demonstrating safety technology.
- Deploying proven freight infrastructure safety technology.
- Developing transportation routing/mode shift alternatives.

Estimated Cost: Research and development costs, deployment costs, and operational costs.

Benefits: Deploying appropriate safety technology and other approaches will help eliminate traffic fatalities, injuries, and property damage. Deployment will also improve transportation operations and efficiencies.

2. Freight Resiliency and Security Enhancements

Overview: Security and resiliency issues abound in the freight environment. To prepare for potential issues, a transportation system security plan should be developed. This plan would include a risk assessment, monitoring methods, pre- and post-incident preparedness, response and recovery, crisis management and evacuation plans, and viable transportation alternatives. In addition, advanced tracking systems to help increase transportation system security, weather and detour alerts, and changeable road signs need continued investment and deployment.

When response is required, work with State and federal agencies to ensure that emergency response services are deployed rapidly in the event of an emergency and/or roadway incident.

Implementing Agency: Caltrans

Type of Action: Research, analyze, develop and deploy freight system resiliency enhancements

Timing:
Begin Development: 2017-2020
Implementation: 2020

Proposed Actions: Develop and deploy security/incident response/resiliency enhancements for the freight transportation system. Strategies may include:

- Assessing freight transportation network security and response readiness.
- Developing a transportation system security plan.
- Coordinating processes with State Emergency Response team.
- Enhancing incident response coordination.
- Increasing educational and training programs.

Estimated Cost: The range of potential measures is quite broad, and thus the cost might be nominal to very high. Actions related to security and border protection are discussed in this Action Plan as part of the Freight Intelligent Transportation Systems action, and would most likely be implemented by Homeland Security or U.S. Customs and Border Protection. Other roadway Intelligent Transportation Systems safety and commercial vehicle measures would also vary in cost. The cost of incident response related to natural or other disasters would be incident specific and could range greatly.

Benefits: The benefits of having such a program or enhancements would contribute to the resiliency of critical freight transportation infrastructure. The responsiveness to the freight industry could be measured in terms how much cost could be saved from quick resumption of freight activity, and reduced freight and shipping delays, after incidents or disasters. Hours of delay reductions, and safety of the public could also be measured, or observed.[10] [11] [12]

[10] California Office of Emergency Services, Critical Infrastructure Protection Division, http://www.caloes.ca.gov/cal-oes-divisions/law-enforcement/critical-infrastructure-protection.
[11] Department of Homeland Security, Transportation Systems Sector, https://www.dhs.gov/transportation-systems-sector#.
[12] Gen Giuliano, et al, "White Paper: Information Technology", Freight Efficiency Strategy Development Group - IT Working Group, January 2016.

ACTION 4: Accelerate use of clean vehicle and equipment technologies and fuels for freight through targeted introduction of zero and near-zero emission technologies, and continued development of renewable fuels.

A. Investments in Advanced Vehicles and Equipment Technology Demonstrations and Deployment, Renewable Fuel Production, and other Freight Technologies

Energy Commission

Overview: Continued investment is needed to support advanced vehicle demonstration and system efficiency gains from intelligent transportation system development.

Implementing Agency: Energy Commission

Type of Action: Funding/incentive

Timing:
Agency Development Work: Ongoing
Implementation: Ongoing

Proposed Actions: The Energy Commission would support continued investments in advanced truck technology demonstrations/deployments, renewable fuel production, intelligent transportation systems, and other sustainable freight technologies under the Alternative and Renewable Fuel and Vehicle Technology Program. This financial support for demonstration and pre-commercial projects can lead to reduced costs for future generations of advanced technology vehicles. Furthermore, by demonstrating the feasibility and reliability of such technologies in the field, these projects can garner further interest from potential fleet adopters.

Estimated Cost: Through July 2016, the Alternative and Renewable Fuel and Vehicle Technology Program has provided over $100 million for the development and deployment of advanced medium- and heavy-duty vehicle technologies, as well as more than $150 million for low-carbon fuels production. Through this action, additional grant and loan mechanisms will be identified to support the accelerated development and deployment of advanced technologies.

Benefits: Projects funded through this program will:

- Reduce the use and dependence on petroleum transportation fuels and increase the use of alternative and renewable fuels and advanced vehicle technologies.

- Produce sustainable alternative and renewable low-carbon fuels in California.
- Expand alternative fueling infrastructure and fueling stations available to the public, existing fleets, public transit, and transportation corridors.
- Improve the efficiency, performance, and market viability of alternative light-, medium-, and heavy-duty vehicle technologies.
- Retrofit medium- and heavy-duty on-road and off-road vehicle fleets to alternative technologies or fuel use.
- Offer incentives for the purchase of alternative fuel vehicles.
- Establish workforce training programs and conduct public outreach on the benefits of alternative transportation fuels and vehicle technologies.
- Support local and regional planning efforts for zero-emission vehicle and fueling infrastructure deployment.

ARB

Overview: Achieving a transition from current technologies to zero and near-zero emission technologies will be challenging, and early investments through incentive programs will be critical to help bridge the increased incremental costs of advanced technologies by:

- Increasing production volumes to drive down manufacturing costs.
- Demonstrating projects to foster consumer acceptance of new technologies and highlight their potential to lower operating and maintenance costs.
- Sending a strong signal to manufacturers and private investors that these technologies will be supported.

ARB is exploring opportunities to further transition its existing incentive portfolio towards one that better aligns with a zero and near-zero emission future for all Californians, including communities that are disproportionately affected by major freight corridors and facilities. ARB elevates environmental justice considerations into its existing incentive programs in a variety of ways: targeting funding for projects that benefit disadvantaged communities, using scoring criteria to give priority to projects that maximize benefits to disadvantaged communities, and implementing outreach efforts that seek to engage and involve these communities in development of guideline and solicitation materials. Looking ahead, ARB remains committed to implementing these environmental justice provisions as part of its incentive programs.

Implementing Agency: ARB

Type of Action: State legislation and incentive

Timing:
Anticipated Board consideration: 2016 and annually thereafter
Implementation schedule: 2016-2023

Proposed Actions: ARB is developing modifications to the Carl Moyer, Air Quality Improvement, and Low Carbon Transportation programs and beginning to implement modifications to its Proposition 1B program that increase the emphasis on and support for zero and near-zero emission equipment used in freight operations, including introduction of truck engines certified to optional low-nitrogen oxides standards. Each of these programs has technology advancement elements, which are under analysis for further opportunities to target a greater range of zero and near-zero projects. The suite of incentive actions include:

- Propose changes to the Carl Moyer Program Guidelines to offer funding for zero and near-zero equipment and associated infrastructure.
- Implement changes made in the 2015 Proposition 1B Goods Movement Emission Reduction Program guidelines to provide higher incentive funding for zero and near-zero emission equipment and the ability to couple this equipment with additional infrastructure incentives.
- Support Air Quality Improvement Program/Low Carbon Transportation Funding Plan to accelerate and expand adoption of certified zero and near-zero emissions vehicles and equipment, and introduce incentives for the production of very low carbon fuels for vehicles and equipment that do not yet have zero emission technology options.
- Coordinate with the California Air Pollution Control Officers Association on investment of local funding towards higher priority freight projects.
- Include maintenance, best practices, etc. requirements beyond manufacturers' recommendations in future incentive contracts for truck operators of plug-in hybrids, hybrids, transformational technologies, etc.

Estimated Cost: ARB will estimate costs from this action as data from the various incentive programs becomes available. For example, Proposition 1B funds are currently being implemented and projects will begin to become operational in 2016 and in future years.

Benefits: This action is anticipated to provide criteria pollutant and greenhouse gas emissions reduction benefits. ARB quantifies emissions reductions for each of its incentive programs in annual reports for each program.

B. Cleaner Combustion Truck Standards

1. Lower In-Use Emission Performance Level for Heavy-Duty Vehicles

Overview: The goals of this action are to ensure that in-use, heavy-duty vehicles continue to operate at their cleanest possible level. ARB would develop and

propose new, supplemental actions to address in-use emissions and compliance and to decrease engine deterioration.

Implementing Agency: ARB

Type of Action: Regulation

Timing:
Anticipated Board consideration: 2016-2020
Implementation schedule: 2017-2026

Proposed Actions: For this proposed action, ARB staff would develop new, supplemental actions, in the form of regulatory amendments or new regulations, to address in-use compliance and to decrease engine deterioration. This suite of actions includes:

- Amendments to ARB's existing Periodic Smoke Inspection and Heavy-Duty Vehicle Inspection Programs to revise the current opacity limit and make other program improvements.
- Amendments to warranty and useful life provisions.
- Amendments to the durability demonstration provisions within the certification requirements for heavy-duty engines.
- Amendments to the Not-To-Exceed supplemental test procedures for heavy-duty diesel engines.
- Adoption of comprehensive heavy-duty vehicle inspection and maintenance program.

The proposed actions are anticipated to be implemented via amendment and adoption of multiple regulations. ARB staff anticipates bringing several of the items to the Board between 2016 and 2020, but some may be brought to the Board later.

Estimated Cost: As this proposed action will initially include a study to further evaluate California's in-use performance and vehicle inspection and maintenance program, anticipated costs are not identified at this time. ARB will estimate costs from this action during the measure development process for the Proposed 2016 State Strategy for the State Implementation Plan. See http://www.arb.ca.gov/planning/sip/sip.htm.

Benefits: As this proposed action will initially include a study to further evaluate California's in-use performance and vehicle inspection and maintenance program, anticipated criteria pollutant and greenhouse gas emissions reduction benefits are not identified at this time. ARB will quantify emissions reductions from this action during the measure development process for the Mobile Source Strategy and Proposed 2016 State Strategy for the State Implementation Plan. See http://www.arb.ca.gov/planning/sip/2016sip/2016mobsrc.htm and http://www.arb.ca.gov/planning/sip/sip.htm.

2. Innovative Technology Certification Flexibility

Overview: ARB's existing medium- and heavy-duty vehicle certification and on-board diagnostic requirements provide a critical and effective mechanism for ensuring a vehicle's expected emission benefits are achieved in-use. However, ARB's engine and vehicle approval paradigm, geared towards traditional technologies, may deter some manufacturers from developing promising new truck and bus technologies that are uncertain to achieve market acceptance. The goal of this action is to encourage early deployment of the next generation of truck and bus technologies through defined, near-term ARB certification and on-board diagnostic compliance flexibility for medium- and heavy-duty vehicles.

Implementing Agency: ARB

Type of Action: Regulation

Timing:

Anticipated Board consideration:	2016
Implementation schedule:	2016-2031

Proposed Actions: Develop a modification to a test procedure that is intended to enable key technology-advancing heavy-duty vehicle regulations and incentive programs. Initial concepts discussed with stakeholders would provide tiered ARB certification and on-board diagnostic requirements for innovative heavy-duty engine or vehicle technology, providing targeted flexibility at market launch and early technology deployment stages, and revert back to full ARB approval requirements once the technology achieves a market foothold.

ARB staff anticipates bringing this measure to the Board in 2016.

Estimated Cost: As this proposed action is a modification to a test procedure, it does not have associated costs identified at this time. ARB will estimate costs from this action during the measure development process for the Proposed 2016 State Strategy for the State Implementation Plan. See http://www.arb.ca.gov/planning/sip/sip.htm.

Benefits: This proposed action is intended to enable technology advancing regulations and incentive programs, and does not have associated emissions reductions identified at this time. ARB will quantify emissions reductions from this action during the measure development process for the Mobile Source Strategy and Proposed 2016 State Strategy for the State Implementation Plan. See http://www.arb.ca.gov/planning/sip/2016sip/2016mobsrc.htm and http://www.arb.ca.gov/planning/sip/sip.htm.

3. Medium- and Heavy-Duty Greenhouse Gas Emissions Standards Phase 2

Overview: The goal of this proposed measure is to advance fuel efficiency improvements and achieve greater greenhouse gas emissions reductions through the introduction of the next generation of integrated engine, powertrain, vehicle, and trailer technologies designed to reduce climate emissions and fuel use. This new round of medium- and heavy-duty vehicle and engine greenhouse gas emission standards, known as Phase 2, will build upon the Phase 1 standards adopted federally in 2011 and in California in 2013.

Implementing Agency: ARB and U.S. Environmental Protection Agency

Type of Action: Regulation

Timing:

Anticipated Board Consideration:	2016-2019
Implementation Schedule:	Implementation will begin with model year 2021 for all new heavy-duty trucks class 2b-8 sold in the nation and model year 2018 for new trailers, and will be fully implemented by model year 2027.

Proposed Actions: In summer 2016, U.S. Environmental Protection Agency expects to finalize the federal Phase 2 standards. The new standards, which push technology improvements beyond what is currently in widespread commercial use, are expected to take effect with model year 2021 for all new class 2b-8 medium- and heavy-duty trucks sold in the nation and in model year 2018 for new trailers, and to be fully phased in by model year 2027. This proposed action would establish Phase 2 greenhouse gas standards for all new class 2b-8 medium- and heavy-duty trucks starting in 2021, and for certain classes of new trailers, starting in 2018. At the federal level, greenhouse gas reduction requirements would apply to certain box-type trailers for the first time.

ARB staff plans to present a California Phase 2 proposal for the Board's consideration in 2017. In addition to harmonizing with the federal Phase 2 standards where applicable, ARB staff's proposal may include some more stringent, California-only provisions that are necessary to meet California's unique air quality challenges. For example, the California Phase 2 proposal may layer additional requirements for vocational vehicle aerodynamics onto the federal Phase 2 program. ARB staff also anticipates presenting amendments to the Tractor-Trailer Greenhouse Gas Regulation in 2019 to harmonize with the federal Phase 2 trailer requirements and include requirements for trailer categories not included in the federal Phase 2 program to further reduce emissions in California.

ARB staff anticipates bringing the California Phase 2 proposal to the Board by 2017. ARB staff also anticipate bringing the amendments to the Tractor-Trailer Greenhouse Gas Regulation to the Board by 2019.

Estimated Cost: ARB will estimate costs from this action during the measure development process for the Proposed 2016 State Strategy for the State Implementation Plan. See http://www.arb.ca.gov/planning/sip/sip.htm.

Benefits: This action is anticipated to provide criteria pollutant and greenhouse gas emissions reduction benefits. ARB will quantify emissions reductions from this action during the measure development process for the Mobile Source Strategy and Proposed 2016 State Strategy for the State Implementation Plan. See http://www.arb.ca.gov/planning/sip/2016sip/2016mobsrc.htm and http://www.arb.ca.gov/planning/sip/sip.htm.

4. Low-Nitrogen Oxides Engine Standard

*Overview: S*ignificant additional emissions reductions from heavy-duty trucks are needed to meet ambient air quality standards and to further reduce the localized risk impacts associated with exposure to toxic diesel particulate matter. To help provide emission reductions needed from heavy-duty trucks operating in California, ARB will develop a heavy-duty low-nitrogen oxides engine standard in California, and, if necessary, petition the U.S. Environmental Protection Agency to establish new federal emission standards for heavy-duty engines.

Implementing Agency: ARB and U.S. Environmental Protection Agency

Type of Action: Regulation and petition

Timing:

ARB petition to U.S. Environmental Protection Agency:	2016
U.S. Environmental Protection Agency Rulemaking:	2017-2019
ARB Rulemaking:	2017-2019
Anticipated Board Consideration:	2019

Proposed Actions: Establish low-nitrogen oxides engine standards for new on-road heavy-duty engines used in medium- and heavy-duty trucks. ARB will begin development of new heavy-duty low-nitrogen oxides emission standards in 2017. ARB may also petition the U.S. Environmental Protection Agency in 2016 to establish new federal heavy-duty engine emission standards. If the U.S. Environmental Protection Agency fails to initiate its own rule development process for a federal standard by 2017, ARB would continue with its development and implementation efforts to establish a California-only lower nitrogen oxides standard. If the U.S. Environmental Protection Agency begins

the regulatory development process for a new federal heavy-duty emission standard by 2017, ARB will coordinate its regulatory development efforts with the federal regulation. In order to achieve the maximum emissions reductions from this proposed action, a federal standard is necessary. A California-only low-nitrogen oxides standard would apply to vehicles with new heavy-duty engines sold in California starting in 2023, while a federal low-nitrogen oxides standard could apply to all new heavy-duty trucks sold nationwide starting in 2024 or later.

If the U.S. Environmental Protection Agency fails to initiate the rule development process by 2017, ARB staff anticipate bringing a California standard to the Board for consideration by 2019.

Estimated Cost: ARB will estimate costs from this action during the measure development process for the Proposed 2016 State Strategy for the State Implementation Plan. See http://www.arb.ca.gov/planning/sip/sip.htm.

Benefits: This action is anticipated to provide criteria pollutant emissions reduction benefits. ARB will quantify emissions reductions from this action during the measure development process for the Mobile Source Strategy and Proposed 2016 State Strategy for the State Implementation Plan. See http://www.arb.ca.gov/planning/sip/2016sip/2016mobsrc.htm and http://www.arb.ca.gov/planning/sip/sip.htm.

C. Freight Technology and Fuels Data Collection and Analysis

1. Freight Hub Data Collection

Overview: The goal of this effort is to collect data, such as facility location, equipment utilization, level of activity, and proximity to sensitive receptors from California based freight hubs. Freight hubs are seaports, airports, railyards, warehouse and distribution centers, truck stops, and border crossings. The information collected will support planning efforts for source/sector specific rulemakings, incentives, enforceable agreements, freight facility performance targets,[13] or other approaches to increase efficiency, reduce emissions, further reduce health risks, improve productivity and competitiveness, reduce congestion, improve safety, security, and resilience, increase use of advanced technologies, as well as reduce other adverse environmental and community impacts.

Implementing Agency: ARB

[13] There is no direction to implement a freight facility performance targets measure in either ARB's *Mobile Source Strategy* or *Proposed 2016 State Strategy for the State Implementation Plan*.

Type of Action: Literature review and freight hub surveys

Timing:
Implementation: 2016+
Analysis: 2016-2017

Proposed Actions: The development of the data collection effort is underway. Data collection will occur through various mechanisms, which may include utilizing existing reporting requirements, new surveys, and an analysis of currently available data.

Staff's proposed work plan includes several milestones during the 2016 timeframe. Staff is in the process of identifying and mapping freight facilities, completing facility site visits, informing stakeholders, developing facility specific surveys, and reviewing existing information. Once this is complete, staff will collaborate with other government agencies, air districts, industry stakeholders, and interested parties to solicit input and refine survey questions and other data collection processes.

Estimated Cost: The data collection effort and analysis is being funded through ARB.

Benefits: Collection of additional data and development of enhanced freight analytical tools would help to influence policy development and direct investments to achieve the following benefits: improve efficiency, productivity, and competitiveness; congestion reduction; improve safety, security, and resilience; improve state of good repair; increase use of advanced technologies; and reduce adverse environmental and community impacts.

2. Zero Emission Vehicle Market Forums

Overview: To address critical barriers to the commercialization of alternative transportation fuels stakeholder workshops are needed to gather information and market insights. More information on the timing and impact of transportation energy technology advances, improvements in performance characteristics, market growth, existing business models, and practices that accelerate commercialization. There is also a need to better understand the continued need, amounts, configuration of government incentives and credits over time, amounts of private investment needed and deployed, sources of investment, and key ingredients for success.

Implementing Agency: GO-Biz and Energy Commission

Type of Action: Outreach

Timing:
Agency Development Work: 2015-2016
Implementation: 2017+

Proposed Actions: GO-Biz and the Energy Commission will host forums to discuss the status of the zero emission vehicle market, including supply chains, technology development, commercial viability, and the role of regional and local economic development organizations in supporting this industry. These forums will be tailored to various stakeholder groups as appropriate: zero emission vehicle owners, facility owners, utilities, electricity ratepayers, and others.

Estimated Cost: Through this action GO-Biz and the Energy Commission would work with business entities and interested stakeholders to help facilitate the growing zero emission vehicle markets and support the emerging business models for companies working to establish cohesive supply chains and effective retail sales models.

Benefits: These actions will assist California businesses in creating green jobs and accelerating the consumer adoption rate of zero emission vehicles, resulting in benefits for the California economy and reducing pollution in communities near high traffic regions.

D. Low-Carbon Renewable Fuels Development and Requirements

1. Renewable Electricity Resources

Overview: Although emissions reductions in the freight sector often focus on mobile source emissions, stationary source emissions from energy generation and usage warrant consideration. In addition to the energy efficiency measures currently being implemented, the increased development of renewable electricity generation is a significant resource to help increase the overall sustainability of the sector. The prospective increase in daytime renewable generation may allow for electric vehicle fueling during normal work hours in certain applications while minimizing impacts to the electric grid.

Implementing Agency: Energy Commission

Type of Action: Policy development

Timing:
Agency Development Work: Ongoing
Implementation: Ongoing

Proposed Actions: Energy Commission would identify opportunities for the utilization of additional renewable electricity generation and daytime

over-generation for the fueling of zero emission vehicles and equipment in the freight sector.

Estimated Cost: Information developed through this effort will help advise the regulatory and incentive mechanisms that will support the business case for renewable energy generation and utilization.

Benefits: Utilizing low-carbon renewable electricity for advanced vehicle fueling will allow California to further maximize the carbon intensity reduction of the fuel used by zero emission vehicles.

2. Natural Gas Vehicle Research Roadmap

Overview: As the transition to zero emission vehicles occurs, low-nitrogen oxides natural gas engines, that utilize low-carbon natural gas, provide an opportunity to use existing technologies to reduce emissions where zero emission options may not yet be available.

Implementing Agency: Energy Commission

Type of Action: Planning

Timing:
Agency Development Work: 2016-2017
Implementation: 2017+

Proposed Actions: The Energy Commission would develop a natural gas vehicle research roadmap that will identify opportunities for further integrating low-carbon renewable natural gas into California's medium- and heavy-duty fleets. A roadmap will serve as a report that integrates the latest information on the state of natural gas vehicle technology and past research efforts to inform future investments in this area. The Energy Commission would analyze and recommend where vehicle research, fuel production, and infrastructure planning efforts should be initiated.

Estimated Cost: This roadmap will provide information enabling efficient usage of public and private investments to support the growing renewable natural gas market.

Benefits: Additional petroleum reduction and the promotion of low-carbon fuel for the medium- and heavy-duty vehicle market will be made possible through this planning.

3. Assess Inclusion of Aviation, Interstate Locomotive, and Marine Fuels in the Post 2020 Cap-and-Trade Program

Overview: Evaluate if aviation, interstate locomotive, and marine fuels can be covered under the Cap-and-Trade Program post 2020.

Implementing Agency: ARB

Type of Action: Regulation

Timing:
Anticipated Program Update: 2018-2020
Implementation Schedule: Post 2020

Proposed Actions: ARB's Cap-and-Trade Program was adopted in 2011 and includes on- and off-road transportation fuels. These fuels are covered at the point of delivery into California and the compliance obligation is assessed on the emissions that would result from the combustion of the fuel within the State. The fuel suppliers are required to acquire and surrender a compliance instrument for each metric ton of emissions that would result from in-state combustion of the fuel. These compliance instruments can be an allowance issued by the State, or a limited use of offsets through voluntary emissions reductions from outside the regulated sectors. Compliance obligations are only assessed from the emissions that would result from the combustion of fossil fuels. If aviation, interstate locomotive, and marine fuels are able to be covered by the Cap-and-Trade Program, they would face the same carbon price and incentive to reduce the use of fossil fuels.

Estimated Cost: As this proposed action is a future assessment of whether additional fuels are able to be covered by the Cap-and-Trade program, it does not have associated costs identified at this time.

Benefits: As this proposed action will initially include an assessment to further evaluate whether additional fuels are able to be covered by California's Cap-and-Trade program, anticipated benefits are not identified at this time. This measure may provide greenhouse gas emissions reductions; should the assessment identify necessary program improvements, the emissions reduction potential of such enhancements will be identified at that time.

4. Assess Inclusion of Aviation, Interstate Locomotive, and Marine Fuels in the Post 2020 Low Carbon Fuel Standard Program

Overview: Evaluate if aviation, interstate locomotive, and marine fuels can be covered under the Low Carbon Fuel Standard Program starting post 2020.

Implementing Agency: ARB

Type of Action: Regulation

Timing:
Anticipated Program Update: 2018-2020
Implementation Schedule: Post 2020

Proposed Actions: ARB's Low Carbon Fuel Standard has been in operation since 2011. The goal of the Low Carbon Fuel Standard is to promote the use of low-carbon fuels by reducing the carbon intensity of transportation fuels by at least 10 percent by 2020, from a 2010 baseline. The Low Carbon Fuel Standard works by setting a declining standard for the carbon intensity of gasoline and diesel and the alternate fuels that replace them. Carbon intensity is a measure of the greenhouse gas emissions associated with the production, distribution, and consumption in the "life cycle" of a transportation fuel.

When importers and producers bring a fuel or fuel blend to market with a carbon intensity that is lower than the standard, they generate credits. Each metric ton of carbon emissions reduced generates one credit. Fuels with a carbon intensity that is higher than the standard generate deficits.

The program currently includes explicit exemptions for aviation, interstate locomotive, and most marine uses. Elimination or changes to these exemptions could create incentives for the use of low carbon fuels in these end uses.

Estimated Cost: As this proposed action is a future assessment of whether additional fuels can be covered by the Low Carbon Fuel Program, it does not have associated costs identified at this time.

Benefits: As this proposed action will initially include an assessment to further evaluate whether additional fuels are able to be covered by California's Low Carbon Fuel Program, anticipated benefits are not identified at this time. This measure may provide greenhouse gas emissions reductions; should the assessment identify necessary program improvements, the emissions reduction potential of such enhancements will be identified at that time.

5. Low-Emission Diesel Requirement

Overview: The goal of this proposed measure is to reduce emissions from the portion of the heavy-duty fleet that will continue to operate on internal combustion engines in order to reduce emissions as quickly as possible. This proposed measure would put into place standards for low-emission diesel, and would require that diesel fuel providers sell steadily increasing volumes of low-emission renewable diesel until it comprises 50 percent of total diesel sales by 2031.

Implementing Agency: ARB

Type of Action: Regulation

Timing:
Anticipated Board Consideration: by 2020
Implementation Schedule: 2023-2031

Proposed Actions: ARB would develop a proposed measure that would require low-emission diesel comprise a steadily increasing percent of the ARB diesel pool. Due to the magnitude of needed nitrogen oxides reductions in the South Coast and the large volumes of low-emission diesel needed for full statewide implementation, the proposed measure would be phased-in with a gradual implementation strategy that starts in the South Coast, and subsequently expands statewide.

This standard is anticipated to increase consumption of low-emission diesel fuels, including: renewable diesel from biomass, nitrogen oxides-mitigated biodiesel, renewable natural gas from biomethane, gas to liquid diesel from biomethane, renewable hydrocarbon diesel, and/or co-processed renewable hydrocarbon diesel.

ARB staff anticipate bringing this action to the Board for consideration by 2020.

Estimated Cost: ARB will estimate costs from this action during the measure development process for the Proposed 2016 State Strategy for the State Implementation Plan. See http://www.arb.ca.gov/planning/sip/sip.htm.

Benefits: This action is anticipated to provide criteria pollutant emissions reduction benefits. The proposed action would provide nitrogen oxides benefits predominately from legacy (pre-2010) on-road heavy-duty vehicles, off-road engines, stationary engines, portable engines, marine vessels and locomotives, as well as nitrogen oxides and diesel particulate matter benefits in potentially all model year off-road engines, stationary engines, portable engines, marine vessels, and locomotives. Interstate vehicles, even those registered out-of-state but operating on ARB diesel blended with low-emission diesel fuels, are also anticipated to provide emissions reduction benefits. ARB will quantify emissions reductions from this action during the measure development process for the Mobile Source Strategy and Proposed 2016 State Strategy for the State Implementation Plan. See http://www.arb.ca.gov/planning/sip/2016sip/2016mobsrc.htm and http://www.arb.ca.gov/planning/sip/sip.htm.

E. Vehicle-Grid Integration Technology Research and Technical Assistance

1. Advanced Transportation Electrification Technologies

Overview: Through the Energy Commission's research and development programs, numerous technologies have been created that will enable advanced energy storage systems to be integrated into electric vehicle charging systems. These technologies will not only provide flexible charging options for these vehicles and stationary energy storage availability, but will also provide opportunities to measure and utilize renewable energy that is generated outside of normal vehicle charging time periods.

Implementing Agency: Energy Commission

Type of Action: Technology development

Timing:

Agency Development Work:	Ongoing
Implementation:	Ongoing

Proposed Actions: The Energy Commission would research applications that integrate advanced energy storage technologies with transportation electrification advancement.

Estimated Cost: Public-private cost-sharing opportunities will be investigated to further develop technologies that will increase the number of advanced technology options for fleets to adopt.

Benefits: The research and development of new product types will enable California to support the long-term development needs that come with the establishment of new technologies. These technologies will provide environmentally beneficial technologies while supporting the supply chains that build the products as the come to market.

2. Vehicle-to-Grid Incentive and Funding Programs

Overview: As the number of plug-in electric vehicle/plug-in hybrid electric vehicles in California increases, the opportunity to utilize excess energy storage capabilities for flexible electricity distribution increases. Support for vehicle-to-grid integration pilots that help develop implementation use cases, communication functionality, and application value, as well as assess load impact per number of vehicles under various charging patterns driven by time-of-use rates, dynamic pricing, and fixed fee charging, will help promote this opportunity.

Implementing Agency: Energy Commission

Type of Action: Funding/incentive

Timing:
Agency Development Work: Ongoing
Implementation: Ongoing

Proposed Actions: The Energy Commission's funding programs will support innovative concepts for deploying vehicle-to-grid technologies in major fleets. The projects will look to develop sustainable business cases for the use of plug-in electric vehicle/plug-in hybrid electric vehicles as distributed energy providers, which will add stability to the grid while assessing the impacts of increased charging and discharging rates on battery packs.

Estimated Cost: Demonstration of vehicle-grid integration technologies improves the business case needed for fleets to acquire zero emission vehicle technologies. By providing public funding for these efforts, California can provide fleets with viable options for the future.

Benefits: Benefits include improving the business case for increased adoption on zero emission vehicle technologies by reducing energy demand charges, reducing costs for long-term investments in power plant construction, and balancing energy supply/consumption in critical load serving regions.

F. Heavy-Duty Zero Emission Vehicle Fueling Infrastructure Research, Development, and Demonstration

1. Medium- and Heavy-Duty Electric Vehicle and Equipment Charging Infrastructure

Overview: To further support the deployment of plug-in electric vehicle/plug-in hybrid electric vehicles in California, a robust charging infrastructure network needs to be developed to support electric-powered medium- and heavy-duty vehicles and equipment. Given the substantial costs that charging for these larger vehicles may have, the need to reduce the overall costs of charging infrastructure is necessary.

Implementing Agency: Energy Commission

Type of Action: Funding/incentive

Timing:
Agency Development Work: 2016-2018
Implementation: 2018+

Proposed Actions: The Energy Commission would identify needed funding for

research, development, and demonstration focused on improving fueling infrastructure for medium- and heavy-duty zero emission vehicles through technology advancement, equipment optimization, cost reduction, and ease of scaling. This effort will be supported by the development of charging standards, which will provide certainty and lower costs for installations.

Estimated Cost: Research and development of advanced fueling infrastructure options will reduce the cost of fueling zero emission vehicles and support the development of cost-effective business models for zero emission vehicles being developed for the freight transport sector.

Benefits: Infrastructure advancements will enable the accelerated development and deployment of zero emission vehicle options.

2. Standardize Medium- and Heavy-Duty Vehicle and Equipment Charging Standards and Protocols

Overview: By standardizing electric vehicle charging technology, the costs and confusion of having numerous charging standards can be avoided. Utilizing lessons learned from the deployment of light-duty plug-in electric vehicle/plug-in hybrid electric vehicles, the benefits of a single charging standard can be realized.

Implementing Agency: Energy Commission

Type of Action: Technology development

Timing:

Agency Development Work:	Ongoing
Implementation:	Ongoing

Proposed Actions: The Energy Commission is working with industry stakeholders and other governmental entities to develop standardized medium- and heavy-duty vehicle and equipment charging protocols. This effort will allow vehicle charging facilities and vehicle/equipment manufacturers to have more certainty in the types of technology that will be needed to support an expanding electric vehicle fleet.

Estimated Cost: Standardization of charging will reduce the costs associated with the need for vehicles to accommodate differing fueling protocols.

Benefits: Standardized charging protocols and infrastructure can reduce costs associated with the deployment of zero emission vehicles and accelerate the deployment of the vehicles, resulting in near-term environmental benefits for California communities.

G. Oceangoing Vessel Standards and Incentives

1. Tier 4 Vessel Standards

Overview: The goal of this proposed measure is to reduce emissions from oceangoing vessels. ARB would advocate with international partners for the International Maritime Organization to establish new Tier 4 nitrogen oxides and particulate matter standards, plus efficiency targets for existing vessels, and new vessel categories not covered by International Maritime Organization efficiency standards.

Implementing Agency: ARB

Type of Action: Advocacy

Timing:

ARB Advocacy:	2015-2018
International Maritime Organization Action, Ratification, and Implementation:	2020-2025

Proposed Actions: Under this action, ARB would work with the U.S. Environmental Protection Agency, U.S. Coast Guard, maritime industry, and international partners to urge the International Maritime Organization to adopt more stringent emission standards for new oceangoing vessels and efficiency requirements for existing vessels. Specifically, ARB would advocate for a Tier 4 nitrogen oxides standard for new marine engines on oceangoing vessels and vessel efficiency requirements for the existing in-use fleet.

Additional regulations are necessary because the existing International Maritime Organization marine engine regulations do not include a particulate matter standard, and the Tier 3 2016 nitrogen oxides standard is higher than the nitrogen oxides standards for other diesel equipment categories. In addition, the International Maritime Organization efficiency standards for existing vessels only require that vessels have a "Ship Energy Efficiency Management Plan." These regulations do not require approval of the plan, tracking of the vessel's progress, or actual improvement in energy efficiency. ARB will communicate and work closely with its partners prior to advocating for specific International Maritime Organization positions.

Estimated Cost: ARB will estimate costs from this action during the measure development process for the Proposed 2016 State Strategy for the State Implementation Plan. See http://www.arb.ca.gov/planning/sip/sip.htm.

Benefits: This action is anticipated to provide criteria pollutant and greenhouse gas emissions reduction benefits. ARB will quantify emissions reductions from this action during the measure development process for the Mobile Source

Strategy and Proposed 2016 State Strategy for the State Implementation Plan. See http://www.arb.ca.gov/planning/sip/2016sip/2016mobsrc.htm and http://www.arb.ca.gov/planning/sip/sip.htm.

2. Incentivize Low Emission Efficient Ship Visits

Overview: The goal of this proposed measure is to achieve early implementation of clean vessel technologies such as liquefied natural gas, Tier 3 standards or better, and incentivize vessels with those technologies in California service. ARB staff would work with California seaports, ocean carriers, and other stakeholders to develop the criteria and to identify the best way to incentivize introduction of Low Emission Efficient Ships into the existing fleet of vessels that visit California seaports.

Implementing Agency: ARB

Type of Action: Incentive

Timing:

Development Work:	2017-2018
Implementation Schedule:	2018+

Proposed Actions: Numerous technologies are available that can reduce emissions from ships and improve the efficiency of a vessel. Incentive programs can be leveraged to encourage vessel owners and operators to implement technologies that exceed current regulatory requirements. Under this proposed action, ARB staff would work with California seaports and other stakeholders to develop criteria for a Low Emission Efficient Ship, targeting nitrogen oxides, diesel particulate matter, greenhouse gas, and sulfur oxide emissions. ARB would also evaluate the necessary levels of incentives most likely to achieve successful utilization of State incentive programs by ocean carriers. In addition, ARB would also pursue partnerships with other ports along the Pacific shipping corridor to develop a “green lane” concept with multiple small incentives for cleaner vessels. Incentives to encourage visits from ships meeting the criteria would involve identification of funding sources and implementation mechanisms such as development of new programs, enhancement of existing programs such as the Port of Long Beach Green Flag program and the Port of Los Angeles Environmental Ship Index Incentive Program, or incorporation into existing statewide incentive programs.

ARB staff anticipate developing criteria for a Low Emission Efficient Ship and incentives for using these ships at California ports by 2018.

Estimated Cost: ARB will estimate costs from this action during the measure development process for the Proposed 2016 State Strategy for the State Implementation Plan. See http://www.arb.ca.gov/planning/sip/sip.htm.

Benefits: This action is anticipated to provide criteria pollutant and greenhouse gas emissions reduction benefits. ARB will quantify emissions reductions from this action during the measure development process for the Mobile Source Strategy and Proposed 2016 State Strategy for the State Implementation Plan. See http://www.arb.ca.gov/planning/sip/2016sip/2016mobsrc.htm and http://www.arb.ca.gov/planning/sip/sip.htm.

3. At-Berth Regulation Amendments

Overview: The goal of this proposed measure is to further reduce emissions from ships. ARB staff would develop and propose amendments to the current At-Berth Regulation and look for additional reductions from additional vessel fleets or types.

Implementing Agency: ARB

Type of Action: Regulation

Timing:

Anticipated Board Consideration:	2017-2018
Implementation Schedule:	2022-2032

Proposed Actions: ARB would evaluate how the current At-Berth Regulation can be amended to achieve further emissions reductions by including smaller fleets and/or additional vessel types (including roll-on/roll-off vehicle carriers, bulk cargo carriers, and tankers). In addition, there are two companies with portable emissions capture and control systems that have successfully demonstrated performance and may now be used for compliance with the current Regulation on certain container vessels. If one or both systems prove to be feasible and cost-effective on additional vessel types, the technology could help support an ARB staff proposal to expand the scope of the Regulation to include additional vessel types and/or smaller fleets.

ARB staff anticipate bringing this measure to the Board in 2017.

Estimated Cost: ARB will estimate costs from this action during the measure development process for the Proposed 2016 State Strategy for the State Implementation Plan. See http://www.arb.ca.gov/planning/sip/sip.htm.

Benefits: This action is anticipated to provide criteria pollutant and greenhouse gas emissions reduction benefits. ARB will quantify emissions reductions from this action during the measure development process for the Mobile Source Strategy and Proposed 2016 State Strategy for the State Implementation Plan. See http://www.arb.ca.gov/planning/sip/2016sip/2016mobsrc.htm and http://www.arb.ca.gov/planning/sip/sip.htm.

H. Zero Emission Freight Vehicle and Equipment Requirements and Incentives

1. Last Mile Delivery

Overview: The goal of this proposed measure is to achieve NOx and greenhouse gas emissions reductions goals through advanced clean technology, and to increase the penetration of the first wave of zero emission heavy-duty technology into applications that are well suited to its use. Last mile delivery fleets are well suited for introducing zero emission technology because they operate in urban centers, have stop and go driving cycles, and are centrally maintained and fueled. Experience gained from demonstrating the viability of advanced technologies in these fleets will benefit the market and enable the same technologies to be used in other heavy-duty vehicle applications.

Implementing Agency: ARB

Type of Action: Regulation

Timing:

Anticipated Board Consideration:	2018
Implementation Schedule:	2020-2050

Proposed Actions: ARB would develop and propose a regulation that would require the use of low-nitrogen oxides engines and the purchase of zero emission trucks for class 3-7 last mile delivery trucks in California. This proposed measure will require certain fleets that operate last mile delivery trucks to purchase zero emission trucks starting 2020, with a low fraction initially and ramping up to a higher percentage of the fleet gradually at time of normal replacement. ARB staff is evaluating options for purchase requirements. The initial ramp up of zero emission trucks will consider the ability of the new technology to meet the operational needs of the users and avoid stranding assets.

ARB staff anticipate bringing this measure to the Board in 2018.

Estimated Cost: ARB will estimate costs from this action during the measure development process for the Proposed 2016 State Strategy for the State Implementation Plan. See http://www.arb.ca.gov/planning/sip/sip.htm.

Benefits: This action is anticipated to provide criteria pollutant and greenhouse gas emissions reduction benefits. ARB will quantify emissions reductions from this action during the measure development process for the Mobile Source Strategy and Proposed 2016 State Strategy for the State Implementation Plan. See http://www.arb.ca.gov/planning/sip/2016sip/2016mobsrc.htm and http://www.arb.ca.gov/planning/sip/sip.htm.

2. Zero Emission Off-Road Forklift Regulation Phase 1

Overview: The goal of this proposed measure is to accelerate the deployment of zero emission technologies in off-road equipment types that are already primed for the technologies that exist today and facilitate further technology development and infrastructure expansion by demonstrating its viability. Forklifts operate in many different industry sectors but are most prevalent in manufacturing and at locations such as warehouses, distribution centers, and ports. There are approximately 100,000 forklifts operating in California, most of which are battery-electric, propane, diesel, or gasoline-fueled. ARB would develop a regulation that focuses on forklifts with lift capacities equal to or less than 8,000 pounds.

Implementing Agency: ARB

Type of Action: Regulation

Timing:

Anticipated Board Consideration:	2020
Implementation Schedule:	2023 - 2035

Proposed Actions: ARB staff would develop and propose a regulation to increase penetration of zero emission equipment in off-road applications with a specific focus on forklifts with lift capacities equal to or less than 8,000 pounds for which zero emission technologies have already gained appreciable customer acceptance and market penetration. This regulation would send a market signal to technology manufacturers and investors that zero-emission technologies will be strongly supported moving forward. This proposed action would advance zero-emission commercialization by increasing the penetration of zero-emission technologies in a way that considers the ability of the technology to meet the operational needs of users and avoids stranding assets. Experience gained from demonstrating the viability of advanced technologies in heavier-duty applications will spur market development and enable the technologies to be transferred to larger, higher power-demand off-road equipment types, such as high lift-capacity forklifts and other equipment types in the construction, industrial, and mining sectors. The regulation could also include requirements that result in the deployment of zero emission technologies in heavier equipment fleets that remain at a particular location for extended periods of time or other similar provisions that would spur further technology innovation.

ARB staff anticipate bringing this regulation to the Board for consideration by 2020.

Estimated Cost: ARB will estimate costs from this action during the measure development process for the Proposed 2016 State Strategy for the State Implementation Plan. See http://www.arb.ca.gov/planning/sip/sip.htm.

Benefits: This action is anticipated to provide criteria pollutant and greenhouse gas emissions reduction benefits. ARB will quantify emissions reductions from this action during the measure development process for the Mobile Source Strategy and Proposed 2016 State Strategy for the State Implementation Plan. See http://www.arb.ca.gov/planning/sip/2016sip/2016mobsrc.htm and http://www.arb.ca.gov/planning/sip/sip.htm.

3. Zero Emission Airport Ground Support Equipment

Overview: The goal of this proposed action is to increase the penetration of the first wave of zero emission heavy-duty technology in applications that are well suited to its use, and to facilitate further technology development and infrastructure expansion. The current commercial availability of several ground support equipment types indicates the feasibility of this transition. Battery-electric ground support equipment are the most common type of zero emission ground support equipment available today. Many large air carriers, which operate diesel ground support equipment have already begun moving towards electric equipment. The added introduction of zero emission ground support equipment will act as a catalyst to further zero emission equipment penetration in the off-road equipment sector and other heavier duty cycle and longer-range applications.

Implementing Agency: ARB

Type of Action: Regulation and incentive

Timing:

Anticipated Board Consideration:	2018
Implementation Schedule:	2023

Proposed Actions: ARB will develop and consider a regulation to transition diesel and large spark ignition airport ground support equipment to zero emission technology that will consider the ability of the technology to meet the operational needs of users and avoid stranding assets.

ARB staff anticipate bringing this measure to the Board by 2018.

Estimated Cost: ARB will estimate costs from this action during the measure development process for the Proposed 2016 State Strategy for the State Implementation Plan. See http://www.arb.ca.gov/planning/sip/sip.htm.

Benefits: This action is anticipated to provide criteria pollutant and greenhouse gas emissions reduction benefits. ARB will quantify emissions reductions from this action during the measure development process for the Mobile Source Strategy and Proposed 2016 State Strategy for the State Implementation Plan.

See http://www.arb.ca.gov/planning/sip/2016sip/2016mobsrc.htm and http://www.arb.ca.gov/planning/sip/sip.htm.

4. Transport Refrigeration Units Used For Cold Storage

Overview: The goal of this proposed measure is to advance zero and near-zero emission technology commercialization by increasing the early penetration of hybrid electric and electric standby-equipped transport refrigeration units used for cold storage, and supporting the needed infrastructure developments. ARB would develop a regulation to reduce nitrogen oxides, particulate matter, and greenhouse gas emissions by reducing the amount of time that transport refrigeration units operate using internal combustion engines while refrigerated trucks, trailers, and shipping containers are parked (stationary) at certain California facilities and other locations.

Implementing Agency: ARB

Type of Action: Regulation and incentive

Timing:

Anticipated Board Consideration:	2017-2018
Implementation Schedule:	2020+

Proposed Actions: The initial concept of the proposed regulation would limit the amount of stationary operating time that a transport refrigeration system powered by an internal combustion engine can operate at certain facilities. The time limit would decrease on a phased compliance schedule. When developing compliance options ARB will consider the ability of technologies to meet the operational needs of the users and avoid stranding assets. These options could include the use of commercially available hybrid electric transport refrigeration units, transport refrigeration units equipped with electric standby motors, and cryogenic transport refrigeration systems. Hybrid electric and electric standby-equipped transport refrigeration units would plug into electric power plugs while stationary and use alternative power while on the road. Development and use of zero emission technologies, such as all-electric plug-in/advanced battery transport refrigeration systems would be encouraged, as well as adequately-sized cold storage facilities, and more efficient inbound delivery appointment and outbound dispatch scheduling.

ARB staff anticipate bringing this measure to the Board in 2018.

Estimated Cost: ARB will estimate costs from this action during the measure development process for the Proposed 2016 State Strategy for the State Implementation Plan. See http://www.arb.ca.gov/planning/sip/sip.htm.

Benefits: This action is anticipated to provide criteria pollutant and greenhouse gas emissions reduction benefits. ARB will quantify emissions reductions from this action during the measure development process for the Mobile Source Strategy and Proposed 2016 State Strategy for the State Implementation Plan. See http://www.arb.ca.gov/planning/sip/2016sip/2016mobsrc.htm and http://www.arb.ca.gov/planning/sip/sip.htm.

I. More Stringent National Locomotive Emission Standards

Overview: The goal of this proposed measure is to reduce emissions from locomotives in order to meet our air quality and climate change goals. ARB would petition U.S. Environmental Protection Agency to promulgate by 2020 new Tier 5 national locomotive emission standards and more stringent national requirements for remanufactured locomotives to reduce criteria and toxic pollutants, fuel consumption, and greenhouse gas emissions.

Implementing Agency: ARB and U.S. Environmental Protection Agency

Type of Action: Petition to U.S. Environmental Protection Agency for federal action

Timing:

ARB petition to U.S. Environmental Protection Agency:	2016
U.S. Environmental Protection Agency rulemaking date:	2020
Implementation schedule:	Remanufactured locomotives beginning in 2023; newly manufactured locomotives beginning in 2025

Proposed Actions: ARB would petition U.S. Environmental Protection Agency for new national locomotive emission standards for significant additional reductions in criteria and toxic pollutants and greenhouse gas emissions (based on aftertreatment, on-board battery technology, and incentives for zero emission track mile and zero emission locomotives). The petition would also request new standards to reduce toxic and criteria emissions in Tier 2, 3, and 4 locomotives upon remanufacture (based on aftertreatment). ARB staff estimate that U.S. Environmental Protection Agency could require manufacturers to implement the new locomotive emission regulations by as early as 2023 for remanufactures and 2025 for newly manufactured locomotives.

ARB staff anticipate petitioning U.S. Environmental Protection Agency to develop this measure in 2016.

Estimated Cost: ARB will estimate costs from this action during the measure development process for the Proposed 2016 State Strategy for the State Implementation Plan. See http://www.arb.ca.gov/planning/sip/sip.htm.

Benefits: This action is anticipated to provide criteria pollutant and greenhouse gas emissions reduction benefits. ARB will quantify emissions reductions from this action during the measure development process for the Mobile Source Strategy and Proposed 2016 State Strategy for the State Implementation Plan. See http://www.arb.ca.gov/planning/sip/2016sip/2016mobsrc.htm and http://www.arb.ca.gov/planning/sip/sip.htm.

J. Further Deployment of Cleaner Technologies Through Regulations, Partnerships, and Incentives

1. On-Road Heavy-Duty Vehicles

Overview: The goal of this proposed measure is to identify concepts that will further reduce nitrogen oxides emissions from on-road heavy-duty vehicles. These concepts will include additional incentive funding and developing technologies to accelerate the penetration of zero and near-zero equipment beyond the rate of natural turnover. This action is specifically for the South Coast.

Implementing Agency: ARB and South Coast Air Quality Management District

Type of Action: Funding programs, regulatory approaches, efficiency strategies, intelligent transportation systems

Timing:
Implementation Schedule: 2016 – 2031

Proposed Actions: Both ARB and South Coast Air Quality Management District will work together to develop a suite of additional actions, including early penetration of zero and near-zero technologies, emission benefits associated with increased operational efficiency strategies, and the potential for new driver assist and intelligent transportation systems. Actions may include:

- Additional regulatory mechanisms that encourage the development of near-zero and zero emission heavy-duty truck deployment.
- Expanding and enhancing existing incentive and other innovative funding programs for heavy-duty vehicles to increase the emphasis on and support for purchase of zero and near-zero emission equipment.
- Additional regulatory mechanisms to require zero emission vehicles in applications, beyond transit buses, airport shuttles, and last mile delivery.
- Advancing development of autonomous and connected vehicle systems, particularly if based on zero emission technologies, as well as greater operational efficiencies, and improvements in transportation logistics.

Estimated Cost: ARB will estimate costs from this action during the measure development process for the Proposed 2016 State Strategy for the State Implementation Plan. See http://www.arb.ca.gov/planning/sip/sip.htm.

Benefits: This action is anticipated to provide criteria pollutant and greenhouse gas emissions reduction benefits. ARB will quantify emissions reductions from this action during the measure development process for the Mobile Source Strategy and Proposed 2016 State Strategy for the State Implementation Plan. See http://www.arb.ca.gov/planning/sip/2016sip/2016mobsrc.htm and http://www.arb.ca.gov/planning/sip/sip.htm.

2. Off-Road Federal and International Sources

Overview: The goals of this proposed measure are to increase the penetration of cleaner oceangoing vessel, locomotive, and aircraft technologies, and to promote efficiency improvements at the equipment, sector, and systems levels. This action is specifically for the South Coast.

Implementing Agency: ARB and South Coast Air Quality Management District

Type of Action: Incentive programs, regulatory approaches, and efficiency

Timing:
Implementation Schedule: 2016 – 2031

Proposed Actions: Both ARB and the South Coast Air Quality Management District will develop a suite of additional actions that target off-road federal and international sources, including oceangoing vessels, locomotives, and aircraft. Actions may include:

- Expanding and enhancing existing incentive and innovative funding programs to increase the emphasis on and support for deployment of cleaner technologies in these sectors.
- Partnering with airports to incentivize cleaner aircraft to come to California airports, along with partnerships with international engine manufacturers to encourage production of cleaner, more efficient engines.
- Seeking continued funding for and partnerships with federal agencies such as the U.S. Department of Energy, U.S. Environmental Protection Agency, Federal Aviation Administration, U.S. Maritime Administration, and Federal Railroad Administration for new technology and fuel demonstration projects.
- Encouraging efficiency improvements, including industry based initiatives (like the San Pedro Bay Ports' Supply Chain Optimization effort to increase seaport competitiveness), as well as other efficiency concepts being developed as part of this Action Plan.

Estimated Cost: ARB will estimate costs from this action during the measure development process for the Proposed 2016 State Strategy for the State Implementation Plan. See http://www.arb.ca.gov/planning/sip/sip.htm.

Benefits: This action is anticipated to provide criteria pollutant and greenhouse gas emissions reduction benefits. ARB will quantify emissions reductions from this action during the measure development process for the Mobile Source Strategy and Proposed 2016 State Strategy for the State Implementation Plan. See http://www.arb.ca.gov/planning/sip/2016sip/2016mobsrc.htm and http://www.arb.ca.gov/planning/sip/sip.htm.

3. Off-Road Equipment

Overview: The goals of this proposed measure are to accelerate the penetration of zero and near-zero equipment and to promote in-use efficiency gains through use of connected and autonomous vehicles and worksite efficiencies. This action is specifically for the South Coast.

Implementing Agency: ARB and South Coast Air Quality Management District

Type of Action: Regulation, incentives, and efficiency measures

Timing:
Implementation Schedule: 2016 – 2031

Proposed Actions: Both ARB and the South Coast Air Quality Management District will develop a suite of additional actions through further exploration of opportunities for early penetration of zero and near-zero equipment technologies, the potential for worksite integration and efficiency, as well as connected and autonomous vehicle technologies. Actions may include:

- Developing requirements for cleaner zero and near-zero technologies for transport refrigeration units.
- Expanding and enhancing existing incentive and other innovative funding programs for off-road equipment to increase the emphasis on and support for zero emission capable equipment.
- Further advanced technology deployment with expansion of zero emission technologies into heavier pieces of off-road equipment such as high lift-capacity forklifts and other equipment in the construction, mining, and industrial sectors.
- Advancing development of autonomous systems, particularly if based on zero emission technologies, as well as greater worksite integration, efficiency, and fleet management technologies.

Estimated Cost: ARB will estimate costs from this action during the measure development process for the Proposed 2016 State Strategy for the State Implementation Plan. See http://www.arb.ca.gov/planning/sip/sip.htm.

Benefits: This action is anticipated to provide criteria pollutant and greenhouse gas emissions reduction benefits. ARB will quantify emissions reductions from this action during the measure development process for the Mobile Source Strategy and Proposed 2016 State Strategy for the State Implementation Plan. See http://www.arb.ca.gov/planning/sip/2016sip/2016mobsrc.htm and http://www.arb.ca.gov/planning/sip/sip.htm.

K. Partnership with Seaports to Advance Freight Vehicle and Equipment Technology Demonstrations

1. Seaport Electrification Demonstration Projects

Overview: Through energy assessment activities at California's seaports, the Energy Commission identified areas where the deployment of plug-in electric vehicle/plug-in hybrid electric vehicles, equipment, and shore power technologies can have a significant impact on the electricity supply and air quality of the surrounding areas.

Implementing Agency: Energy Commission

Type of Action: Technology deployment

Timing:

Agency Development Work:	Ongoing
Implementation:	Ongoing

Proposed Actions: The Energy Commission would collaborate with seaports to develop demonstration projects that will promote electrification of service equipment and increase shore power applications to expand zero emission vehicles globally. The Energy Commission would continue to work with seaport operators to determine what policy and economic support may accelerate these deployments, as well as identifying opportunities to leverage public funding to reduce any economic impacts from these efforts.

Estimated Cost: Through July 2016, the Alternative and Renewable Fuel and Vehicle Technology Program has provided over $100 million for the development and deployment of advanced medium- and heavy-duty vehicle technologies. Through this action, additional grant and loan mechanisms will be identified to support the accelerated development and deployment of advanced mobile and stationary technologies.

Benefits: Advanced technology implementation will provide cost-effective building and lighting efficiency options and accelerate the near-term deployment of zero

and near-zero emission technologies that will provide environmental benefits to disadvantaged communities.

2. Terminal Cost-Sharing

Overview: The differing contracts between seaports in California and their tenants often prevent a one-size fits all approach to adopting energy-efficient cost-saving technologies.

Implementing Agency: Energy Commission

Type of Action: Funding/incentive

Timing:
Agency Development Work: Ongoing
Implementation: Ongoing

Proposed Actions: The Energy Commission would work with California seaports to identify innovative contract mechanisms that will allow seaports and terminal operators to cost-share installation of zero emission vehicle fueling infrastructure, advanced lighting and other energy efficiency measures. The Energy Commission would provide recommendations on areas where public funding may enable and accelerate the transition to these newer technologies.

Estimated Cost: Upfront costs associated with infrastructure improvements can be shared between property owners and operators to ensure the economic benefits of these improvements will be equitably accrued.

Benefits: By eliminating contractual barriers preventing cost-effective technologies from being deployed, California seaports can work with tenants to expedite the deployment of clean and efficient technologies.

3. Opportunities to Coordinate with Department of Defense

Overview: With numerous Department of Defense installations located near major freight hubs in California, synergies to combine advanced vehicle deployments between the sectors exist. Vehicle and infrastructure deployment for closely situated facilities can be coordinated to enable economies of scale and lessons learned from previous efforts.

Implementing Agency: Energy Commission

Type of Action: Technology development, funding/incentive

Timing:
Agency Development Work: Ongoing
Implementation: Ongoing

Proposed Actions: The Energy Commission would provide information from related projects to interested parties to help enable the information exchange that will bring efficiencies to the deployment of these technologies for California seaports and defense facilities. The Energy Commission would leverage opportunities to combine advanced vehicle technology deployments by the Department of Defense with similar actions from nearby seaports.

Estimated Cost: As the Department of Defense works to integrate clean and reliable technologies into its marine activities, lessons learned through partnerships with California's seaports can help reduce the need to duplicate technology development efforts, and in turn reduce the associated costs.

Benefits: These actions will accelerate the adoption of cleaner technologies by the Department of Defense installations located throughout California.

L. Outreach and Advocacy to Increase Awareness of Advanced Vehicle and Equipment Technologies and Clean Energy Generation Options for Freight

1. Freight Fleets

Overview: Significant advances in technology and vehicle options have been made over the past few years that are unknown to regional planning organizations.

Implementing Agency: Energy Commission and ARB

Type of Action: Outreach

Timing:

Agency Development Work:	Ongoing
Implementation:	Ongoing

Proposed Actions: The Energy Commission and ARB will work to increase freight fleet awareness of advanced vehicle technology option through outreach and education campaigns. These efforts will be coordinated with regional planning efforts, to provide information relevant to each region's specific needs.

Estimated Cost: Because these proposed activities consist of unknown future actions, estimated costs are not identified at this time.

Benefits: The Energy Commission and ARB will provide California fleets with objective information and technical expertise to support educated purchases of advanced technology vehicles and equipment. These vehicles can provide fuel cost savings, improve air quality, and reduce California's dependence on petroleum products.

2. International Partners

Overview: The goals of this proposed measure are to engage in international actions that help other regions move toward a more sustainable freight transport system, marked by improved efficiency, use of zero emission technologies, and improved market integrity between governments. This action builds on California's ongoing leadership in supporting national and international zero emission vehicle deployment and clean energy generation.

Implementing Agency: Caltrans, ARB, Energy Commission, GO-Biz

Type of Action: Advocacy

Timing:
Implementation: Ongoing

Proposed Actions: For this proposed measure, all State agencies will continue to engage in supporting State advocacy at the international level on topics related to sustainable freight. Examples of such efforts include:

- Coordinating research and investments in clean energy generation.
- Researching and fostering cross-border investments in zero and near-zero emission freight technologies.
- Deepening collaborations to foster improvements in market integrity (such as developing complementary market-based programs to reduce greenhouse gas emissions).
- Developing common standards for equipment and refueling infrastructure.
- Coordinating sustainable freight programs between regions and countries.

This can be accomplished through conferring with international leaders at related summits, developing Memorandums of Understanding with other governments, and sharing California lessons learned at conferences and meetings with international policymakers.

Estimated Cost: Because this proposed measure consists of unknown future actions, estimated costs are not identified at this time.

Benefits: California has a long history of effectively balancing environmental protection with affordable, safe, and reliable transportation options. This success is due to California's pioneering and innovative policies. Caltrans, ARB, Energy Commission, and GO-Biz are at the forefront of these policies. To share their successes and learn from others, the State agencies are committed to cooperating with other countries and jurisdictions interested in addressing complex transportation issues and creating sustainable freight systems worldwide.

ACTION 5: Convene a freight think tank of experts to provide insight into the demands on the future freight transport system and then identify the transformative technologies, solutions, partnerships, and critical steps to meet those demands, consistent with the Guiding Principles.

A. Anticipating Future Demands on California's Freight System

Overview: There is a need to understand and anticipate changes in the demands on the freight transport system, and to accommodate those potential changes in long-term planning for infrastructure and technology investments, while pursuing the sustainability goals of the Action Plan.

Technology advances in intelligent transportation systems, shipping alliances, drought, shifts in energy resources, three-dimensional printers and drones, and changes in consumer purchasing behavior with e-commerce are just a few of the things changing California's freight transport system. These and other emerging trends will drive multiple transitions in the structure of the freight system over the next several decades.

As domestic and international demands for the types and quantity of goods change, cargo owners, labor, and logistics providers must quickly adapt to remain competitive. But California's logistics infrastructure is typically designed to accommodate the current operational structure and it often takes a decade or more to build new facilities. Given the significant investments necessary to build facilities and infrastructure, California can enhance the utility of those investments by considering designs that are flexible and supportive of a continuously evolving freight network.

To succeed, State and local planners need to enhance their understanding of what trends may change future demand and how, what resources may be needed to make these goods, how and where they will be made, and who will consume them. The State agencies will host an executive-level session with strategists working for beneficial cargo owners, freight transport and logistics providers, labor interests, as well as academic researchers and economists, to gain expert insight on current work in these areas and identify additional needs.

Implementing Agency: Caltrans, ARB, Energy Commission, GO-Biz

Type of Action: Need identification, coordination, and partnership

Timing:

Agency Development Work:	2016+
Implementation:	2017+

Proposed Actions: Identify trends with the potential to significantly change what goods will need to be moved, where, and how in California. The purpose of session discussions will be to:

- Ask what issues should be on the table as California considers long-term decisions about infrastructure and facilities, including what research is being done or needs to be done to better inform those decisions.
- Understand the global, national, state, and regional trends in resources, production, and consumption of goods that impact the effectiveness of California's current freight network.
- Seek expert input on possible changes in supply chains and logistics, land use, technology applications, consumer behavior and other factors that will require California to alter its supporting infrastructure.
- Recognize market, technology, policy, and other factors on the horizon that will drive changes in the freight system and brainstorm on how California can respond in a way that fosters sustainability, job growth, and competitiveness.
- Identify opportunities for private and public sector partners to collaborate on responding to changing cargo demands and influencing progress towards a future freight system that achieves the goals as set forth in this Action Plan.

Estimated Cost: Because these proposed activities consist of unknown future actions, estimated costs are not identified at this time.

Benefits: Expert insight into the drivers for change and the potential responses that California can consider as part of long-term planning for the future freight transport system will allow the State to better evaluate prospective actions. Information and partnership opportunities would help to influence policy development and direct investments to achieve benefits to realize the long-term goals described by the Action Plan's Vision and Guiding Principles.

ACTION 6: Convene industry stakeholder working groups to identify a target or targets and deploy strategies that consider commercial viability and promote the competitiveness of California's statewide and local freight transport system. Develop economic growth and competitiveness metrics, models, and other tools and data to analyze benefits and impacts of actions, including costs, and develop and implement a suite of quantitative metrics to track progress in order to ensure that the impacts of actions on economic growth and competitiveness are considered throughout the development and implementation process.

A. Competitiveness Data Development and Utilization

Overview: 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 metric to measure and track California freight industry competitiveness, analyses of the costs and benefits of State actions, and an ongoing benchmarking of the State's freight industry. In order to fully implement Action 6, the State agencies, in conjunction with an economic competitiveness working group of State agency representatives, industry stakeholders, economists, and subject matter experts, will be establishing targets, metrics, and models.

Implementing Agency: GO-Biz

Type of Action: Convene stakeholder group, assess needs, coordinate, implement procedures, and develop tools and metrics to support implementation

Timing:

Agency Development Work:	2016+
Implementation:	2017+

Proposed Actions: Go-Biz will convene a working group of necessary private and public sector partners to further assess freight transport system competiveness target or targets, metrics, models, and data needs. The working group shall be tasked with the following responsibilities:

- Developing a State competitiveness baseline, future competitiveness target or targets, and a suite of quantitative metrics and models to measure and track State freight industry competitiveness.
- Providing applicable evaluative criteria, quantitative metrics, and economic models for State agencies to consider when developing an economic analysis of the costs and benefits of State actions, including identifying the potential for stranded assets and associated costs.
- Identifying opportunities for private and public sector partners to collaborate on freight data collection and modeling tool development - see Action 3 D. Freight Data Collection and Modeling Tool Development to

Enhance Knowledge and Planning for Freight Corridor Improvement and State Investments.

- Conducting ongoing benchmarking of the State's freight industry on a regional scale so as to ground freight industry competitiveness efforts across regions.

Estimated Cost: Because these proposed activities consist of unknown future actions, estimated costs are not identified at this time.

Benefits: Development of enhanced freight competitiveness metrics and data will allow the State to better evaluate the benefits and impacts of infrastructure enhancements, regulations, incentives, and other actions affecting the freight transport sector. The quantitative metric and ongoing regional benchmarking will help to ensure progress towards supporting economic competitiveness and reaches the State's competitiveness target or targets. This information would help to influence policy development and direct investments to achieve the following benefits: improving economic efficiency, productivity, and competitiveness.

B. Marketing Campaign for California's Freight Transportation System

Overview: In order to attract business and bolster California's economy, there is a need to promote the unique capabilities of California's freight transport system.

Implementing Agency: GO-Biz

Type of Action: Convene stakeholder group, *o*utreach, promotion

Timing:
Agency Development Work: 2016+
Implementation: 2017+

Proposed Actions: Go-Biz will convene a stakeholder working group that will consider developing draft strategic marketing programs and campaigns that promote California's freight transport system capabilities, achievements, and leverage its location and unique competitive advantage.

Estimated Cost: Because these proposed activities consist of unknown future actions, estimated costs are not identified at this time.

Benefits: These strategies can bring benefits to State, regional, and local economies as it attracts business and operations to California.

ACTION 7: Work with the freight efficiency development group to refine its work to identify and deploy strategies to improve the efficiency of freight transport in California now and in the coming years, consistent with the objectives of this Action Plan.

A. Truck Trip Planning, Coordination, and Management Improvements

1. Truck Platooning

Overview: Vehicle or truck platooning involves tethering two or more vehicles in close proximity (e.g., three feet) along a roadway at up to highway speeds using wireless signals (vehicle-to-vehicle communication technology). The front truck controls speed and braking for the whole chain of trucks, while the following vehicles remain engaged in steering. All trucks in the "train" are equipped with dash cameras and monitors that keep track of the road in front of the lead truck, as well as the road behind the rear truck. Collision mitigation systems are on each tractor and drivers can manually override the system to break in emergencies.

Caltrans is collaborating with University of California, Berkeley to research and demonstrate truck-platooning technology. Two-linked vehicles have been successfully demonstrated; however, there are still technological, regulatory, and legislative hurdles that need to be overcome before widespread implementation. The next step is with three linked vehicles and safe maneuvering in and out of formation.

Implementing Agency: Caltrans

Type of Action: Support development and implementation

Timing:
Begin Development: Present to 2020+
Implementation: 2020+

Proposed Actions: Support automated (vehicle-to-vehicle) truck platooning technology. Strategies may involve:

- Continuing with truck platooning advanced technology and operations research.
- Demonstrating advanced technology on roadways including a pilot project along a freight corridor.
- Continuing advancement until technology is safe.

Estimated Cost: Per truck brake cost will be around $2,500 and autonomous driverless technology will cost around $30,000. According to the Hub Modernization white paper, it is all but impossible to give stable cost projections

because much technology is still under development and different models are being tested.[14] There have been unconfirmed estimates in the range of $150 to $200 per year, per vehicle.

Benefits: This technology would reduce aerodynamic drag, create fuel consumption savings, and reduce carbon emissions (in the range of 4 to 10 percent).[15] Automated truck speed and spacing, in conjunction with vehicle-to-vehicle communication, can double throughput capacity. Estimated fuel-cost savings is as much as $500,000 a year per 100 trucks outfitted with the new technology.

2. Truck Route Designation

Overview: Improve truck trip planning by establishing and publishing verified primary Surface Transportation Assistance Act, alternate truck routes, and rest stops throughout the state, particularly in key freight corridors.

Implementing Agency: Caltrans

Type of Action: Publish designated and alternate truck routes

Timing:
Begin Development: 2017-2019
Implementation: 2019

Proposed Actions: To improve truck trip planning, establish and publish verified primary Surface Transportation Assistance Act routes, alternate truck routes, and rest stops throughout the State, particularly in key highway freight corridors and adjacent local roads. Strategies may include:

- Working with trucking and planning partners to identify current and alternate routing as well as rest stops.
- Creating maps/routing/facilities in a geographic information system format accessible by mobile phone/devices.
- Updating information on a regular basis to keep information current.

Estimated Cost: Costs would be minimized by appending the data gathering process to an existing practice. Additional labor hours may be needed to meet the objective. Caltrans Office of Truck Services publishes current Surface Transportation Assistance Act routes on its website but Surface Transportation

[14] Thomas O'Brien, "White Paper: Operational Modernization at Distribution Hubs", Freight Efficiency Strategies Development Group, February 2016.
[15] North American Council for Freight Efficiency, "CR England Peloton Technology Platooning Test Nov 2013", 2013, http://nacfe.org/wp-content/uploads/2013/12/CR-England.pdf.

Assistance Act routes statewide have not been identified. Coordination with cities, counties, regional planning agencies, California Highway Patrol, shippers, and other organizations would be necessary.

Benefits: Having local Surface Transportation Assistance Act route information will effectively address the issues of route searching and re-routing. Carriers can confidently optimize their routes and minimize vehicle miles traveled. Efficient routing would have modest emissions reductions, but would improve safety along with property damage due to truck off-tracking into public and private property. Reduction in violations and fines may reduce operating costs. Additionally, hazardous freight could travel more safely when transported through Surface Transportation Assistance Act designated routes.[16]

3. Compatible Roadway Design

Overview: The Surface Transportation Assistance Act allows large commercial trucks and trailers to operate on the interstate and certain primary routes. Longer than California legal trucks, Surface Transportation Assistance Act trucks require a larger turning radius than most local roads can handle. Caltrans is proposing to take actions to help ensure heavy-duty trucks can safely negotiate aging freight interchanges and routes within urban corridors. With the anticipation of freight volume increases and continuing emphasis placed on infill, urban density, and walkable/bike-friendly communities, efficient freight movement is becoming increasingly more complex and challenging. Improving design and roadway geometrics, accommodating truck parking for delivery and pick-ups, addressing last mile inefficiencies, and safe interchange movements will benefit all roadway users. In addition, system efficiencies are possible if safe movement of larger/heavier vehicles were feasible—perhaps only under limited circumstances only.

Implementing Agency: Caltrans

Type of Action: Departmental design and guideline changes

Timing:
Begin Development: 2016-2018
Implementation: 2018

Proposed Actions: Ensure roadway design and planning consider standard heavy-duty truck geometries. Investigate the possibility for increased truck weight and/or length on key freight corridors. Such strategies may include:

- Reviewing the latest Highway Design Manual for design allowances for truck geometries especially within interchanges and urban freight routes.

[16] Gen Giuliano, et al, “White Paper: Information Technology”, Freight Efficiency Strategy Development Group - IT Working Group, January 2016.

- Facilitating the development of design based guidelines that can aid localities in planning for truck movements at intersections, docks, and the interface between public roadways and other nodes.
- Evaluating impacts of potentially increasing allowable standard truck sizes operating within the State under very limited circumstances only.
- Reviewing latest Regional Transportation Plan Guidelines to ensure Smart Growth and other initiative considerations are compatible with urban freight truck movement.
- Making recommendations for adjustments to reflect freight truck/delivery needs.
- Verifying that modifications are included as amendments or within the subsequent document versions.

Estimated Cost: Only nine projects from the 2014 California Freight Mobility Plan were identified as addressing Surface Transportation Assistance Act issues—all located in Northern California. The total cost for eight projects was nearly $31 million with one project's cost, undetermined. Other associated costs include repair to damaged infrastructure and property (bridge hits, interchange damage, property damage, cost of delay from incidents, etc.), cost of staff and partners to analyze deficient locations and correct infrastructure geometries and barriers to freight movement, and reduction in infrastructure life and maintenance cost increases. Potential costs will be incurred if roadways need to be redesigned after realizing they do not work for trucks. Additional costs for allowing increased weight/length trucks include redesigned and constructed infrastructure and increased maintenance costs on key corridors.

Benefits: Savings for business (and ultimately consumers) if trucks did not need to be re-routed, double parked, and ticketed. Reduced barriers, delays, urban congestion, and bottlenecks. Increased safety with fewer accidents and modal conflicts, and more timely deliveries and pick-ups. Benefits of allowing larger trucks on the system include more capacity per load/trip, fewer trips and therefore, emissions with a savings of 4 to 27 percent in fuel consumption depending on configuration.[17] Can improve efficiency and flow of freight if specially developed dedicated lanes are built with stronger pavement materials.

4. Truck Parking

Overview: Sufficient, safe commercial truck parking is a statewide and national issue. Consequences of truck parking shortages threaten roadway safety, public health, and economic productivity. The growth in volume of trucks has exacerbated the parking issue. The federal hours of services rule requires drivers to stop driving to rest. Some drivers face the dilemma of illegally

[17] Vasco, Sanchez, et al, "The longer and heavier vehicle debate: A review of empirical evidence from Germany", *Transportation Research Part D: Transport and Environment*, October 2015.

exceeding maximum hours of service by encircling neighborhoods trying to find a safe, legal location to park or parking in inappropriate or illegal areas. With demand surpassing supply, some have no choice but to find makeshift locations to rest in close proximity to or on freeway on- or off-ramps.

Caltrans will work with partners to improve the truck parking supply issue. Research is also in progress to test a truck parking availability/reservation system, which will improve efficiency by guaranteeing a parking space for a fee.

Implementing Agency: Caltrans

Type of Action: Need identification and recommendations

Timing:
Begin Development: 2016-Ongoing
Implementation: 2017+

Proposed Actions: Research opportunities to increase the supply of truck parking along the freight network. Included strategies may entail:

- Assessing current and future planned public and private truck parking facilities to establish statewide needs.
- Considering inclusion of refueling and/or charging stations for alternative fuel vehicles and implementation of parking space availability/reservation systems technology.
- Siting and recommending potential future parking sites.

Estimated Cost: As reported in the Mid-America Freight Coalition Truck Parking Management Systems Synthesis (2015), the costs to implement truck parking management systems ranged between $2.04 million (Minnesota) to $4.4 million (Michigan) and $4.8 million (I-95 corridor).

Benefits: Increasing the supply of truck parking supports safe parking decisions, reduces driver fatigue related crashes, and discourages trucks from parking in residential neighborhoods and along roadway shoulders, entrance and exit ramps and underneath overpasses. Both drivers and carriers will be more efficient and productive, thereby increasing profitability. Private truck stops have the potential to increase business and monetize their largest asset (land). Reduced driver stress and frustration will aid in driver retention. Environmental benefits due to reduced idling (e.g., 15 minutes saves two gallons of diesel and produces fewer greenhouse gas emissions).[18]

[18] Gen Giuliano, et al, “White Paper: Information Technology”, Freight Efficiency Strategy Development Group - IT Working Group, January 2016.

5. Drayage Truck Optimization

Overview: Current drayage processes require duplicative paperwork. In many cases, documents are physically handed to the next station in the process. Safety and security practices are critical and needed, but opportunities remain throughout the system that can improve freight throughput efficiencies via flow and timing of information. By creating a more automated management system, freight transportation information exchange approaches seamlessness and money is saved through reduced delay and operating costs.

Implementing Agency: Caltrans

Type of Action: Assist in deployment of drayage efficiency technologies

Timing:
Begin Development: 2016-Ongoing
Implementation: 2017

Proposed Actions: Support and accelerate the development of dynamic truck travel information and drayage optimization. Strategies may include:

- Determining operational information flow inefficiencies.
- Investigating available and developing truck optimization technologies.
- Researching virtual container yard concept.
- Collaborating with partners to deploy a trial system.
- Encouraging widespread system wide deployment, if warranted.

Estimated Cost: Costs would be variable depending on volume, labor, equipment, and other specific shipper variables, for the service. Incentive fees and taxation might help cover some costs, and public-private partnership investments by all private and public stakeholders.

Benefits: Overall, this would improve operational efficiency, reduce congestion, enhance economic competitiveness, enhance safety, and be environmentally sustainable. In essence, this would help reduce costs, increase container velocity and truck turn times, improve reliability and predictability, and improve labor and equipment deployment. Container visibility to entire supply chains, real-time traffic data, pavement preservation, reduced truck turn times, and truck queue reductions would also be realized.[19]

[19] Miguel Jaller, "Strategies to Maximize Asset Utilization in the California Freight System: Part II – Strategies", Freight Efficiency Strategy Development Group, January 2016.

6. Freight Corridor Traffic Management

Overview: Along with regional agency partners, Caltrans has developed a connected vehicle project called "One California." It applies advanced technologies that allow vehicles to communicate wirelessly with one another and through devices on surrounding infrastructure for the purpose of improving transportation safety, mobility, and efficiency and reducing environmental impacts. This project takes an integrated approach to addressing transportation challenges and needs that cover a broad range of multi-modal goals.

Aspects of the project include truck signal priority, access to routing around congestion, information regarding queue lengths and seaport wait times, route guidance to lower emissions, and real-time traffic data collected from trucks. Giving trucks access to more green lights along congested freight routes will improve traffic flow and system efficiency, resulting in reduced vehicle congestion, more reliability, fewer emissions, and less delay. Access to real-time traffic and queue length data will result in less idling, reduced delay, and cleaner air. Quality data will also enhance planning forecasts and programming decisions. The Southern California Association of Governments is demonstrating a freight signal priority project.

Worth acknowledging is the Interstate 10 Western Connected Freight Corridor Coalition, a voluntary effort of state Departments of Transportation that are committed to a collaborative pilot project for a potential new connected vehicle corridor, with its westernmost terminus at Long Beach/Los Angeles, California, and easternmost terminus at Houston, Texas, along Interstate 10 and 210, where appropriate. Actions to develop a connected vehicle corridor will demonstrate: Interstate Freight credentialing and permitting with a single end-to-end permit per load; truck parking and reservation systems at strategic locations; interstate transponder technology (e.g., PrePass and/or PrePass 360) to facilitate a single inspection for a truck and load once on the Corridor; interstate communicating Weigh-In-Motion devices between and among participating states; and connected vehicle technologies.

Implementing Agency: Caltrans

Type of Action: Deploy research

Timing:
Begin Development: 2016-Ongoing
Implementation: 2017

Proposed Actions: Develop and implement freight-priority traffic management systems such as freight signal priority and eco-routing. Strategies may consist of:

- Seeking and obtaining funding for a demonstration project.

- Deploying technology and equipment along a freight corridor.
- Following up to ensure successful implementation.
- If deemed successful, implementing in another freight corridor.

Estimated Cost: Freight signal priority can be implemented with existing technologies that are used in a similar system called transit signal priority, which cost $8,000 to $35,000 per signal depending on system design, functionality, and type of equipment (U.S. Department of Transportation, 2002). The implementation costs are expected to be minimal for truck eco-routing. Most truck drivers and truck fleets are already using some form of a route planning system.

Benefits: In the case of freight signal priority, a simulation modeling study shows that a freight signal priority scheme that is geared towards reducing fuel consumption (referred to as "eco-freight signal priority") provides up to 4 percent fuel savings for freight vehicles that are equipped with connected vehicle technology. This is equivalent to $649,000 annual savings for a fleet of 1,000 delivery vehicles driving 30,000 miles on arterials each year. In the case of truck eco-routing, a comparative evaluation of route options for truck shows that on average the most fuel-efficient route could save fuel by 9 to 18 percent compared to the fastest route.[20]

B. Freight Intelligent Transportation Systems Enhancements

Overview: Valuable information regarding truck trips and techniques to improve freight efficiencies can be gained through use of roadside technology. Caltrans will support the development 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 intelligent transportation systems into State-owned roadside facilities (e.g. rest areas), traffic information can be pushed to travelers providing smart truck parking and reservation systems. These innovative techniques will enhance freight productivity and reduce traveler inconvenience.

Implementing Agency: Caltrans

Type of Action: Work with industry to research, develop, and implement

Timing:

Begin Development:	2017-Ongoing
Implementation:	Ongoing

[20] Gen Giuliano, et al, "White Paper: Information Technology", Freight Efficiency Strategy Development Group - IT Working Group, January 2016.

Proposed Actions: Integrate intelligent transportation systems into State roadside facilities and border ports of entry for monitoring traveler information, smart truck parking, and freight mobility systems. Strategies may include:

- Identifying information to be collected and technologies available.
- Determining the best key freight corridor(s) to prioritize installation.
- Developing a plan for project funding, deployment, and phasing.
- Implementing project(s).
- Monitoring progress.

Estimated Cost: Estimates vary depending upon sophistication of systems. Washington State's Freight Alerts system cost estimate is $380,000 per year.[21] Utah's Department of Transportation spent approximately $1 million initially to develop the Advanced Traveler Information System and Advanced Traffic Management System software. Annual software support costs for Commuter Link are approximately $50,000. The 511-phone system costs approximately $275,000 annually in usage charges. The cost of designing and implementing these enhancements varies, but is typically in the $200,000 to $300,000 range. Utah's Department of Transportation spent $50,000 setting up the mobile web capabilities and has a $25,000 annual maintenance contract.[22] Minnesota's Trucker Info's upfront cost is $150,000, and annual maintenance and operations cost is $10,000. The preliminary cost estimate for the California/Mexico border regions is around the level of $40 million as outlined in the Concept of Operations (part of the on-going federally funded Pre-Deployment Strategy).

Benefits: Truckers in particular can realize significant benefits by avoiding traffic congestion, meeting delivery obligations to beneficial cargo owners, and reducing fuel consumption. As the system is more fully deployed, logistics firms can better schedule load pick-ups and deliveries and optimize overall operations to increase productivity.

C. Off-Hour Delivery/Pick-Up Strategy Development

Overview: Most truck traffic occurs during the busiest and most congested times of the day. Shifting cargo pick-up and delivery to off-peak hours alleviates congestion at terminal gates and nearby roadways. However, during off-peak periods, especially at night, there is ample capacity for truck movement. The logistics of shifting arrivals and deliveries to non-typical business operating hours is a major challenge. Additional labor cost and safety alone, as well as community concerns, can deter businesses from implementing such strategies. Some businesses however, are compatible with work hour changes, providing opportunities for efficiencies. To help achieve that outcome, traffic mitigation fee

[21] Washington State Department of Transportation, "Freight Mobility Joint Report on Washington State Freight Highway and Rail Projects", September 2008.
[22] Mid-Ohio Regional Planning Commission, "Advanced Traveler Information System Study: Task 3 Findings", May 2009.

programs have been implemented in several areas of the State in order to encourage off-peak hour delivery by charging cargo owners for the delivery rather than making shippers absorb all of the added cost. Improvement of these programs may rely on examining the corridors in which they operate and establishing some common metrics, as well as developing dynamic pricing schemes.

Implementing Agency: Caltrans

Type of Action: Support research, deployment, and analysis

Timing:
Begin Development: 2016-Ongoing
Implementation: Ongoing

Proposed Actions: Support increase in off-hour deliveries and pick-ups. Strategies may include:

- Assessing feasibility of implementing off-hour strategies in industries with least negative financial and community impact.
- Assessing safety risk of off-hour strategies.
- Demonstrating pilot with or without incentives.
- Following up on progress.
- Deploying on wider scale, if successful.
- Supporting the use of traffic mitigation fee programs such as PierPass.

Estimated Cost: One example is Pier Pass at the Ports of Los Angeles and Long Beach, where cost would increase to $69.17 per 20 foot equivalent unit and $133 per 40 foot container.[23]

Benefits: Off-peak deliveries will yield economic benefits due to greater efficiencies and improved reliability within the supply chain. Other benefits include greater productivity, reduced cost per delivery, and more predictable transit time. Truckers in particular can realize significant benefits by avoiding traffic congestion, meeting delivery obligations to beneficial cargo owners, and reducing fuel consumption. As the system is more fully deployed, logistics firms can better schedule load pick-ups and deliveries and optimize overall operations to increase productivity.

D. Cross-Jurisdictional Information Sharing

Overview: Efficient movement of freight can improve through cross-jurisdictional information sharing. Instead of duplicating efforts by using the same processes

[23] Journal of Commerce, "PierPass to hike fee, citing higher ILWU costs", July 2015, http://www.joc.com/port-news/us-ports/port-los-angeles/pierpass-hike-fee-citing-higher-ilwu-costs_20150709.html.

between State and national borders, information can be streamlined (if it can be done safely and securely). Implementation of this strategy would improve transit times and minimize conflicts. Operational efficiencies would require technological upgrades, policy interoperability, and data sharing. Project objectives would include:

- All interstate credentialing and permitting information will be handled "end-to-end" with a single permit per load.
- Truck parking and reservation systems will be in place at strategic locations, expandable as needed and as practical.
- Interstate transponder technology will be in use to facilitate a single inspection for each truck and load, one along the selected corridor.
- Interstate communicating Weigh-In-Motion devices will be in place and communicating between and among participates.

This streamlining process will benefit from economies of scale (cost savings); reduce idling, congestion, delay, and emissions.

Implementing Agency: Caltrans

Type of Action: Information coordination and collaboration

Timing:
Begin Development: 2017-2020
Implementation: 2020+

Proposed Actions: Coordinate with other states and Mexico to share truck/load information and make truck inspections more efficient. Strategies may include:

- Assessing information duplication between states and Mexico.
- Consulting with other State Departments of Transportation, regional planning agencies, tribal governments, and other stakeholders.
- Determining safe alternate options for sharing mutual information.
- Creating and deploying a trial demonstration project.
- Developing interstate and binational agreements to implement information sharing processes.
- Deploying process and creating best practices guidelines.

Estimated Cost: The associated costs are information reproduction/replication costs; cost of a central sharing program/database; demonstration/pilot costs; dual-nation agreements, and operational management costs.

Benefits: This action employs information sharing and knowledge management that looks beyond static boundaries. These efforts will help develop, foster, and leverage interagency communication, coordination, and information sharing to address freight inefficiencies, to integrate, and if needed, transition to a common technology. This streamlining process will benefit from economies of scale (cost savings), reduced idling, congestion delay, and emissions. Cross-border

shipping delay reduction, increased origin/destination data, reduced handling time, and permit streamlining are additional benefits.

ACTION 8: Convene stakeholders and the California Workforce Development Board to identify and implement steps to ensure that the existing and future workforce meets the needs of the California sustainable freight transport system and sufficiently skilled labor is available to meet the needs of an expanding freight-related job market.

A. Regional Workforce Development Initiatives

Overview: California's Sustainable Freight Action Plan can result in economic benefits to communities across the State, reflected primarily, but not exclusively, in job creation and retention. A skilled and nimble workforce will be one key factor in competitiveness as freight industry firms move toward a zero emissions future. Targeted human capital investments to up-skill journey-level workers and creating apprenticeship pipelines have the potential to support increased operational efficiency and effective technological deployment across the freight sector, while bringing benefits to local communities in the form of improved job quality and access.

Implementing Agency: GO-Biz and the California Workforce Development Board

Type of Action: Partnership, coordination

Timing:

Agency Development Work:	2016+
Implementation:	2017-2030

Proposed Actions: Convene regional partners to propose and coordinate workforce investment initiatives and opportunities. Strategies may include:

- Establishing a robust, integrated system of pre-apprenticeship pipelines and journey-level upskilling programs in the top twenty mission-critical occupations in the freight industry.
- Spanning the State with a network of regional training partnerships, driven by local industries and connected to seamless supply-side coalitions of community, workforce, labor, and education partners, that can guarantee a consistent, high-quality supply of skilled labor to manufacture, build, operate, and maintain the State's zero emissions freight infrastructure.
- Aligning regional, multi-modal freight transportation plans with regional workforce initiatives like the California Workforce Development Board's SlingShot Initiative.

Estimated Cost: Because these proposed activities consist of unknown future actions, estimated costs are not identified at this time.

Benefits: These strategies can bring benefits to local communities in the form of improved job quality and local pathways to family-supporting careers.

B. Training Models

Overview: Traditional occupations will require new skills and aptitudes as the freight industry moves toward a zero emissions model.

Implementing Agency: GO-Biz and the California Workforce Development Board

Type of Action: Training development

Timing:
Agency Development Work: 2016+
Implementation: 2017-2030

Proposed Actions: Convene stakeholders to develop training models like the California Workforce Development Board's Proposition 39 multi-craft construction pre-apprenticeships that can be replicated along key freight corridors.

Estimated Cost: Because the proposed activity consists of unknown future actions, estimated costs are not identified at this time.

Benefits: These strategies can bring benefits to local communities in the form of improved job quality and local pathways to family-supporting careers.

C. Community Workforce Agreements

Overview: Community Workforce Agreements can help secure local economic benefits from public and private investment in the freight network by guaranteeing both job quality and access through negotiated terms like local hire and apprenticeship utilization. Negotiated with input from key community stakeholders, including business, labor, the public workforce system, community-based organizations, and education providers, Community Workforce Agreements have seen tremendous success in major cities across the country.

Implementing Agency: GO-Biz and the California Workforce Development Board

Type of Action: Partnership, coordination

Timing:
Agency Development Work: 2016+
Implementation: 2017+

Proposed Actions: Support development of Community Workforce Agreements wherever possible.

Estimated Cost: Because the proposed activity consists of unknown future actions, estimated costs are not identified at this time.

Benefits: These strategies can bring benefits to local communities in the form of improved job quality and local pathways to family-supporting careers and help to provide the State and its modernizing infrastructure a growing cadre of highly skilled workers.

Appendix D: Pilot Projects

This section summarizes the three pilot project concepts the State agencies are considering recommending for further development and potential implementation within the next three years. While the State agencies do not have designated funding for these projects and cannot guarantee eventual implementation of the pilot project concepts, this section identifies actions the State agencies will explore to potentially support project implementation.

To help coordinate progress on each of the three project concepts below, the State agencies identified State agency leads for each project to oversee and coordinate State participation in the pilot project. Future efforts may include further research, convening and leading discussions with potential partners, identification of project funding through current funding options or new funding, development of work plans, helping to identify and implement other State support actions as appropriate, and tracking and reporting progress as part of the broader progress report on Action Plan implementation anticipated for July 2018.

A. Dairy Biomethane for Freight Vehicles

Lead Agency: ARB
Location: San Joaquin Valley

Processing dairy biogas into biomethane for use in natural gas vehicles is a strategy with the potential to advance a number of State goals, including the potential to reduce emissions. The strategy provides a particular benefit by demonstrating a model for advancing the State's Short-Lived Climate Pollutant reduction goals from the dairy industry (see Appendix G for discussion of the State's Short-Lived Climate Pollutant Reduction Strategy). For example, there are a cluster of sixteen dairies within a six-mile radius in Kern County that are currently undertaking an ongoing effort to build digesters with fuel generation capabilities. This cluster of dairies could generate 1.5 to 2.5 million-diesel gasoline equivalents per year using these digesters. Developing economies of scale for digesters will first need pilot projects so that future projects can leverage demonstrated real-world data.

The State agencies can work with local partners to demonstrate a commercial-scale dairy biogas to biomethane project. The pilot may focus on distribution of dairy biomethane through pipeline injection and a local fueling station servicing freight and other vehicles in California. Proof of concept and successful operations can help with expansion of biomethane projects throughout the Central Valley and the rest of the State. Specific actions under consideration to advance progress include:

ARB

- Provide technical assistance by evaluating appropriateness of project vehicle and equipment technology applications.
- Advise on testing, monitoring, and quantification of criteria and greenhouse gas emission impacts.
- Assist in identifying funding for zero and near-zero emission vehicles and equipment, as appropriate.
- Provide guidance on technology mitigation measures for project environmental impacts.
- Coordinate with the local air district and provide technical assistance with securing air quality permits, as appropriate.
- Assist with engaging local environmental justice interests as part of the project development process.
- Assist with engaging the U.S. Environmental Protection Agency AgSTAR program as part of the project development process.
- Assist with engaging the California Public Utilities Commission as part of the project development process.

Energy Commission

- Consider for inclusion in future biofuels production facility solicitations through the Alternative and Renewable Fuel Vehicle Technology Program.
- Support usage of renewable natural gas in the Central Valley through the Alternative and Renewable Fuel Vehicle Technology Program's natural gas vehicle purchase incentives.
- Work with the California Department of Food and Agriculture and California Public Utilities Commission to coordinate the promotion of renewable natural gas in California.
- Identify research and development needs for renewable natural gas production and integrate into Natural Gas Research Roadmap.

Caltrans

- Provide data and/or policy support for initial planning analysis.
- Assist with roadway access.
- Assist with development of roadway signage.

Governor's Office of Business and Economic Development

- Coordinate public and private sector resources to establish fueling infrastructure for zero and near-zero emission vehicles.
- Collaborate with stakeholders to coordinate resources and strategies to better establish zero or near-zero emission vehicles in their fleets for freight operations.

- Develop a forum with the freight industry, State agencies, and local economic development organizations to discuss the status of, and opportunities to support, technology development appropriate to the freight industry.
- Develop and implement strategies that enable use of California's Innovation Hub network, California Workforce Investment Board, and other outside resources.

B. Advanced Technology for Truck Corridors

Lead: Caltrans
Location: Southern California

Facilities such as Interstates 710, 10, and 15, State Route 60, and other freight corridors in California provide key connections between intermodal freight facilities and the rest of California's transportation system. The highways often operate under congested conditions as a result of heavy truck volumes as freight moves in and out of ports and across the State. These highways will have to adapt to accommodate additional freight vehicle demand expected over the next 20 years.

Innovative projects that address truck travel in critical locations must remain options to reduce freight congestion with less impact on nearby communities. Innovative solutions to explore further include the use of dedicated heavy-duty truck facilities, advanced traveler information systems, connected vehicle technology, incentives for the use of zero and near-zero emission vehicles and renewable fuels, and short haul rail.

The State agencies can work with partners to promote new technologies that increase efficiencies and encourage zero and near-zero emission vehicles on primary freight corridors. Multiple partners can explore options for intelligent transportation systems, connected and semi-autonomous vehicles technologies, collaborative logistics, and potential incentives for zero and near-zero emission trucks. The pilot may focus on freight signal priority, traveler information systems, and communication systems infrastructure on arterial roads, as well as integrated corridor management on highways. Specific actions under consideration to advance progress on this include:

Caltrans

- Explore options for demonstrating the following intelligent transportation system applications, depending on the nature and location of the proposed project:
  - Freight Signal Priority.
  - Freight Advanced Traveler Information System: Freight-specific dynamic travel planning and performance and drayage optimization.
  - Eco-Freight Advanced Traveler Information System: Eco-routing.
  - Probe enabled traffic monitoring.

- Identify location of potential project and review existing system and regional plans for relevant concepts.
- Continue discussions with appropriate regional and local partners.
- Provide data or policy support for initial planning analysis.
- Provide input and project oversight for improvements to the State highway system.
- Explore the need for regulatory or legislative changes.

ARB

- Provide input on incentives for zero and near-zero emission trucks.
- Advise on testing, monitoring, and quantification of project criteria and greenhouse gas emission impacts.
- Assist in identifying funding for zero and near-zero emission vehicles and equipment, as appropriate.
- Provide guidance on technology mitigation measures for project environmental impacts.
- Coordinate with local air district and provide technical assistance with securing air quality permits, as appropriate.
- Assist with engaging local environmental justice interests as part of the project development process.

Energy Commission

- Explore opportunities for installing zero-emission infrastructure that can support light-, medium-, and heavy-duty vehicles.
- Identify opportunities for renewable electricity resources and daytime over-generation to fuel medium- and heavy-duty zero-emission vehicles.
- Research improvements to medium- and heavy-duty zero-emission vehicle infrastructure through technology, equipment optimization, and scalability.
- Consider eligible activities in future solicitation for advanced truck technology demonstrations, deployments, renewable fuel production, intelligent transportation systems, and other freight technologies.

Governor's Office of Business and Economic Development

- Engage with California ports and partner State agencies to demonstrate a large addressable market for new zero and near-zero emission technology.
- Collaborate with stakeholders to coordinate resources and strategies to better establish zero or near-zero emission vehicles in their fleets for freight operations.
- Develop a forum with the freight industry, State agencies, and local economic development organizations to discuss the status of, and opportunities to support, technology development appropriate to the freight industry.

- Develop and implement strategies that enable use of California's Innovation Hub network, California Workforce Investment Board, and other outside resources.

C. Advanced Technology Corridors at Border Ports of Entry

Lead: Caltrans
Location: California-Mexico Border

With insufficient capacity at cross-border facilities and surrounding roadways, 1.6 million trucks crossing per year have resulted in severely congested border entry facilities, subsequently generating significant delays for trucks crossing the international border. The current border infrastructure between the U.S. and Mexico will be inadequate for projected binational commerce growth in the coming decades. Technological and operational advances in development at the planned Otay Mesa East and Calexico Ports of Entry for state of the art intelligent transportation systems, data collection and sharing, and connectivity to the international highway network have the potential to improve border operations, lower trade-related emissions, reduce congestion, and minimize border wait-times.

The State agencies can work with partners to implement information technology management systems, innovative operation techniques, and enhanced traffic management technology. In addition, partner with federal and local stakeholders to incent zero and near-zero emission truck crossings at international ports of entry facilities. The pilot may focus on building capacity for technological means of traffic management, such as Bluetooth sensors in the roadway, Global Positioning System readers, variable messaging, and a specialized border wait time application. Specific actions under consideration to advance progress on this include:

Caltrans

- Explore options for demonstrating the following intelligent transportation system applications, which could vary depending on the nature and location of the proposed project:
  - Freight Signal Priority.
  - Freight Advanced Traveler Information System: Freight-specific dynamic travel planning and performance and drayage optimization.
  - Eco-Freight Advanced Traveler Information System: Eco-routing.
  - Probe enabled traffic monitoring.
- Assist with planning studies and initiatives.
- Explore options for funding, which could vary depending on the nature and location of the proposed project.
- Assist with coordinating transportation planning efforts between California and Mexico.
- Provide input and present briefings on border transportation issues.

- Coordinate with U.S. Department of Homeland Security on programs related to border movement.
- Explore the need for regulatory or legislative changes.

ARB

- Provide input on incentive provisions for zero and near-zero emission trucks.
- Advise on testing, monitoring, and quantification, of project criteria and greenhouse gas emission impacts.
- Provide guidance on technology mitigation measures for project environmental impacts.
- Coordinate with the local air district and provide technical assistance with securing air quality permits for the project, as appropriate.
- Assist with engaging local environmental justice interests as part of the project development process.

Energy Commission

- Explore opportunities for installing zero-emission vehicle infrastructure that can support light-, medium-, and heavy-duty vehicles.

Governor's Office of Business and Economic Development

- Collaborate with stakeholders to coordinate resources and strategies to better establish zero or near-zero emission vehicles in their fleets for freight operations.
- Develop a forum with the freight industry, State agencies, and local economic development organizations to discuss the status of, and opportunities to support, technology development appropriate to the freight industry.
- Develop and implement strategies that enable use of California's Innovation Hub network, California Workforce Investment Board, and other outside resources.

D. Process

Ideas from the State agencies' research and stakeholder engagement efforts provided the starting point for identification of the pilot project concepts. The State agencies received over 50 ideas in November 2015. The State agencies reviewed each idea against the objectives set by Executive Order B-32-15: projects should be corridor level and within the State's primary trade corridors; integrate advanced technologies, fuels, infrastructure, and local economic development; have potential to achieve measureable progress toward the freight targets; provide system transformation and innovative potential; provide the opportunity to integrate State agency support, and have potential to scale up implementation across the State.

Based on these objectives, the State agencies presented the following five pilot projects concepts, consisting of modifications and combinations of the submitted ideas, for public comment at the public workshops and webinar in January and February 2016:

- Food Consolidation and Distribution Hub (Northern California): An agricultural consolidation and distribution center to promote a more efficient delivery system using clean trucks and rail service.

- Urban Delivery (Bay Area): A combination of strategies to address urban freight congestion and emissions: off-peak delivery, truck parking and charging, collaborative logistics, cargo bicycles, and local workforce development.

- Dairy Biogas for Freight Vehicles (San Joaquin Valley): A biomethane production cluster and fueling infrastructure for trucks.

- Advanced Technology Truck Only Lane (Southern California): A dedicated truck lane with options for intelligent transportation systems, connected vehicle technologies, collaborative logistics, zero and near-zero emission trucks, and truck platooning.

- Advanced Technology Truck Fast Lane (Border): A dedicated clean truck lane with intelligent transportation systems and connected vehicle technologies to allow for faster inspection and processing of truck crossing at the border.

After the workshops, the State agencies gathered additional information on each project concept and collectively assessed available resources, funding options, partnerships, and other opportunities to support these project types. As a result of the State agencies' review of this information and comments collected through public outreach events, the State agencies are continuing to consider the three pilot project concepts discussed above.

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Appendix E: Discussion Concepts for Potential Future Action

In addition to the suite of Actions identified in Appendix C, the State agencies have also identified transformational concepts for further exploration and potential future action. They include complex, big-picture ideas that are promising, but will require further discussion with experts and stakeholders to determine feasibility and effectiveness.

The State agencies will continue to gather more detail on the concepts described here, and will develop any subsequent actions through separate public processes. As the State agencies move forward, the concepts may change, be adjusted or new concepts may be added. Implementation of these concepts and any subsequently identified actions will also be conditional based on applicable public processes, necessary financing approvals, and environmental reviews.

A. Inland Marine Corridors

In 2013, the U.S. Department of Transportation partnered with State and local agencies to partially fund the operation of Marine Highway 580 green trade corridor.

A barge service moving among the ports of Oakland, Stockton, and West Sacramento holds promise for increased freight volumes and capacity. Public and private benefits could include reduced emissions and congestion on nearby Interstate 580 corridor. The barge service also offers an opportunity for the State to establish a zero or near-zero emission freight corridor, with the use of low emission marine vessels. The State sees this as an opportunity to expand markets and promote workforce development at inland ports, with a focus on zero emission corridors.

B. Non-traditional Transport Methodologies

As congestion near major freight hubs increases, it is important to explore innovative methods to moving freight. Some private companies have already begun considering transformational ideas, including hyperloop and un-manned aircraft for freight. Another option is to divert trucks hauling freight via dedicated, clean energy underground facilities serving inland locations where transloading and distribution can occur. These types of projects could transform freight movement by increasing efficiency, improving safety, reducing traffic congestion, and using alternative cleaner fuel technologies.

C. Packaging Optimization

As e-commerce continues to increase, it is important to explore opportunities to reduce the full life-cycle impacts of packaging production. Reducing the size and weight of packaging materials could provide private and public sector benefits, including cost, time, waste, and emission savings. The shipping industry is already

implementing strategies to promote package optimization. For example, several shippers apply dimensional weight pricing. This aims to avoid the use of oversized boxes by setting the dimensional weight according to the size of the box and charging for the dimensional weight or the actual weight, whichever is greater. In addition to smaller and lighter packaging, companies are also beginning to use sustainable, natural, bio-degradable, and non-petroleum-based materials to reduce waste. Additionally, packaging is important to protecting the commodity being shipped, therefore optimized packaging must continue to minimize damage to products. This will help to avoid reverse logistics.

D. Supply Chain Consolidation in the Agriculture Industry

A fragmented food supply chain leads to inefficient transportation of goods and can limit the ability for some growers to reach competitive markets. Coordination among regional producers, carriers, and logistics facilities can help harness economies of scale by reducing the number of less-than-load trips and providing a centralized location for the storage and consolidation of perishable goods. Regional collaboration through options such as centralized storage locations and incentives to freight consolidators and managers may lead to increased efficiencies and lower transportation costs.

E. System Efficiency

System efficiency improvements can produce economic and air quality benefits. By implementing one or more efficiency strategies, businesses may be able to cut travel time, decrease fuel costs, and increase the capacity of the system to transport more freight within the existing footprint. Supply chain efficiencies generally decrease cost, and if proven, become widely adopted due to their ability to increase business competitiveness.

To gain insight into industry vision and best practices, the State convened a group of academic and industry professionals that were tasked with providing recommendations on how the public and private sectors can work together to bring about new technology or practices that can enhance efficiency. The resulting concepts, as well as others, could lead to significant public benefit and further the State's sustainable freight goals. Some efficiency measures the State agencies are pursuing include increased and more advanced truck parking, freight traveler information systems, load consolidation, reservation systems at ports, and coordinating data gathering and modeling at the State level. Other concepts, which are of interest but require industry leadership, are receiver-led consolidation, full integration of chassis pool systems, virtual container yards, and load tracking systems. Detailed descriptions of the efficiency measures are in Appendix F, Freight Efficiency Working Group Papers. Some freight optimization efforts are already underway and can be part of the continuing dialogue of the Freight Efficiency Strategy Development Group.

F. Local Sourcing for Local Markets

Buying local provides environmental, infrastructure, and economic benefits. It reduces environmental impacts, as local purchases require less transportation, and contributes to less sprawl, congestion, habitat loss, and pollution. It also supports local businesses, stimulates the economy, provides jobs, and keeps more money in the community. To maximize the benefits of "buy local" programs California could further support local and regional programs as well as develop and initiate state-level programs. Some examples of state-level programs include competitive grant programs that incentivize partnerships with other California businesses, a focused advertising effort on the benefits of conducting business in California, and a database of California businesses and their goods and services for purchasers to readily search.

G. Programmatic Environmental Review Process for Freight Projects

One idea might be to use environmental review at the plan, or programmatic, level as a potential tool to help accelerate freight project construction and operation timelines, as well as improve the responsiveness of the system to competitive demands. To work for freight infrastructure and facilities, planners could develop regional scale plans that include multiple freight projects and conduct a programmatic environmental review of those plans. As part of the programmatic review, planners would expand community involvement and influence to seek local input and support for both the design and locations of the included freight projects.

H. Infrastructure Projects

In addition to the discussion concepts listed above, there are large transformational infrastructure projects proposed that could be critical in developing a sustainable freight transport system. They have the potential to provide lessons learned for future actions and a platform for innovative strategies. The State agencies will continue to track development of the following projects and seek opportunities for partnership with local governments, the ports, border officials, railroads, and others where appropriate.

1. Interstate 710

Interstate 710 is a vital transportation corridor, linking the ports of Long Beach and Los Angeles to major Southern California distribution centers and intermodal rail yard facilities. Interstate 710 experiences serious congestion and safety issues as a result of population growth, increased cargo container volume at the ports of Los Angeles and Long Beach, increasing traffic volumes, and an aging infrastructure. The Interstate 710 Corridor Project aims to improve air quality, noise pollution, public health, and traffic safety, modernize the freeway design, address projected traffic volumes, and address the projected growth in population,

employment, and activities related to freight. The corridor is 18 miles long and runs from the southern terminus of Interstate 710 to its connection to State Route 60.[1]

2. Otay Mesa East Port of Entry

Insufficient capacity at existing border crossings in the San Diego-Baja California region costs the United States and Mexico billions of dollars in foregone economic output each year. Hours-long delays are undermining productivity and industry competitiveness. Additionally, the current border infrastructure between the U.S. and Mexico will be inadequate for projected binational commerce growth in the coming decades. The State Route 11/Otay Mesa East Port of Entry Project will provide fast, predictable, and secure crossings via tolled approach roads that connect directly to a new state-of-the-art port of entry serving both passenger and commercial vehicles.[2] The total cost of the project for facilities on both sides of the border is approximately $900 million. The project consists of three segments, with construction of the first occurring now, construction of the second to be initiated shortly upon award of a 2016 Fostering Advancements in Shipping and Transportation for the Long-Term Achievement of National Efficiencies (FASTLANE) federal discretionary grant, and the final segment contingent on securing funds. The intelligent transportation system portion of the project, which will provide the underlying architecture, hardware, and software to support the entire toll collection system, will begin construction in 2018-2019 and will cost approximately $36 million.

3. Southern California On-dock Rail

Intermodal transitions are an essential link in the freight transport system, especially for transcontinental freight. For international goods, on-dock rail facilities provide an opportunity to improve the efficiency of intermodal transportation and reduce the impact on nearby communities, compared to near-dock rail locations in Southern California. Examples of related concepts include previously proposed near-dock rail facilities such as the expansion of the Union Pacific Intermodal Container Transfer Facility and the Southern California International Gateway near the San Pedro Bay Ports. One idea to explore further is shifting anticipated growth from near-dock to on-dock rail facilities that utilize clean technologies and are not adjacent to communities.

[1] Caltrans, "I-710 Corridor Project Draft EIR/EIS", June 2012, http://www.dot.ca.gov/dist07/resources/envdocs/docs/710corridor/docs/1.0%20Proposed%20Project.pdf.

[2] San Diego Association of Governments, "SR11/Otay mesa East Port of Entry", January 2016, http://www.sandag.org/uploads/projectid/projectid_56_20230.pdf.

Appendix F: Freight Efficiency Working Group Papers

As part of developing the Action Plan, the State agencies solicited feedback from a broad range of stakeholders through a variety of engagement activities and outreach efforts. A component of this engagement was the development of the Freight Efficiency Strategies Development Group made up of freight experts from academia, industry, and government. The purpose and main task of this group was to produce a series of white papers that identify promising strategies for increasing the efficiency of the freight system. A series of six papers were developed over the course of six months. Each paper focuses on a specific theme for increasing freight efficiency within the larger freight system.

The content of the white papers produced by the group represents discussions among many individuals representing various freight industry stakeholders. It may not reflect consensus on the part of all of the participants, nor do these papers necessarily represent the official opinion or policy of the represented organizations, but rather a range of thinking that might be used to inform and build consensus for the development of the Action Plan. Given the perspective of the various freight stakeholders, paper authors attempted to include dissenting opinions and areas of concurrence where they exist. All information provided in the papers was considered by State agency staff when identifying potential actions for the Action Plan.

Abstracts for each paper are included below.

Topic #1: Funding for Freight Infrastructure and Clean Equipment
Lead Authors: Will Kempton and Garth Hopkins, California Transportation Commission

The white paper provides an overview of the need for additional funding for both continued development of California's freight infrastructure and expansion of clean equipment for freight. The paper advocates for the continuation of the successful Trade Corridors Improvement Fund and the Goods Movement Emission Reduction Program. As additional funding for freight improvements is identified, both Trade Corridors Improvement Fund and Goods Movement Emission Reduction Program should be continued under a new program titled "Trade Corridors Improvement Fund / Goods Movement Emission Reduction Program -Phase II". The white paper also lists suggested selection criteria and possible improvements for a new program.

Topic #2: Strategies to Maximize Asset Utilization in the California Freight System: Part I – Background and General Recommendations
Lead Author: Miguel Jaller, University of California, Davis

This paper (Part I of a two-part series) provides a brief overview of the freight system, with an emphasis on key stakeholders, their roles and interactions, and implications associated with the types of freight movements and layers of the

economy. The work discusses major inefficiencies in the on-road trucking and maritime sectors, where congestion often impedes maximizing asset utilization. The paper presents a number of general recommendations to improve freight efficiency, while specific strategies are discussed in the second part of this series. General recommendations include: conducting sound freight planning at all levels with emphasis on urban freight; identifying behaviors that need to be fostered, or mitigated, among the various stakeholders; developing participatory stakeholder engagement; fostering information sharing; developing plans, agreements and platforms for active conversation to address labor issues; investing in workforce development; and investing in research and continued improvement efforts. In addition, this paper acknowledges the fact that it is not likely that any single strategy will result in significant enough improvements on its own. The inherently complex nature of the system will require an equally complex set of solutions.

Topic #3: Strategies to Maximize Asset Utilization in the California Freight System: Part II – Strategies
Lead Author: Miguel Jaller, University of California, Davis

The freight system is multi-faceted and there could be a myriad of potential strategies; however, the paper focuses on those that could improve or help maximize asset utilization by fostering collaborative logistics practices and/or freight demand management. The strategies analyzed include: receiver-led consolidation; voluntary off-hour delivery programs; development of an integrated Chassis Pool of Pools; integrated system for dray services; load matching and maximizing capacity; improving Traffic Mitigation Fee programs; implementing advanced appointment and reservation systems; and relaxing vehicle size and weight restrictions. The paper discusses each strategy in terms of its nature (collaborative logistics or freight demand management); the geographic scope of the inefficiency or implementation; the expected benefits; level of implementation effort/time/cost; the primary stakeholders targeted; the stakeholders' role in the implementation/planning effort; the potential for unintended consequences; and barriers for implementation. The research shows that there is great variability in the level of data available (e.g., research reports, operational reports, implementation programs, pilot tests) to conduct detailed assessments, highlighting the need for additional efforts to be able to estimate the magnitude of the potential effects of each strategy to reduce inefficiencies (e.g., congestion/delays, environmental emissions, safety, and economic impacts, and costs, among others). However, stakeholder engagement during the research process allowed for a qualitative assessment based on empirical evidence from ongoing efforts.

Topic # 4: Planning and Policy
Lead Authors: Tom O'Brien, California State University, Long Beach

Increasing trade volumes at freight hubs and nodes, including seaports, airports, intermodal facilities, and border crossings, provide significant economic benefit but also social costs. Increased volume of trade creates jobs, generates State and local

tax revenue, and creates positive externalities. High trade volumes also impose costs, including vehicle congestion, collisions, environmental costs, and increased infrastructure development and maintenance and preservation costs. This white paper explores the ways that state departments of transportation can enhance their policy and planning efforts—and the outreach efforts that inform those processes—to better implement infrastructure, operational, and technology based modernization strategies to improve system productivity and efficiency.

Topic # 5: Operational Modernization at Distribution Nodes
Lead Authors: Tom O'Brien, California State University, Long Beach

This white paper identifies a range of technological and process-driven opportunities that hold the potential for modernizing distribution nodes to promote freight efficiency while also improving safety and air quality standards. To promote improved truck access at distribution nodes, the research investigated the use of truck platooning, virtual container yards, design-based guidelines, and weigh-in-motion strategies to improve freight efficiency. The research also explores strategies focused on establishing energy independence at marine terminals through use of energy microgrids.

Topic # 6: Information Technology
Lead Author: Genevieve Giuliano, University of Southern California

This white paper explores the potential to improve data and information systems, both public and private, to increase system efficiency. It presents recommendations for using information technology solutions to increase the efficiency of California's multimodal freight transport system. These recommendations resulted from a consensus-based process by working group committee members. The two challenges addressed were information problems in the freight transport supply chain and information problems in statewide trucking. Regarding the freight supply chain, recommended strategies include: accelerating and expanding the Freight Advanced Traveler Information System program; implementing ports-wide appointment systems at the State's major ports; and developing and implementing a transparent supply chain wide load tracking system. Regarding statewide trucking, recommendations included a statewide smart parking system; "push" freight information system; statewide freight information platform; border region information technology systems strategy; and freight focused traffic management.

The full white papers are available on the Action Plan website here: http://www.casustainablefreight.org/. Table F-1 summarizes recommended strategies from each of the white papers.

Table F-1. White Paper Recommended Strategies

WHITE PAPER TITLE	THEMES	STRATEGIES
Funding for Freight Infrastructure and Clean Equipment Lead Authors: Will Kempton and Garth Hopkins California Transportation Commission		I. All Federal and State freight funding administered by the State should continue using the successful TCIF model".
		II. Ensure TCIF/GMERP-Phase II Funds are Leveraged With Other Funding Sources
		III. Develop a Long-Term Funding Program Specifically for Freight Infrastructure and Clean Equipment
		IV. Build on the GMERP Program with the Dedication of Cap-And-Trade Funds for Freight Infrastructure and Clean Equipment Which Will Reduce Freight Emissions
		V. Minimize the Complexity of State Administered Freight Funding Programs
		VI. Improve Existing Access Infrastructure to California's Major Port Facilities
		VII. Underwrite Present Capital Expenses In Anticipation of Future Benefits
Maximizing Asset Utilization: General Recommendations Lead Author: Miguel Jaller University of California, Davis	**A. Cargo and Vehicle Movements** **B. Inefficiencies in the Freight System** **C. Key Stakeholders, their Roles and Interactions**	I. Hours of Service Rules – The State must consider the potential negative impact that the Hours of Service rules can have for freight efficiency, because the enforcement of the restart provisions of the Final Rule would introduce significant inefficiencies in the California Freight System.
		II. Driver Shortages – The State must consider labor shortages in the trucking industry (e.g. qualified truckers). Evaluate Workforce Development Strategies
		III. Conduct sound freight planning at all levels with emphasis on urban freight and strategic freight corridors
		IV. Planning efforts will allow identifying the types of freight behaviors that need to be fostered or mitigated among the various stakeholders.
		V. Participatory stakeholder engagement
		VI. Developing appropriate strategies requires insights and detailed analysis of how each supply chain operates.
		VII. Information sharing may not only be incentivized for planning purposes, but also to recognize the value of information as an input and output to operational processes. Information sharing may also involve active and dynamic freight data collection schemes.

Maximizing Asset Utilization: Strategies Lead Author: Miguel Jaller University of California, Davis	**A. Improving Performance of the Distribution Economy**	I. Voluntarily Off-Hour Deliveries (Demand Management): Research the effects and challenges of expanding off-hour delivery through incentive programs.
		II. Receiver-Led Consolidation (Collaborative Logistics): Research and develop incentive programs to foster the development of delivery (receiver-led) consolidation in urban areas.
		III. Freight Parking: Improve freight parking/loading/unloading area management and availability
	B. International Gateways	IV. Chassis Pool of Pools (C-PoP) Integrated System (CL): Work with stakeholders to support the design, development, and implementation of an integrated chassis pool system.
		V. Improving Traffic Mitigation Fee Programs (DM): Work with stakeholders to research information systems, develop pricing schemes, and develop common performance and efficiency indicators regarding Freight Demand Strategies.
		VI. Implement Advanced Appointment / Reservation Systems (DM): Research and assess the capability of flexible appointment systems to reduce congestion and improve efficiency at California ports.
		VII. Develop an integrated system for Drayage operations and Services (CL): Research and develop an integrated information system that is compatible with existing services such as FRATIS (Freight Advance Traffic Information System).
		VIII. (a). Reducing total transactions and Maximizing Capacity (CL): Support the planning and research of potential applications of load matching services.
		VIII (b). Reducing total transactions and Maximizing Capacity (CL): Research the development of an incentive program to increase the likelihood of matching or provide an information platform that decreases empty and non-revenue generating trips.
		IX. Relaxing vehicle size and weight limits (DM): Investigate the opportunity for increased truck size and length and identify corridors where it would be possible to lift current restrictions.
Planning and Policy Lead Author: Tom O'Brien – California State University, Long Beach	**A. Strategic Statewide and Interregional Freight Planning**	I. Freight Education: Form public-private partnerships to implement public education initiatives that communicate the importance of freight in compelling ways.
	B. Truck Routes and Integrated Corridor Management	II. Truck routes: Research the state's ability to provide information current local truck routes throughout the state to avoid adverse impacts to communities.
		III. Assessing national best practices: Look to other states for examples of their experiences with integrated corridor management, environmental streamlining, and data collection

Operational Modernization at Distribution Nodes Lead Author: Tom O'Brien California State University Long Beach	**A. Energy Efficiency at Marine Terminals**	I. Energy Efficiency at Marine Terminals: Use Smart Micro Grids to increase energy reliability at marine terminals and promote the use of alternative energy in the system. State may potentially need to regulate cost.
	B. Improved Truck Access at Nodes	II. Truck Platooning: Mitigate bottlenecks at ports through Truck Platooning to promote efficient use of roadways.
		III. Virtual Container Yards: Promote the use of virtual container yards to increase empty container interchange between importers and exporters; reduce the incidence of uncoordinated empty trips between import warehouses and ports.
	C. Design-based Guidelines	III. Intermodal facilities: Implement design based guidelines in order to consolidate deliveries across vendors and encourage the prevalence of intermodal freight facilities.
Information Technology Lead Author: Genevieve Guiliano University of Southern California	**A. Information Problems in the Goods Movement Supply Chain**	I. Accelerate and Expand the FRATIS Program: Establish public private partnerships that would integrate and manage freight movement and other data and provide operation and maintenance support to facilitate the establishment of FRATIS at a larger scale.
		II. Implement a system-wide appointments system at California's major seaports: research the feasibility of an appointment system for truck gate entries and dock transactions that is universal across all port terminals in a given complex.
		III. Design a fully transparent tracking system across the supply chain: Research the effects of tracking systems on load matching; trip predictability, and drayage turn times.
	B. Information Problems in Statewide Tracking	IV. Develop and Implement a statewide parking system and increase the supply of truck parking: Implement an action plan to integrate and expand truck parking reservation systems in the state.
		V. Develop and implement a "push" freight traffic information system: research feasibility of corridor specific traffic alerts designed for truckers.
		VI. Develop and implement a statewide freight information platform: Integrate state and regional truck route data and present it in an accessible format.
		VII. Implement the Border Region ITS Strategy
		VIII. Freight Focused Traffic Management: Develop and Implement freight priority traffic management in high volume truck corridors

This research effort was made possible by the insights and contributions of the Freight Efficiency Strategies Development Group, including the following members:

Dan Sperling, Chair (UC Davis/Air Resources Board Member)
Kome Ajise (Caltrans)
Don Anair (Union of Concerned Scientists on behalf of CA Cleaner Coalition)
Heather Arias (Air Resources Board)
Matt Barth (UC Riverside)
Alison Bird (FedEx)
Coco Briseno (Caltrans)
Kerry Cartwright (Port of Los Angeles)
Christina Casgar (San Diego Association of Governments)
Mike Christensen (Port of Long Beach)
Steven Cliff (Air Resources Board)
Cynthia Cory (California Farm Bureau)
Richard Coyle (California Trucking Association)
Matt Davis (Port of Oakland)
LaDonna DiCamillo (BNSF Railroad)
Karl Dreher (Caltrans)
Marlon Flournoy (Caltrans)
Andrea Fox (California Farm Bureau)
Elizabeth Fretheim (Walmart)
Genevieve Giuliano (Metrans/University of Southern California)
Fran Inman (Majestic Realty/National Freight Advisory Committee)
James Jack (Coalition for Responsible Transportation)
Mitch Jackson (FedEx)
Mike Jacob (Pacific Merchant Shipping Association)
Miguel Jaller-Martelo (UC Davis)
Fred Johring (Harbor Trucking Association)
Will Kempton (California Transportation Commission)
Lee Kindberg (Maersk Line)
Ted Knapp (Caltrans)
Wes LaBar (PEAR Strategies)
David Libatique (Port of Los Angeles)
Wes Lujan (Union Pacific Railroad)
Cynthia Marvin (Air Resources Board)
Rich Matteis (California Farm Bureau)
Scott Moore (Union Pacific Railroad)
Annie Nam (Southern California Association of Governments)
Tom O'Brien (Cal State Long Beach)
Peter Okurowski (California Environmental Associates)
David Pettit (Natural Resources Defense Council)
Laura Podolski (UC Davis)
Frank Ramirez (Governor's Office of Business and Economic Development)
Clint Schelbitzki (Union Pacific Railroad)
Chris Schmidt (Caltrans)

Chris Shimoda (California Trucking Association)
Pat Smith (Harris Ranch)
Louis Stewart (Governor's Office of Business and Economic Development)
Mike Sutherland (Air Resources Board)
Bob Toy (Union Pacific Railroad)

Appendix G: Background for Action Plan Development

This section provides the context for Executive Order B-32-15 (see Appendix A) and information considered when developing this document, including the impact of freight on California's economy, emerging trends in the freight system, existing State policies, programs, plans, and funding for freight, as well as the public process.

A. Freight and the Economy

Freight transport is a vital component of California's regional and statewide economies. In 2014, California's economy was comparable to the eighth largest economy in the world, with the State's gross domestic product at $2.3 trillion.[1] [2] The State's freight sector, broadly defined to encompass industries that heavily rely on the transportation of their raw materials, intermediate goods and components, as well as their final goods and finished products. The sector includes businesses in the transportation, warehousing, utilities, trade, manufacturing, construction, agriculture, and mining industries. It accounted for over $740 billion, or 32 percent of California's gross domestic product in 2014, while also comprising 5 million, or 33 percent of jobs in the State the same year.[3] California's economy depends on an efficient, integrated, sustainable, and multimodal freight transport system. Understanding the relationship between freight transportation and the economy will be critical for State agencies to consider future freight transport system actions and how to optimize opportunities for growth in California.

Tied to California's diversified economy and its prosperity are exports and imports of both goods and services through the State's key gateways (seaports, airports, and border ports of entry) and the highway and rail corridors that connect the gateways to the rest of the State, nation, and world.

[1] United Nations Statistics Division, National Accounts: World Gross Domestic Product Ranking 2014, http://unstats.un.org/unsd/snaama/Introduction.asp, accessed March 11, 2016.
[2] U.S. Department of Commerce, Bureau of Economic Analysis, Regional Economic Accounts, http://www.bea.gov/regional/index.htm, accessed March 11, 2016.
[3] State of California Employment Development Department, Labor Market Information by California Geographic Areas, http://www.labormarketinfo.edd.ca.gov/geography/lmi-by-geography.html, accessed March 21, 2016.

California's Freight System at a Glance

- Twelve deep water seaports.
- Approximately 6,000 miles of railroad track.
- Twelve airports with major cargo operations.
- Over 5,800 centerline miles of high-traffic volume interstate and state highways.
- Three international commercial land ports of entry.
- Approximately 19,370 miles of hazardous liquid and natural gas pipelines.

California has four key freight gateway regions: the San Diego-Mexico Border region, the Los Angeles-Inland Empire region, the San Francisco Bay Area, and the Sacramento-San Joaquin Valley region. Los Angeles is not only California's main gateway, it is ranked first in the nation for total trade with $393.7 billion in 2013.[4]

International trade and investment is a major economic engine for the State, broadly benefitting businesses, communities, consumers, and regional, State, and local governments. California's export merchandise in 2015 totaled $165.4 billion, representing 11 percent of the U.S. total exports. Mexico is the State's largest market ($26.8 billion), followed by Canada ($16.9 billion), and China ($14.4 billion). Computers and electronic products are California's top exports by value, accounting for 26.1 percent of all the State's exports, followed by transportation equipment and agricultural products.[5] The dairy industry continues to lead California's agricultural economy, followed by almonds and grapes (milk contributes $9.4 billion, almonds contribute $5.9 billion, and grapes contribute $5.2 billion).[6]

Looking forward, the Federal Highway Administration has predicted a 40 percent growth in U.S. transported freight tons and a 92 percent growth in transported freight value between 2015 and 2045.[7] For California, the equivalent 2015-2045 projections show that transported freight tons and freight value will grow by 59 percent and 133 percent, respectively.[8] Because of this anticipated growth, the demand for all commercial freight modes (truck, ship, air, and rail) will likely

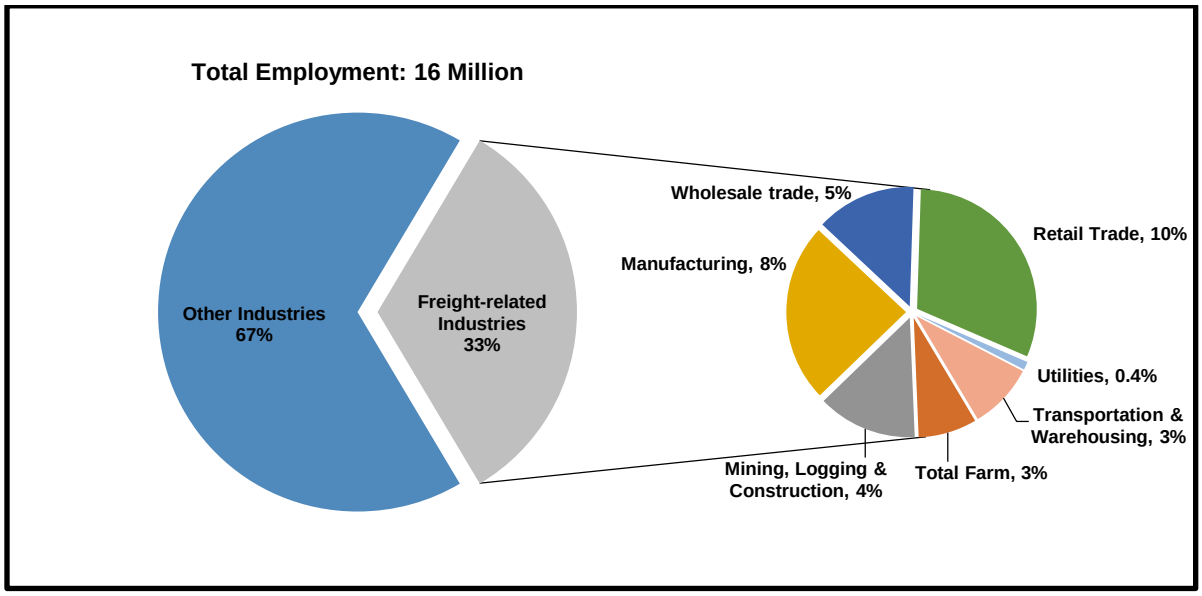
[4] U.S. Department of Commerce, International Trade Administration, July 2015.
[5] U.S. Census Bureau Foreign Trade Statistics, https://www.census.gov/foreign-trade/statistics/state/data/index.html, accessed February 15, 2016.
[6] California Department of Food and Agriculture, California Agricultural Production Statistics Agricultural Statistics Review Report 2015, https://www.cdfa.ca.gov/statistics/, accessed February 15, 2016.
[7] U.S. Department of Transportation, Bureau of Transportation Statistics and Federal Highway Administration, Freight Analysis Framework, V 4.1, 2016, http://www.rita.dot.gov/bts/press_releases/bts013_16, accessed March 21, 2016.
[8] Ibid.

increase, with the expectation that trucking will continue to have the dominant share of freight transport activity.

In terms of workforce composition, “one out of every seven jobs in the U.S. is transportation related,” according to the U.S. Department of Transportation. Freight, a sub-component of the transportation sector, employs millions of workers nationwide. The range of job types, skill sets, and career paths within California’s freight transportation industry is as diverse and complex as the industry itself.

California’s freight sector provides a wide range of employment across the freight modes, such as for-hire freight carriers, marine terminal workers, rail employees, airport employees (passenger and cargo), truck drivers, private transportation providers, freight forwarders, logistics providers, technicians that service and maintain vehicles, and others. Figure G-1 describes the composition of freight-related employment by sector and its relation to the total number of workers in the State.

Figure G-1: California Industry Employment Composition, 2014



Data source: State of California Employment Development Department, Labor Market Information Division

The following sections discuss the broad cost and benefit areas associated with changes to the freight transport sector.

1. Safety Considerations

Safety is important for the entire passenger and freight transport system. Identifying incident trends can shed light on potential infrastructure and possible operational adjustments that Caltrans and other infrastructure owners/operators can make. In addition, improved technology can eliminate or reduce the severity of certain accidents. California’s freight transport system is generally safe, but when collisions

do occur, the consequences can be extreme because of the large mass of freight vehicles and their loads.

The cost components include productivity losses, property damage, medical costs, rehabilitation costs, congestion costs, legal and court costs, emergency services such as medical, police, and fire services, insurance administration costs, and the costs to employers. Values for more intangible costs such as quality-of-life valuations are additional considerations.

2. Congestion Impacts

Congestion affects economic productivity in several ways. The growth in freight is a major contributor to congestion in urban areas and on intercity routes. Congestion affects the timeliness and reliability of freight transportation. Congestion on the ground and in the air affects both businesses and households, reducing the number of workers and job sites within easy reach of any location. It costs commuters time and money and imposes increased expenses on businesses, shippers, and manufacturers, which are often passed along to the consumer.

Growing freight demand increases recurring congestion at freight bottlenecks, places where freight and passenger service conflict with one another, and where there is not enough room for local pickup and delivery. Congested freight hubs include international gateways such as ports, airports, and border crossings. The need for additional system capacity is acknowledged while also recognizing the need to reduce emissions.

Table G-1 presents a summary of congestion data for the major California urban areas. The Los Angeles region ranks second in the nation, in contrast to Sacramento, which ranks number 35 on the list. No matter the position, congestion is a factor that affects commuters in most larger urban cities. In 2014, congestion cost a total of $160 billion in the U.S. The average commuter spent an extra 42 hours traveling on the roads, representing 6.9 billion hours of extra time. Similarly, a staggering 3.1 billion gallons of fuel were consumed in the process.

Table G-1: Highway Congestion in Major California Urbanized Areas 2014 (thousands U.S. $)

Description	LA, LB, Anaheim	San Francisco/Oakland	San Diego	Sacramento
Congestion Rank	2	4	61	35
Hrs Delay	622,509	146,013	79,412	60,220
Hrs Delay / Commuter (1,000 persons hrs)	80	78	42	43
Cost of Congestion	$13,318,000	$3,143,000	$1,658,000	1,334,000
Cost of Congestion/Commuter	$1,711.00	$1,675	$887	$958

Source: Urban Mobility Report 2015

The value of increased time, fuel consumption, and other operating costs experienced by trucks due to congestion is approximately 18 percent ($28.0 billion) of total congestion costs in U.S. urban areas.[9] This does not include any value for the freight transported in the trucks.

3. Border Delays

Cross-border commerce is important for the continued success of the economies of California, Mexico, and the U.S. as a whole. Mexico is California's number one export market, purchasing about 15 percent of all California exports. Two-way trade between Mexico and the U.S. has increased dramatically, and continued growth is expected. The vast majority of freight flows (98 percent) are by trucks, many of which use the State highway system.

Inadequate infrastructure at border crossings continues to create traffic congestion, delaying freight movement. Border delays increase transportation costs, interrupt just-in-time manufacturing cycles, add to labor costs, discourage trips across the border, inhibit potential growth in business income, hinder trade in the long term, and generate harmful environmental impacts. Delays cost the U.S. and Mexican economies an estimated $7.2 billion in foregone gross output and more than 62,000 jobs in 2007.[10] Two hour or longer delays in freight movement at the Otay Mesa–Mesa de Otay and Tecate–Tecate ports of entry are significantly impacting productivity, industry competiveness, and loss of business income at the regional, State, and national level. By 2050, border crossings in San Diego County will exceed approximately 4.4 million truckloads per year and 39 million tons of freight, valued at $309 billion.[11] This increase in truck traffic will impact California's already strained ports of entry and bottlenecks in its State highway system near the border.

4. Environmental Impacts

The emissions from the heavy equipment that transports freight within and through California contributes to both elevated ambient levels of criteria pollutants such as particulate matter and ozone, as well as localized health impacts near freight hubs and facilities. This freight activity also contributes to community quality of life impacts, such as noise, light, vibration, and safety. ARB and its partners have motivated and required extensive changes across the State, focusing on the use of cleaner technologies. Industry has made substantial investments to transition its

[9] Texas A&M University, Transportation Institute: Urban Mobility Report, 2015.
[10] U.S. Department of Transportation, Federal Highway Administration, "Measuring Cross-Border Travel Times for Freight: Otay Mesa International Border Crossing Final Report," September 2010.
[11] San Diego Association of Governments, "2050 Regional Transportation Plan Technical Appendix 11: San Diego and Imperial Valley Gateway Study: Comprehensive Freight Gateway Study," March 2010.

mostly diesel-fueled freight equipment to cleaner models, while refineries retooled to produce cleaner fuels. However, significant additional reductions from freight equipment are necessary to meet ambient air quality standards and reduce the localized risk impacts associated with exposure to toxic diesel particulate matter, and additional strategies are needed to help reduce community quality of life impacts.

The air quality and health impacts of freight operations in California have been quantified and are well documented. Freight equipment currently accounts for about half of the statewide diesel particulate matter emissions, which are both a toxic air contaminant and a contributor to black carbon, a powerful short-lived climate pollutant. Freight operations also account for approximately 45 percent of the statewide nitrogen oxides emissions and 6 percent of the statewide greenhouse gas emissions.

A peer-reviewed methodology developed by the U.S. Environmental Protection Agency (U.S. EPA) is the basis for the estimation of premature deaths, hospitalizations, and emergency room visits related to particulate matter exposure presented below. It includes observed relationships between emissions and exposure, and California-specific demographic and baseline health incidence rate data.[12] Table G-2 shows the premature deaths, hospitalizations, and emergency room visits associated with freight emissions of both primary and secondary particulate matter (particle nitrates formed from photochemical reactions of the precursor nitrogen oxide).

The costs associated with freight-related health impacts are high. Over 99 percent of the economic impact is from premature death. U.S. EPA established the value of mortality risk reduction as $7.4 million in 2006 dollars. Adjusted for real income and inflation, the value of mortality risk reduction is equivalent to $8.9 million in 2013 dollars. Table G-3 lists the economic value of avoiding the adverse health impacts associated with freight emissions in 2013 dollars.

[12] ARB, “Initial Statement of Reasons, Appendix J, Regulation to Reduce Emissions of Diesel Particulate Matter, Oxides of Nitrogen and Other Criteria Pollutants from In-Use Heavy-Duty Diesel-Fueled Vehicles,” 2010.

TABLE G-2: Statewide Health Effects and Valuation (2013 $) Associated with Freight Emissions Contributing to PM2.5—Midpoint Projections

PM2.5 and NOx	2012	2030	2050
Mortality	2,200	980	1,100
Hospitalizations*	330	150	160
ER Visits†	950	420	450
Valuation (billions)	$20	$9	$10

* Includes respiratory and cardiovascular hospitalizations.
† Includes asthma and cardiovascular emergency room visits.

TABLE G-3: Statewide Health Effects and Valuation (2013 $) Associated with Freight Emissions Contributing to PM2.5—Uncertainty Ranges**

PM2.5 and NOx	2012	2030	2050
Mortality	1,700-2,700	770-1,200	830-1,300
Hospitalizations*	43-770	19-340	20-370
ER Visits†	600-1,300	260-570	280-620
Valuation (billions)	$16-$24	$7-$11	$7-$12

* Includes respiratory and cardiovascular hospitalizations.
**Uncertainty ranges only reflect uncertainty in the concentration-response function, and do not reflect uncertainty in emission projections, spatial interpolation, and aggregation.
† Includes asthma and cardiovascular emergency room visits.

Contingent valuation and wage-risk studies, which examine the willingness to pay for a minor decrease in the risk of premature death, are the basis for the value of mortality risk reduction. As real income increases, people are willing to pay more to reduce their risk of premature death.

The economic values of respiratory and cardiovascular hospitalizations are from Chestnut, et al. (2006).[13] The authors of this study estimated the value of reducing hospitalizations based on cost of illness and willingness to pay. The economic value of emergency room visits for asthma is from the U.S. EPA's 2011 Regulatory Impact Assessment for Ozone and PM2.5.[14] The values reflect inflation to 2013 dollars using the U.S. Bureau of Labor Statistics Consumer Price Index for medical care.

[13] Lauraine G. Chestnut, Mark A. Thayer, Jeffery K. Lazo, ad Stephen K. Van Den Eeden, "The Economic Value of Preventing Respiratory and Cardiovascular Hospitalizations," *Contemporary Economic Policy*, Vol. 24, 2006, pp. 127–143.
[14] U.S. EPA, "Regulatory Impact Analysis for the Federal Implementation Plans to Reduce Interstate Transport of Fine Particulate Matter and Ozone in 27 States," June 2011.

5. Labor and Workforce Development

Freight transportation creates jobs (direct, induced, and indirect), fuels economic growth, supports personal and business income, and generates revenue that contributes to federal, State, and local taxes. Like the sector itself, freight-related employment is dynamic and continually changing. The push for California's freight transportation industry is toward improved efficiency and reliability, reduced costs, increased productivity, faster transaction speed, and improved worker and public safety.

As California leads investment and development of these technologies that support a sustainable freight transport system, it must recognize that the transition to advanced technologies will require the development of a skilled workforce to operate and maintain these new technologies and systems. It will be critical to identify training needs and partnerships necessary to innovate, operate, and maintain these technologies over time while benefitting local economies.

B. Emerging Trends

The State agencies also recognize that the freight transport industry is ever evolving, and a number of trends will likely affect the future of freight movement in California. Many different factors affect modal choice, including modal characteristics, commodity characteristics, shipper/receiver characteristics, and logistics costs. Often, the most significant of these are time, cost, and reliability. How the industry weighs these factors in response to system changes illustrates how those changes will drive emerging trends. This section describes the emerging trends, how they might affect freight movement, and associated considerations for future State agency actions and planning.

1. Growth in Freight Volume

The U.S. Department of Transportation Freight Analysis Framework tool projects freight movement in California to significantly increase by the year 2045, with an approximately 133 percent increase in value and 59 percent increase in tons from 2015. The Freight Analysis Framework is a commodity flow database that contains freight movement information by mode, commodity type, and origin-destination zones. Projections indicate that California's population will increase by approximately 33 percent from 2010 to 2050.[15] More freight and resources will be required to foster a growing population, resulting in the rise in freight volumes moving in California. Increase in freight volume will occur across all modes of

[15] California Department of Finance, "Report P-1 (County): State and County Total Population Projections 2010-2060 (5-year increments)", December 2014, http://www.dof.ca.gov/Forecasting/Demographics/Projections/documents/P-1_Total_CAProj_2010-2060_5-Year.xls, accessed March 10, 2016.

transportation but of these projections, freight movement from trucks will continue to be the most used mode to move freight.[16]

Technologies such as zero emission and near-zero emission vehicles, intelligent transportation systems, and automated connected vehicles can help alleviate the impacts on the environment and public health, as well as increase system wide efficiencies. Thus, State policies and programs must be prepared to support improvements in technology and system efficiencies across all sectors.

2. Changing Geography of the Supply Chain

The geography of the supply chain is changing as businesses seek to add value, increase efficiency, and minimize costs. Manufacturers have begun to return production to the U.S. or neighboring countries in response to evolving global conditions that have gradually reduced the primary benefit of offshore production. Changes in rising offshore labor costs, automation, advantages to domestic transportation rates, and rightshoring, where a company considers total cost in order to determine the optimal location of facilities for serving a particular market, have led to nearshoring. Nearshoring is the practice of transferring a business process or manufacturing facility to a location that is in close geographic proximity to the company. For example, a U.S. company nearshoring production from Asia to Mexico. In fact, California's manufacturing share of gross domestic product was 11 percent as of January 2015 and California's manufacturing output has grown from $160 billion in 2002 to almost $260 billion in 2014.[17] The changing trade dynamics of the supply chain have revived production in the U.S. and in neighboring countries as it allows for improved competitiveness and an increasing domestic job market.

The resulting benefits of domestic job growth favor shorter supply chains and trade between the U.S., Mexico, and Canada. Economic growth and cross-border trade between the U.S. and bordering countries has advanced over the past two decades. As the potential benefits of nearshoring outweigh those of offshore productions, trade among the U.S, Mexico, and Canada will continue to increase freight movement and force a higher demand on the existing infrastructure. To capitalize on nearshoring and the strengthened trade between U.S. and bordering countries, it is necessary to modernize the infrastructure and cargo processing strategies in order to handle the expected higher volume of traffic at border entries.

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[16]U.S. Department of Transportation, Freight Analysis Framework, http://ops.fhwa.dot.gov/FREIGHT/freight_analysis/faf/index.htm, accessed February 4, 2016.

[17] National Association of Manufacturers, "California Manufacturing Facts," December 2015, http://www.nam.org/Data-and-Reports/State-Manufacturing-Data/State-Manufacturing-Data/December-2015/Manufacturing-Facts--California.pdf, accessed February 4, 2016.

Other factors that may influence business decisions on the supply chain may also derive from national and international pressures. California faces domestic competition from other states in the nation to modernize their freight facilities, and global competition from international ports and the expansion of the Panama and Nicaraguan Canal. California's ports of entry, seaports, and airports will need to maintain California's hold on the trade market by improving the efficiency of freight movement in the State.

Below is the first of several case studies that introduce current innovative projects from other entities and provide an example of the type of work that can help make progress towards achieving the State's goals.

3. Transportation Energy and Infrastructure

Transportation energy is used to move freight in medium- and heavy-duty vehicles and off-road equipment. Growth in State freight movement by tonnage will likely increase by 60 percent in 2040, with a commensurate demand in transportation energy.

Transportation energy demand forecasts shows that gasoline and diesel will be the primary sources of transportation fuel through 2026.[18] The development and use of non-petroleum based transportation fuels such as diesel substitutes, gasoline substitutes, biomethane gas, renewable hydrogen, and renewable electricity represent the largest existing stock of alternative fuel in the California transportation sector. Transportation fuels are indexed in price to gasoline, diesel, and conventional natural gas where prices are volatile and unpredictable.

Development and investments in transportation fueling infrastructure for zero emission, near-zero emission, and biofuels is an integral part of the sustainable freight solution. As vehicle and equipment technologies mature, it is critical that infrastructure capacity and costs keep pace as well. In this way, affected freight stakeholders can make informed decision as they transition to low-carbon transportation energy systems.

State and federal policies have encouraged the development and use of renewable and alternative fuels and technologies. Low and very-low carbon transportation fuels have the potential to displace roughly 3.4 billion gallons of diesel used per year in California and represent an immediate and long-term opportunity to reduce greenhouse gas emissions, reduce petroleum dependence, and foster business sustainability through in-state production and consumption. While the State has forged a leadership position in the production, installation, and consumption of low-carbon transportation energy systems, support for the continuation of this trend

[18] California Energy Commission, "2015 Integrated Energy Policy Report," February 2016.

will require active engagement of both the public and private sectors until markets can self-sustain these systems.

4. Larger Ocean Vessels

Ocean carriers around the world have responded to competitive and cost pressures by introducing larger ocean vessels to their fleet. Larger vessels have begun voyages to U.S. seaports. The largest vessel to call at a U.S. seaport first arrived in December 2015, carrying 18,000 twenty-foot equivalent units. The previous record holder arrived in June 2014, carrying 13,000 twenty-foot equivalent units.[19] These larger vessels allow beneficial cargo owners to ship more containers on fewer trips and on more fuel-efficient engines. Furthermore, the coordination of ocean carriers sharing of excess capacity has also created opportunities for ocean carriers to form alliances and to share trade routes that were previously exclusive.

Although the operation of larger vessels allows more opportunities to reduce costs, increase efficiency, and reduce emissions, they inevitably affect the demand on port infrastructure, contribute to port congestion, and increase the time vessels stay at-berth while unloading. Having larger vessels be more common in ocean shipping transport induces further effects to U.S. ports and surrounding freight areas to upgrade facilities and infrastructures in order to handle larger influxes of freight. The large influx of containers arriving at once may in turn cause greater peak period congestion on rail and surrounding highways, and require the port equipment and infrastructure to match the technology of the larger vessels. Operational efficiencies and infrastructure improvements will help accommodate the new norm of larger oceangoing vessels. Improvements to port terminal efficiency, investments in automated cargo handling and coordination with vessel alliances may benefit port efficiency, increase berth and yard productivity, and alleviate congestion. Efforts are already underway. For example, the Port of Los Angeles' Pasha terminal and Port of Long Beach's Long Beach Container Terminal have invested in advanced technology to automate the terminals and improve efficiency.

5. Increased Vulnerability of Freight Facilities

The effects of climate change are a global concern and one that has received international attention. Projections indicate glacial ice caps are melting at alarming rates and sea level will gradually rise approximately 5 to 24 inches by 2050 (relative to 2000) and 17 to 66 inches by 2100. The Paris Agreement, adopted at the United Nations Conference on Climate Change in December 2015, is evidence that leaders around the world are working together to minimize the detrimental impacts resulting from climate change. The Paris Agreement set a global commitment to reduce

[19] APM Terminals, "APM Terminals Pier 400 Los Angeles Sets New Record with the Largest Container Ship Call Ever at US Port," December 2015, http://www.apmterminals.com/en/news/press-releases/2014/12/apmt-los-angeles-pier400-setting-ulcs-call, accessed March 14, 2016.

carbon emissions from human activity and limit global warming to less than 2 degrees Celsius compared to pre-industrial levels.[20]

These efforts are important to reduce the risks to communities, public and private property, and infrastructure from storm surges, flooding, and permanent inundation and erosion. Climate change could affect many different aspects of the freight transport system, including coastal and low-lying seaports, airports, roads, and energy and fueling infrastructure. Extreme weather associated with climate change also threatens freight infrastructure. Severe storm events, floods, and landslides may cause road closures and damage energy and fuel distribution systems as well as transportation infrastructure. Extreme heat may cause pavement to buckle and metal rail lines to kink and break.

Preventive measures will help ensure California's freight transport system can continue operating in the future. This includes developing an understanding of the susceptibilities of the freight transport system. For example, the Energy Commission has released a solicitation to fund research to identify and assess vulnerabilities of California's transportation fuel sector to extreme weather-related events and identify options to promote resilience. At a physical improvement level, facilities need to be safe from extreme currents and flooding above the watermark for expected sea level rise, particularly during storm events. Although important to recognize the first impact of higher tides, a comprehensive outlook on all aspects of freight infrastructure functions will need to be improved.

Building infrastructure resilient to the effects of climate change is critical to preserve the economic advantage of California's location to worldwide markets. Strategies to improve freight infrastructure serve more than a purpose to enhance the safety of those that work and live near the freight corridor, but also provide confidence to beneficial cargo owners that business can continue uninterrupted throughout California. These will have cascading economic effects especially to those who depend on freight transport as a way of living.[21]

6. Expansion in Last Mile Sector of Freight Transport

The high demand of e-commerce has resulted in the expansion of the last mile freight delivery sector. Last mile freight delivery is the freight transit from the final distribution center to the customer or retailer. E-commerce is the sale of goods or services on the internet. Retailers continue to balance the need for drivers and

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[20] United Nations Framework Convention on Climate Change, "Adoption of the Paris Agreement," December 12, 2015, http://www.cop21.gouv.fr/wp-content/uploads/2015/12/l09r01.pdf, accessed March 14, 2016

[21] California Natural Resources Agency, "Safeguarding California: Reducing Climate Risk", July 2014, http://resources.ca.gov/docs/climate/Final_Safeguarding_CA_Plan_July_31_2014.pdf, accessed on February 4, 2016.

delivery capabilities to maintain the expectations and convenience consumers have with online retail without passing along the costs to them. Technology has assisted with the streamlining of e-commerce and the demographic that has grown with technology also largely contribute to the growing e-commerce market.

In the U.S., Generation X, ages 35 to 50 years old, comprise approximately 66 million people of the population while Generation Y, ages 18 to 34 years old, are estimated at 75 million in 2015. With immigration of this age group to the U.S., Generation Y's will peak at 81 million by 2036.[22] Sixty percent of consumers shop online, and up until 2013, Generation X's spent more money in e-commerce than other age groups, but today's scientific and industry research indicates that Generation Y's spend more money online than any other demographic.[23] Research suggests that Generation Y's are motivated to shop online based on current trends (i.e. what's popular), indicating that online purchases will continue to grow as the spending power of the generation increases along with the ability to purchase directly from social media websites.[24] Projections indicate online retail sales will reach $385 billion in 2017 and $414 billion in 2018, up from $263 billion in 2013.[25] Retailers recognizing the growing trend of online purchases may see e-commerce as a benefit with many larger retailers investing in delivery and fulfillment systems, and strategies that focus on the end customer. To meet this need, e-commerce retailers may want to improve urban logistics to optimize solutions for last mile deliveries, such as crowdsourcing and deliveries on shorter delivery routes. Crowdsourcing is the process of obtaining needed services, ideas, or content by soliciting contributions from a large group of people, especially from an online community. For example, an online retailer has experimented with crowdsourcing couriers to make deliveries to their end consumer. The crowdsourcing demand model may provide some benefits but it also requires route strategies to arrange for the final delivery. Implementing this strategy at a larger scale may result in development of smaller urban warehouses to provide quicker deliveries to customers.

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[22] Fry, Richard, "This Year, Millennials will Overtake Baby Boomers," *Pew Research Center*, January 16, 2015, http://www.pewresearch.org/fact-tank/2015/01/16/this-year-millennials-will-overtake-baby-boomers/, accessed on February 4, 2016.

[23] Smith, Cooper, "Gen X and Baby Boomer Present a Huge Opportunity for Online Retailer," *Business Insider*, April 27, 2015, http://www.businessinsider.com/the-age-demographics-of-who-shops-online-and-on-mobile-2015-4, accessed on February 4, 2016.

[24] Nobel, S.M., et al., "What Drives College Age Generation Y Consumers?," *Journal of Business Research*, Vol. 62, 2009, https://www.researchgate.net/publication/222678642_What_drives_college-age_Generation_Y_consumers, accessed on February 4, 2016.

[25] Enright, Allison, "U.S. Online Retail Sales will Grow 57% by 2018; Projected Growth," May 12, 2014, https://www.internetretailer.com/2014/05/12/us-online-retail-sales-will-grow-57-2018, accessed on February 4, 2016.

Although crowdsourcing and shorter delivery routes may help facilitate meeting the demands of e-commerce, the increased movement of freight in urban areas will have an impact on the existing infrastructure. Larger volumes of trucks and passenger vehicles increase traffic in urban and residential roads and can contribute to congestion and safety issues. Local infrastructure improvements of city streets and local transportation corridors will be necessary as they provide increasingly vital connections between freight facilities, distribution centers, and homes. State and local partners must continue to develop and implement strategies that help minimize the impacts of increasing numbers of freight vehicles. Such impacts include increased demand on neighborhood parking and streets, increased urban congestion, as well as increased conflicts between last mile delivery trucks and vehicles with light-duty automobiles, pedestrians, and bicycles.

While projections indicate the volume of last mile deliveries made by truck will increase, there are other possible methods of delivery on the horizon that may influence a shift away from trucks. These could include cargo bicycles, delivery by drone, use of transportation network company services in urban areas, increased use of the U.S. Postal Service, or opportunities for customers to pick up packages at stores or strategically located kiosks. Additionally, efficiency measures could optimize shipments by truck, thereby reducing the number of trucks in urban areas.

7. Emerging Technologies

New technologies are revolutionizing the way the freight transport system operates, offering solutions, opportunities, and challenges. By capturing the benefits of emerging technologies such as information systems and facility modernization, these technologies can cut travel time and fueling costs while increasing the capacity of the system to transport more cargo within the existing transportation infrastructure.

The freight transport system has an opportunity to incorporate emerging technologies to improve communication, safety, and facility modernization. Communication and information technology improvements provide a wide range of smart pricing and costing models for smarter management decisions, smart-phone enabled technology to provide for dynamic and real-time load information sharing, and expedited inspection processes. The integration of advanced information technology can improve data collection to enable faster and more accurate analysis of freight routes, travel times, and infrastructure capacity. In addition, freight facility modernization has the potential to increase productivity and decrease operating costs while increasing throughput of existing infrastructure and capacity. The development of emerging technologies in the freight transport system provides potential to improve freight transportation reliability and safety as well as support efforts toward a successful transition to cleaner zero and near-zero emission goals.

C. Integration of Existing State Policies, Programs, Plans, and Funding

Collectively, the following State agencies have responsibility for influencing different and intersecting components of the freight transport system:[26]

- Caltrans' mission is to provide a safe, sustainable, integrated, and efficient transportation system to enhance California's economy and livability. This includes supporting development of a robust system for the efficient operation and service of freight movement in the State. The department directly manages more than 50,000 lane miles of State and federal highways, as well as over 12,000 highway bridges; administers technical assistance and grants to regional partners for local planning and projects; permits more than 400 public-use airports and special-use hospital heliports; and plays a strong role identifying options for long-term transportation infrastructure funding.

- ARB's mission is to promote and protect public health, welfare, and ecological resources through the effective and efficient reduction of air pollutants while recognizing and considering the effects on the economy of the State. The Board is responsible for providing safe and clean air and provides leadership in implementing and enforcing air pollution control rules, regulations, and incentive programs affecting mobile and stationary sources, including those related to freight, that are based on the best possible scientific and economic information.

- The Energy Commission is the State's primary energy policy and planning agency and is committed to reducing energy costs and environmental impacts of energy use, while ensuring a safe, resilient, and reliable supply of energy. To help advance the State's energy policy, the Commission offers incentives aimed at transforming transportation through the development and deployment of low-carbon alternative fuels and advanced vehicle technologies that can be used to move people and freight in the State, as well as gathers and analyzes data on current petroleum fuel price, supply, and demand issues.

- The Governor's Office of Business and Economic Development (GO-Biz) is the State's point of contact for economic development and job creation efforts, and provides a range of services to business owners including attraction, retention and expansion services, business development services,

[26] Other State government agencies and bodies including but not limited to: the California Department of Food and Agriculture, California Department of Public Health, California Workforce Development Board, California Public Utilities Commission, Governor's Office of Planning and Research, and Strategic Growth Council have objectives, policies, and programs that intersect with the freight transport system. Caltrans, ARB, the Energy Commission, and GO-Biz will continue to coordinate with these and other agencies on potential involvement moving forward.

permit streamlining and regulatory assistance, small business assistance, promotion of economic growth and jobs through innovation, assistance with state programs, coordination with local and regional agencies, and international trade development.

As part of the Action Plan development process, the State agencies worked together to consider their existing policies, programs and investments, as well as recent State plans related to California's freight transport system. The State agencies used this information as the starting point for identifying further opportunities to accelerate change through greater coordination across existing programs, and additional actions to address system needs.

The following section briefly describes the State agencies' current activities and planning efforts related to the freight transport system.

1. Current Activities

California has a suite of policies, programs, and investments that intersect with the freight transport system and are aimed at advancing system efficiencies, clean freight vehicle and equipment technologies, and operations across the State, including:

- Implementation of intelligent transportation systems technology, including freight sector demonstrations and expanded integration into State roadside facilities with state-of-the-art truck scale technology, dependable and sophisticated traffic sensors, and the ability to share freight inspection, routing, and weather information. Work is also underway with freight partners to improve communications and telematics, container matching, and connected vehicles, which will reduce greenhouse gases, relieve congestion, improve economic margins for businesses, and benefit disadvantaged communities.

- Programs to promote advanced transportation technology to improve system safety and efficiency such as connected (e.g., truck platooning) vehicles and freight priority traffic management systems (e.g., traffic sensing, preemptive signals).

- Coordination with national and international entities on truck information.

- Use of innovative technology, techniques and materials to encourage system preservation, reduce peak demand, and increase fuel efficiency.

- Development of tools for freight data collection, analysis, and modeling.

- Efforts to improve the existing infrastructure in order to reduce congestion, meet current standards, and improve access for interstate commerce. For example, work is underway to raise the vertical clearance of structures crossing Interstate 80. This allows standard trucks traveling the interstate route to avoid detours through local roads, which have historically caused delays and stresses on the local roadway system.

- Regulations requiring in-use and new fleet upgrades to cleaner technologies across vehicle and equipment types, rules for when vehicles are idling and vessels are docked, as well as incentive programs to help with development and deployment of zero and near-zero emission vehicles and equipment. This builds off the success of other modes and sectors in transitioning technology to electrification. For example, California has led a consortium of other states to expand the availability of electric vehicles, the State is developing the nation's first electric high-speed rail system, and local transit providers are expanding electric service.

- Programs to advance development, market growth, and acceptance of clean, low-carbon fuels and infrastructure for freight movement. This includes rules to help reduce the overall carbon intensity of transportation fuels, incentive programs to support development and manufacturing of low carbon transportation fuels and associated fueling infrastructure, roadmaps and action plans to advance alternative fuels development, as well as specific fuel rules for marine vessels and locomotives.

- Actions to advance building energy efficiency, including at freight-related building and commercial facilities. As identified in the Governor's January 2015 inaugural address and through Senate Bill 350 (De Leon, Chapter 547, Statutes of 2015), efforts to double energy efficiency savings by 2030 will include energy efficiency measures to be implemented by all sectors of the freight movement industry. Energy efficiency measures not only reduce greenhouse gas emissions, but also provide businesses with a favorable return on efficiency investments where financial savings can be used for other building energy investments, such as renewable generation.

2. Recent Plans

Starting in 2014 and throughout 2015, the State agencies released a series of plans and documents related to California's freight transport system, including the *California Freight Mobility Plan*, the *2014 Integrated Energy Policy Report Update*, the *Sustainable Freight Pathways to Zero and Near-Zero Emissions Discussion Document*, the *Heavy-Duty Technology and Fuels Assessments*, and the *Safeguarding California: Implementation Action Plans Report*. Collectively, these documents represent the most recent iteration of the State's work to characterize California's freight transport system, the system's relationship to achieving broader

transportation, air quality, energy, climate and resiliency goals, and identify potential State actions to influence freight transport system.

a. California Freight Mobility Plan

In December 2014, Caltrans finalized the *California Freight Mobility Plan*, which describes the condition and performance of the current system and a forecast for freight volumes in the future.[27] The *California Freight Mobility Plan* discusses a variety of freight transport system issues such as: the economic context of freight, labor and workforce development, the community and environmental context, safety, security and resiliency issues, intelligent transportation systems and technology, border issues, and California Native American tribal freight connections. The *California Freight Mobility Plan* also includes a list of potential freight transportation infrastructure projects across the State. Pursuant to the requirements of the Fixing America's Surface Transportation (FAST) Act, Caltrans in conjunction with the California Freight Advisory Committee and the California Transportation Commission will be updating the plan beginning in the Fall of 2016 through December 2017 to bring it into compliance with new federal requirements.

b. 2014 Integrated Energy Policy Report Update

In February 2015, the Energy Commission adopted the *2014 Integrated Energy Policy Report Update*.[28] The 2014 update of this biennial policy report is notable for its focus on transportation energy issues. It provides an overview of where transportation technologies are headed in the future, and discusses opportunities and challenges for integrating the transportation system and fueling infrastructure with the electricity and natural gas systems. The report also discusses the role of incentives and opportunities to leverage funding toward transforming the transportation system to achieve the State's climate, air quality, and energy goals.

c. Sustainable Freight: Pathways to Zero and Near-Zero Emissions Discussion Document

In April 2015, ARB staff released the *Sustainable Freight: Pathways to Zero and Near-Zero Emissions Discussion Document* that outlines initial steps ARB intends to take and propose to accelerate progress toward zero and near-zero emission freight

[27] California State Transportation Agency and Caltrans, "California Freight Mobility Plan," December 2014, http://www.dot.ca.gov/hq/tpp/offices/ogm/cfmp.html, accessed April 11, 2016.
[28] Energy Commission, "2014 Integrated Energy Policy Report Update," February 2015, http://www.energy.ca.gov/2014publications/CEC-100-2014-001/CEC-100-2014-001-CMF.pdf, accessed April 11, 2016.

vehicle and equipment technology in California.[29] It describes the range of potential actions available to ARB for trucks, oceangoing vessels, locomotives, transport refrigeration units, commercial harbor craft, aircraft, and cargo, industrial, and ground service equipment. Immediate, near-, and long-term concepts to achieve a cleaner freight system are included.

d. Heavy-Duty Technology and Fuels Assessments

Throughout 2015, ARB staff, along with South Coast Air Quality Management District staff, released a series of technology and fuels assessment reports for a variety of source categories, including trucks and buses, transport refrigeration units, locomotives, conventional and alternative fuels, oceangoing vessels, commercial harbor craft, cargo handling equipment, and aviation.[30] These technology assessments evaluate how the various technologies for each mode work, the fuels necessary to power each technology, as well as the state of market readiness, costs, environmental benefits, technology performance, and current deployment challenges.

e. Safeguarding California: Implementation Action Plans

The California Natural Resources Agency released the *Safeguarding California: Implementation Action Plans* report in March 2016, which sets forth how the State will help residents, communities, and natural systems adapt to the potentially catastrophic effects of climate change.[31] The report includes implementation plans that identify steps across different sectors including water, transportation, agriculture, biodiversity and habitat, emergency management, and energy, to build the resilience of California's residents, communities, and ecosystems to the emerging impacts of climate change. The key adaptation efforts for sustainable freight transportation include:

- A better understanding of expected climate impacts to inform transportation planning: specifically, regional climate model downscaling and specific vulnerabilities of transportation, energy, and fueling infrastructure.

[29] ARB, "Sustainable Freight: Pathways to Zero and Near-Zero Emissions Discussion Document," April 2015, http://www.arb.ca.gov/gmp/sfti/sustainable-freight-pathways-to-zero-and-near-zero-emissions-discussion-document.pdf, accessed April 11, 2016.
[30] ARB, Technology and Fuels Assessments Reports, April 2015 to April 2016, http://www.arb.ca.gov/msprog/tech/report.htm, accessed April 11, 2016.
[31] California Natural Resources Agency, "Safeguarding California: Implementation Action Plans," March 2016, http://resources.ca.gov/docs/climate/safeguarding/Safeguarding%20California-Implementation%20Action%20Plans.pdf, accessed April 11, 2016,

- A better understanding of evolving trends that may impact transportation systems: opportunities with vehicle electrification and other advanced clean vehicles on timing and demand for energy supplies along with better understanding of likelihood of land subsidence events that may compromise transportation systems.

- Improving the reliability of California's transportation and freight systems in the face of expected climate impacts: translating the findings of vulnerability studies into actions that improve the reliability of California's transportation by integrating climate considerations into planning, design, programming, construction, operations, and maintenance.

3. Freight Funding Programs

California's diverse set of funding programs support a wide range of freight movement activities. Some of these programs are direct sources of funding for transportation infrastructure and others are discretionary, and support freight vehicle and equipment technology advancement. Funding and incentives for freight sector buildings are also available to improve energy efficiency, energy conservation, and renewable energy generation. Examples of some of these freight funding sources for California follow.

a. Bond Funding

The Highway Safety, Traffic Reduction, Air Quality, and Port Security Bond Act of 2006, approved by the voters as Proposition 1B, provided almost $20 billion in funding for California's transportation infrastructure. Over $3 billion in Proposition 1B funds were dedicated to the improvement of the State's freight network through the Trade Corridors Improvement Fund, Goods Movement Emission Reduction Program, and the California Ports and Maritime Security Grants Program.

Trade Corridors Improvement Fund

Proposition 1B made $2 billion available for infrastructure improvements along federally designated "Trade Corridors of National Significance" in California, or along other corridors within California that have a high volume of freight movement – this program was called the Trade Corridors Improvement Fund. The bond funding was leveraged with other funds to support projects costing over $7 billion. The Trade Corridors Improvement Fund uses Proposition 1B funds made available to the California Transportation Commission upon appropriation in the annual Budget Bill by the Legislature. The Trade Corridors Improvement Fund is subject to conditions and criteria in statute. The law placed emphasis on projects that improve trade corridor mobility. The California Transportation Commission consulted with ARB to help develop air quality evaluation criteria for proposed projects.

The types of projects funded under this program include highway expansions, grade separations, rail capacity increases, and port access improvements.[32] Bond funds for the programs are all programmed on specific projects, with many projects already completed and in use. Notable infrastructure investments were the construction of the Colton Crossing grade separation in San Bernardino County and the replacement of the Gerald Desmond Bridge in Long Beach.

Goods Movement Emission Reduction Program

Proposition 1B also made $1 billion available to ARB to reduce freight air pollution, and the associated health effects, on impacted communities along California's trade corridors. The Legislature created the Goods Movement Emission Reduction Program at ARB to implement the bond funding. Local agencies (like air districts and seaports) apply to ARB for funding; then those agencies offer financial incentives to owners of equipment used in freight movement to upgrade to cleaner technologies. ARB adopted guidelines and priorities for the last round of Goods Movement Emission Reduction Program funds in June 2015 that incorporated the State's initiative to foster zero and near-zero emission technologies.

The types of projects funded under the Goods Movement Emission Reduction Program include investments to replace, retrofit or upgrade trucks, locomotives, cargo handling equipment, transport refrigeration units, and commercial harbor craft, as well as install shoreside electrical power for ships at-berth. These investments must achieve early or extra emission reductions not otherwise required by law or regulation, which ARB describes as "early or extra" reductions.[33] As of December 2015, the Goods Movement Emission Reduction Program has upgraded almost 13,000 trucks, 25 locomotives, 3 harbor craft engines, and installed electrical infrastructure for ship plug-ins at 37 berths at the Ports of Los Angeles, Long Beach, Oakland, and Hueneme. These projects reduced 2,600 tons of fine particulate matter and 94,000 tons of nitrogen oxides emission throughout the State's trade corridors.[34] ARB awarded the final round of approximately $220 million in funding to five local air districts in 2015 for projects that will be completed over the next one to four years and yield additional benefits. The program bond monies have leveraged substantial match funding from private, local, and federal sources – more than one match dollar for every program dollar invested.

California Ports and Maritime Security Grant Program

Proposition 1B also directed that $100 million be made available upon appropriation by the Legislature for grants to eligible entities for port and maritime security projects

[32] For more information see: http://www.dot.ca.gov/hq/tpp/offices/ogm/tcif.html.

[33] For more information see: http://www.arb.ca.gov/bonds/gmbond/gmbond.htm.

[34] ARB, "Proposition 1B: Goods Movement Emission Reduction Program, Semi-Annual Status Report", June 2016.

such as equipment for security or detection of overweight loads.[35] The Governor's Office of Emergency Services administered the program, and program funding has been exhausted. Projects funded under this program include investments such as maritime security risk management, maritime domain awareness, and maritime security mitigation protocols to support resiliency capabilities.

b. Additional Funding

In addition to the bond fund programs discussed above, a number of other funding and financing programs help to improve freight movement across the State. Although none of these programs are dedicated to freight infrastructure and equipment, a portion of the dollars may be allocated to help to fund construction and maintenance of key physical infrastructure, develop and deploy advanced technology engines and equipment, produce alternative and renewable low carbon fuels and associated infrastructure, as well as promote workforce development.

National Corridor Planning & Development Program
Coordinated Border Infrastructure Program

The Transportation Equity Act for the 21st Century authorized The National Corridor Planning and Development Program, and the Coordinated Border Infrastructure Program, discretionary grant programs funded by a single funding source. These programs provided funding for planning, project development, construction, and operation of projects that serve border regions near Mexico and Canada and high priority corridors to states and metropolitan planning organizations throughout the nation. Some projects in this category include innovative and problem-solving techniques for proposed border stations or ports of entry, projects to reduce travel time through international border crossings, improvements in Mexico border crossing vehicle safety, and security.

Carl Moyer Memorial Air Quality Standards Attainment Program

The Carl Moyer Memorial Air Quality Standards Attainment Program (Carl Moyer Program) provides grant funding for cleaner-than-required engines and equipment. The program is authorized at $69 million per year and funded through Department of Motor Vehicle smog abatement and tire fees. Typically, most of these funds are allocated to non-freight sources. Local air districts administer Carl Moyer Program grants, selecting cost-effective projects among source categories that include on-road trucks and buses, off-road equipment, locomotives, marine engines, portable and stationary agricultural equipment, and light-duty vehicle scrap. ARB works collaboratively with the air districts and other stakeholders to set guidelines and ensure the program achieves pollutant reductions to help California meet its

[35] Governor's Office of Homeland Security, California Port and Maritime Security Grant Program Guidelines and Application Kit, 2007.

clean air commitments. As of December 2015, approximately $1 billion in State and local funds have been invested through the Carl Moyer Program to clean up dirty engines. To date, the program has cleaned up more than 50,000 engines, reducing approximately 175,000 tons of ozone precursors and 6,500 tons of particulate matter.

Low Carbon Transportation Investments and Air Quality Improvement Program

ARB's Low Carbon Transportation Investments and Air Quality Improvement Program projects provide incentives to reduce greenhouse gas emissions, criteria pollutants, and toxic air contaminants through the development and deployment of advanced technology and clean transportation.

California Cap-and-Trade auction proceeds support Low Carbon Transportation investments. Per statute, these funds must further the purposes of Assembly Bill 32 (AB 32; Núñez, Chapter 488, Statutes of 2006) with a priority for benefitting disadvantaged communities. Each year, the Legislature appropriates funding to ARB for Low Carbon Transportation projects and Air Quality Improvement Program projects. The Air Quality Improvement Program is a voluntary mobile source incentive program administered by ARB to fund clean vehicle and equipment projects, research of biofuels production and air quality impacts of alternative fuels, and workforce training. The Air Quality Improvement Program Guidelines and annual Funding Plans guide ARB's implementation of the Air Quality Improvement Program.[36] The current freight-related Low Carbon Transportation and Air Quality Improvement Program Projects include Advanced Technology Demonstration Projects, Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project, Zero-Emission Truck and Bus Pilot Projects, and Truck Loan Assistance Program.

Alternative and Renewable Fuel and Vehicle Technology Program

The Alternative and Renewable Fuel and Vehicle Technology Program authorizes the Energy Commission to develop and deploy alternative and renewable fuels and advanced transportation technologies to help implement the State's climate change policies. The Energy Commission has an annual program budget of approximately $100 million to support projects around the State. Alternative and Renewable Fuel and Vehicle Technology Program projects help to improve and produce alternative and renewable low carbon fuels for existing and emerging engines in California, as well as expand fueling stations, equipment and fueling infrastructure for existing fleets, public transit, and transportation corridors. Funding is also for demonstration and deployment of advanced vehicle and equipment technologies, including improvement and retrofit of light-, medium-, and heavy-duty vehicle technologies and on-road and non-road vehicle fleets. Technologies are demonstrated on the freight

[36] For additional information see: http://www.arb.ca.gov/msprog/aqip/aqip.htm.

system at seaports, along freight transportation corridors, warehouse and distribution centers, and retail and commercial centers. Program projects also help to establish workforce training programs, conduct education, and create technology centers that promote workforce development to support advanced vehicle technologies.[37]

California Alternative Energy and Advanced Transportation Financing Authority

The California Alternative Energy and Advanced Transportation Financing Authority, in the State Treasurer's Office, works collaboratively with public and private partners to provide innovative and effective financing solutions for California's industries. It assists in increasing the development and deployment of renewable energy sources, energy efficiency, and advanced transportation and manufacturing technologies to reduce air pollution, conserve energy, and promote economic development and jobs.

California Pollution Control Financing Authority

The California Pollution Control Financing Authority, in the State Treasurer's Office, provides low-cost innovative financing to California businesses (including freight sector businesses) for qualifying projects that control pollution and improve water supply. Examples of recent assistance include projects to purchase clean air vehicles by waste companies, construct and operate anaerobic digesters, recycle used oil, and convert animal waste to clean burning fuel. Additionally, the California Pollution Control Financing Authority administers the California Capital Access Program, which helps participating financial institutions extend credit to small businesses through microloans and larger loans for start-up, expansion, and working capital up to $20 million.

The California Pollution Control Financing Authority also partners with State agencies to achieve the State's environmental policy objectives by administering high-impact financing programs designed to assist regulated entities and other stakeholders with accessing private capital.

The Infrastructure State Revolving Fund Program

The California Infrastructure and Economic Development Bank uses its Infrastructure State Revolving Fund program to provide financial assistance to public agencies and non-profit corporations for a wide variety of infrastructure and economic development projects. Recently, Assembly Bill 1533 (Chapter 383, Statutes of 2015) amended the Infrastructure State Revolving Fund program by expanding project criteria to include goods movement-related projects.

[37] For additional information see: http://www.energy.ca.gov/altfuels/.

Applicants eligible for financial assistance through this program could receive funding in amounts ranging from $50,000 to $25 million, with loan terms up to 30 years. Although not ideal to fund capital projects in their entirety, the Infrastructure State Revolving Fund program is a possible funding partner for freight projects that promote economic efficiency, revitalize communities, and enhance the quality of life for people of California.

c. Potential Freight Funding

This section discusses new and proposed freight funding sources that could be used for investing in California's freight transport system, both the infrastructure and the vehicles and equipment that move cargo.

Fixing America's Surface Transportation Act

On December 4, 2015, President Obama signed into law a new five year, $305 billion surface transportation bill, the "Fixing America's Surface Transportation (FAST) Act," which authorizes funding for existing core highway and transit programs and created two new freight programs funded by the Highway Trust Fund:

- National Highway Freight Program: Established to improve the efficiency of freight movement on the National Highway Freight Network in addition to critical urban and rural freight corridors and support Federal goals for freight. The total formula program authorized $6.3 billion. Within this framework, the State could receive an estimated $117 million a year for the next five years.

- Nationally Significant Freight and Highway Projects: A corollary discretionary grant program that will allow the Secretary of Transportation to award grants for nationally or regionally significant transportation infrastructure projects across modes, including freight rail projects. The program is initially funded at approximately $900 million per year nationwide, with annual increases until it is funded to $1 billion in 2020. California will work with local and regional partners to put the State in the best position to be awarded as much of this discretionary funding as possible.

Prior to the Fixing America's Surface Transportation Act, the U.S. did not have a coordinated freight investment program. By establishing a dedicated, committed funding source, the law underscores the importance of freight movement and freight supporting infrastructure to both the California and U.S. economies.[38]

[38] For additional information see: https://www.fhwa.dot.gov/fastact/legislation.cfm.

Governor Brown's Funding Proposal

On January 7, 2016, the Governor released his proposed 10-year funding plan that will provide a total of $36 billion for transportation, with an emphasis on repairing and maintaining the existing transportation infrastructure. The Governor's proposal also includes a significant commitment to improving infrastructure on the State's trade corridors. Approximately $2 billion is slated for freight infrastructure investments. The package includes a combination of new revenues, additional investments of Cap-and-Trade auction proceeds, accelerated loan repayments, Caltrans efficiencies and streamlined project delivery, accountability measures, and constitutional protections for the new revenues.[39] The funding proposal addresses the following Administration priorities:

- Focus new revenue primarily on "fix-it-first" investments to repair neighborhood roads and State highways and bridges, including needed maintenance along the State's primary trade corridors. The funding proposal would allocate $518 million for State highway repairs and maintenance, and $342 million for local roads in fiscal year 2016-2017.

- Make key investments in trade corridors to support continued economic growth and implementation of a sustainable freight transport strategy. A total of $211 million has been assigned for trade corridor enhancement. In past investments through the Trade Corridors Improvement Fund program, the State leveraged $2 for every $1 spent to improve its trade corridors. The State should expect the same leverage with this proposed investment.

- Provide funding to match locally generated funds for high-priority transportation projects. It is also important to address local freight priorities.

- Continue measures to improve performance, accountability, and efficiency at Caltrans. Taking such measures will enhance project delivery for both the State and project stakeholders.

- Invest in passenger rail and public transit modernization and improvement. Investments in passenger rail can also benefit freight rail. Grade separations, operations improvements, and double tracking can improve the safety, mobility, and carbon footprint of passenger and freight rail operators.

The Governor's proposal also includes a one-year appropriation of funding for cleaner vehicles, equipment, and fuels used to transport passengers and freight, as well as off-road equipment used in agriculture and other applications. This funding would:

[39] For additional information see: http://www.ebudget.ca.gov/FullBudgetSummary.pdf.

- Continue the Low Carbon Transportation and Air Quality Improvement Program projects. The Governor's proposal would appropriate $500 million in Cap-and-Trade auction proceeds to ARB for Low Carbon Transportation and Fuels investments. Typically, passenger transportation projects to help achieve the Governor's zero emission vehicle targets and implement the Legislature's low-income equity programs to increase personal mobility in disadvantaged communities receive funds. This appropriation includes $40 million for very low carbon fuel production incentives, a new element to ARB's Low Carbon Transportation program.

- Invest in in-state biofuel production through the expansion of existing facilities or construction of new facilities. The Governor's proposal would appropriate $25 million in Cap-and-Trade auction proceeds to the Energy Commission for incentives through the Alternative and Renewable Fuel and Vehicle Technology Program. Some of these fuels may support freight transport.

D. Relationship to Plans Under Development

When developing this document, the State agencies also considered the ongoing development of a number of other plans and strategies that intersect with freight transport projects or investments. The following section describes how the Action Plan will inform those plans and strategies as they are developed and updated.

1. National Freight Strategic Plan

The *Draft National Freight Strategic Plan* presents solutions and strategies to address infrastructure, institutional, and financial bottlenecks that hinder the safe and efficient movement of freight.[40] It also identifies best practices for mitigating the impact of freight movement on communities and proving reliable funding for transportation. The plan is the framework for national freight policy and will guide development of the next iteration of the California Freight Mobility Plan.

2. California Transportation Plan

The *California Transportation Plan 2040* identifies statewide multi-modal transportation system resources to achieve maximum feasible greenhouse gas reductions while meeting the State's transportation needs.[41] The plan also highlights the need for infrastructure improvements targeted at freight movement

[40] U.S. Department of Transportation, "Draft National Freight Strategic Plan," October 2015, https://www.transportation.gov/sites/dot.gov/files/docs/DRAFT_NFSP_for_Public_Comment_508_10%2015%2015%20v1.pdf, accessed April 11, 2016.

[41] Caltrans, "California Transportation Plan 2040 Final Review Draft," February 29, 2016, http://www.dot.ca.gov/hq/tpp/californiatransportationplan2040/final-draft-ctp2040/index.shtml, accessed April 11, 2016.

and increased public benefits such as more efficient, cost-effective, and environmentally-friendly freight. The *California Transportation Plan 2040* refers to the California Sustainable Freight Action Plan and the California Freight Mobility Plan as instrumental in creating freight transportation policy in the coming decades.

3. Regional Transportation Plan Guidelines

The current *2010 California Regional Transportation Plan Guidelines* provide a uniform transportation planning framework throughout the State identifying federal and State requirements for the development of Regional Transportation Plans.[42] The Regional Transportation Plans, also called Long Range Transportation Plans are used in California by both Metropolitan Planning Organizations and Regional Transportation Planning Agencies to conduct long range (a minimum of 20 years) planning in their regions. Through the regional planning process, Metropolitan Planning Organizations and Regional Transportation Planning Agencies can create strategies for improving the regional freight transportation system so positive impacts (e.g. job creation, access to goods) are maximized and negative impacts (e.g. land use conflicts, air pollution) are minimized. Metropolitan Planning Organizations and Regional Transportation Planning Agencies must plan for freight transportation infrastructure in the same way they plan transportation infrastructure for the movement of people, supporting projected population growth and economic development. The process to update the current *2010 California Regional Transportation Plan Guidelines* has been launched by the California Transportation Commission with adoption anticipated by December 2016, and will include some of the strategies from this document that most pertain to regional transportation agencies.

4. Mobile Source Strategy

ARB staff released a *Mobile Source Strategy* in May 2016 to support multiple planning efforts. [43] These include State Implementation Plans required under the Clean Air Act to meet federal air quality standards, California's Scoping Plan Update to meet greenhouse gas emission reductions goals, the Short-Lived Climate Pollutant Reduction Strategy to reduce short-lived climate forcers, and this Action Plan to promote a cleaner, more efficient freight transport system. The *Mobile Source Strategy* outlines ARB's integrated approach to meeting these multiple goals over the next 15 years through a comprehensive suite of

[42] California Transportation Commission, "2010 California Regional Transportation Plan Guidelines," April 7, 2010, http://www.catc.ca.gov/programs/rtp/2010_RTP_Guidelines.pdf, accessed April 11, 2016.

[43] ARB, "Mobile Source Strategy," May 2016, http://www.arb.ca.gov/planning/sip/2016sip/2016mobsrc.pdf, accessed June 16, 2016.

potential actions. In May 2016, ARB also released the Proposed 2016 State Strategy for the State Implementation Plan. The Proposed 2016 State Strategy for the State Implementation Plan will contain the suite of measures that provide the regulatory and programmatic mechanisms necessary to implement the emission reductions needed to meet federal air quality standards.

5. State Implementation Plans (South Coast and San Joaquin Valley)

Areas around the State with poor air quality that do not meet national air quality standards (nonattainment areas) must develop State Implementation Plans to show how the standards will be met. U.S. EPA is required to review the latest health research every five years to ensure standards remain protective of public health. Based on research demonstrating adverse health effects at lower exposure levels, U.S. EPA has recently revised federal standards for ozone and fine particulate matter. State Implementation Plans for meeting these standards are due in 2016. Two areas of the State have the most critical air quality challenges – the South Coast and the San Joaquin Valley. Clean Air Act deadlines will be a driver for the pace of emission reductions needed, especially meeting ozone standards in the South Coast, and fine particulate matter standards in the San Joaquin Valley. Each regional State Implementation Plan that needs emission reductions beyond current control programs will include detailed measures from the State Strategy for the State Implementation Plan to address attainment needs. ARB will consider approval of the regional State Implementation Plans for ozone and fine particulate matter along with the State Strategy for the State Implementation Plan prior to submitting the plans to U.S. EPA. Additional actions identified in this document may also help provide further emission reductions to meet federal air quality standards.

6. Climate Change Scoping Plan

The *Climate Change Scoping Plan* describes how the State intends to meet its greenhouse gas emissions reduction goals of reducing emissions to 1990 levels by 2020, and further reducing emissions to 1990 levels by 2050. The Board considered the first Scoping Plan in 2008 and approved the first update in May 2014.[44] The update identified the need for substantial new actions to move the heavy-duty sector toward zero emissions. ARB will develop the next update, the 2030 Target Scoping Plan, through fall 2016, and will focus on measures to meet the midterm 2030 greenhouse gas emissions reduction target. ARB released a *2030 Target Scoping Plan Concept Paper* on June 17, 2016, to inform the ongoing stakeholder process for how to most effectively achieve a 40 percent reduction in GHG emissions by

[44] ARB, "First Update to the Climate Change Scoping Plan," May 2014, http://www.arb.ca.gov/planning/sip/2016sip/2016mobsrc_dd.pdf, accessed April 11, 2016.

2030 as compared to 1990 statewide GHG emissions.[45] The 2030 Target Scoping Plan will incorporate potential actions from the Action Plan that provide greenhouse gas emissions reduction benefits, and may include development of additional actions related to freight. If ARB identifies additional freight-related actions during this process, they will inform subsequent updates to the Action Plan.

7. Short-Lived Climate Pollutant Reduction Strategy

ARB is required to develop a Short-Lived Climate Pollutant Reduction Strategy under Senate Bill 605 (Lara, Chapter 523, Statutes of 2014). Short-lived climate pollutants are powerful climate forcers that remain in the atmosphere for a much shorter period than longer-lived climate pollutants, such as carbon dioxide. Black carbon, one of the three main types of short-lived climate pollutants, is a component of fine particulate matter emitted by the diesel engines used to move freight. Methane, another short-lived climate pollutant, is the principal component of natural gas. ARB released a *Proposed Short-Lived Climate Pollutant Reduction Strategy* on April 11, 2016, which was presented to the ARB Board in May 2016.[46] Both the Short-Lived Climate Pollutant Reduction Strategy and the Action Plan will inform development of the 2030 Target Scoping Plan.

E. Public Process

This Action Plan was developed with input from a broad group of stakeholders, including, but not limited to, cargo owners, the logistics industry, labor, ports, utilities, business leaders, community and environmental justice organizations, agencies at all levels, and other interested stakeholders in an open and public process. The State agencies sought input on development of the freight targets, potential actions to support progress towards meeting those targets, pilot project ideas, and the approach to assess the economic impacts of the plan through a variety of venues.

As a starting point, the State agencies built on existing stakeholder input and public processes recently completed for their respective freight-related planning efforts. As part of the development process, each of the agencies continued to convene and participate in regular committees, focus groups, individual meetings, and conference calls with stakeholders who were previously engaged in planning efforts. This included each of the State agencies holding numerous meetings and conference calls with individuals and stakeholder groups such as industry associations, environmental groups, California Native American Tribes, and small businesses on specific issues or recommendations.

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[45] ARB, "2030 Target Scoping Plan Concept Paper," June 2016, http://www.arb.ca.gov/cc/scopingplan/document/2030_sp_concept_paper2016.pdf, accessed June 17, 2016.

[46] ARB, "Proposed Short-Lived Climate Pollutant Strategy," April 2016, http://www.arb.ca.gov/cc/shortlived/meetings/04112016/proposedstrategy.pdf, accessed April 11, 2016.

The State agencies also hosted a series of public meetings, regional workshops, and statewide webinars from July 2015 through spring 2016 to solicit input on the development of the Action Plan, as well as help engage audiences beyond the transportation, environmental, and industry interests that were already participating in the State's freight transport efforts. Specifically, the State agencies kicked off the public process at two events. These included a California Freight Advisory Committee meeting on July 28, 2015, where executive representatives from the participating agencies introduced the public to the effort. California Freight Advisory Committee meetings are open to the public. Members of the California Freight Advisory Committee include representatives of seaports, railroads, airports, trucking, shipping, carriers, freight-related associations, freight industry workforce, regional, local, State, and federal agencies, California Native American Tribal governments, environmental organizations, safety organizations, and community organizations. The State agencies hosted a second kick-off event through a webinar on October 1, 2015.

Also in October, the State agencies participated in another public meeting of the California Freight Advisory Committee to share draft targets, discuss a process for evaluating the economic impacts of actions that the agencies would recommend to support those targets, and provide additional information regarding sharing of pilot project ideas with the State agencies.

The State agencies co-hosted public regional workshops and a webinar throughout the State (in Redding, Sacramento, Oakland, Fresno, Modesto, Bakersfield, Monterey, Los Angeles, San Bernardino, El Centro, and San Diego) in January and February 2016. The workshops included discussion of freight system efficiency and zero emission technology targets, preliminary concepts for actions to help make progress toward meeting the targets, initial pilot project ideas, local perspectives on both progress to date, and regional priorities for California's freight transport system. Also in February, the State agencies hosted a public meeting of the California Freight Advisory Committee and a webinar to provide additional opportunities for public engagement.

To maintain improved relationships with tribal governments, Governor Brown issued Executive Order B-10-11 (September 2011), requiring that every State department and agency consult with Native American Tribes before taking action that would impact them. As part of the development process, the State agencies engaged the tribes through meetings of the Native American Advisory Committee in November 2015 and March 2016, as well as by convening three tribal listening sessions in March 2016.

Following the release of the draft Action Plan for public comment on May 3, 2016, State agency staff provided informational updates at public meetings of the California Freight Advisory Committee, California Transportation Commission, and ARB to solicit input. The State agencies also continued to meet with stakeholders to gather additional input and comments on the draft through July 6, 2016.

A broad range of stakeholders representing industry, regional and local government, and community and environmental groups submitted over 85 comments on the draft for consideration. Many of the comments submitted on the draft Action Plan fit into a few major themes, requesting: continued development work between the State and industry partners on data, metrics, and tools to help increase efficiency and competitiveness of the freight transport system; further commitment and prioritization by the State agencies to address localized community and health impacts in the State's infrastructure and regulatory programs; further clarification in the Action Plan on its role and relationship to existing State and regional plans, State funding activities, and regulatory development; as well as consideration of specific partnerships, technologies, and other concepts as the State agencies proceed to develop the identified State agency Actions and supporting implementation steps further. The Action Plan incorporates changes throughout the document and appendices to help address these comments and others, with key additions on:

- Next steps for convening and working with an industry stakeholder workgroup on a suite of metrics to support economic growth and competitiveness.

- Priorities for considering community concerns, with direction to avoid, reduce, or eliminate air toxic hot spots and adverse localized impacts of freight projects on surrounding communities.

- A new task to collaborate with stakeholders on developing a statewide, freight funding strategy to help support investments consistent with the long-term Vision and Guiding Principles presented in this document.

- Next step milestones and engagement opportunities to ensure continuity with our partners on Action Plan implementation.

All written comments received by the State agencies can be viewed at http://www.casustainablefreight.org/.

Following consideration of public comments, as well as Board and Commission direction received, State agency staff made appropriate changes and finalized the document. Moving forward, the State agencies expect to begin implementing the Action Plan over the next five years. Full implementation may extend over several decades as we evaluate and adapt to achieve the Targets and the Vision. Further refinement and implementation will be subject to additional public engagement.

1. Actions

The State agency Actions and implementation steps include data collection, research and analysis, planning, regulation, funding and incentives, advocacy, outreach, and coordination. To the extent feasible, the State agencies considered planning and development timelines, developed associated implementation steps, developed estimates of potential direct costs and benefits, and described impacted

sectors for these Actions in Appendix C. State agency staff will develop each proposal through the applicable public processes, including extensive stakeholder outreach and involvement, workshops, and economic and environmental assessments as appropriate. As the State agency actions identified in this Action Plan are further developed, State agency staff will update and adjust their proposals as necessary to ensure that they reflect any new information, additional analyses, new technologies or other factors that emerge during the process.

2. Pilot Projects

The State agencies will continue work on the pilot project concepts through research, outreach, and actions. For each pilot project concept identified in this Action Plan, the State agencies have identified a lead State agency to act as the liaison for the actions, funding, and progress of the project. The State agency leads for each pilot project concept will initiate research and discussions with potential partners to further define the scope and implementation milestones of the project concepts.

3. Discussion Concepts for Potential Future Action

Further implementation of the discussion concepts the State agencies have identified will depend on identification of private, academic, and other government agency partners. The State agencies will continue to discuss these concepts with potential partners as part of the processes to help further define actionable items.

As the State agencies move forward gathering additional information and developing the Actions, pilot projects, and other Action Plan concepts further, the concepts may change, be adjusted, or new concepts may be added. Implementation of the concepts will also be conditional based on the successful completion of applicable public processes, necessary financing approvals, technical analysis, and economic and environmental reviews. The State agencies anticipate the following implementation milestones.

- Late summer 2016: The State agencies will host meetings of both the competitiveness and efficiency stakeholder workgroups.

- September 2016: The State agencies will discuss Action Plan implementation at a meeting of the California Freight Advisory Committee, and anticipate providing additional periodic updates at future California Freight Advisory Committee meetings.

- By January 2017: The State agencies will work on actions to enact a freight transport funding package and distribute federal Fixing America's Surface Transportation Act funds dedicated to addressing key State and regional improvements to freight corridors in California.

- By January 2017: Initiate work to collaborate with industry, regional and local agencies, and others on developing a statewide funding strategy to help support investments in transportation assets and advanced vehicles and equipment consistent with the long-term Vision and Guiding Principles presented in this document.

- Early 2017: The State agencies will host a meeting of the sustainable freight think tank.

- By July 2017: The State agencies will establish work plans for the workgroups on competitiveness, system efficiency, workforce development, and regulatory and permitting process improvements. For pilot projects, the State agencies will prepare work plans for the three project concepts identifying scope, partners, timelines, and funding options.

- By July 2018: The State agencies anticipate providing a full progress report on Action Plan efforts.

- By 2019: The State agencies will evaluate the Action Plan Targets to determine if adjustments are needed.

- By 2019: Statute requires Caltrans to have completed an update of the 2014 *California Freight Mobility Plan*.

Moving forward, the State agencies will also develop ad hoc groups and hold additional stakeholder meetings as necessary to discuss other issues that develop during the Action Plan implementation process.

Appendix H: Comments Received on the Draft Action Plan

The State agencies released a draft Action Plan for public comment on May 3, 2016, and comments on the draft were collected through July 6, 2016. Over 85 comments were received and reviewed, and can be viewed on the Action Plan website at www.casustainablefreight.org. Below is a list of the organizations that submitted comments:

Agricultural Council of California
Agricultural Energy Consumers Association
Airlines For America
Alameda County Transportation Commission
Almond Alliance of California
American Chemistry Council
American Lung Association in California
American Trucking Associations
Association of American Railroads
Association of California Egg Farmers
Association of Monterey Bay Area Governments
Avocet Infinite Plc (United Kingdom)
Bay Area Air Quality Management District
Bay Planning Coalition
BizFed
BNSF Railway
BYD Motors
California Airports Council
California Association of Nurseries and Garden Centers
California Association of Port Authorities
California Association of Wheat Growers
California Bean Shippers Association
California Business Properties Association
California Business Roundtable
California Chamber of Commerce
California Citrus Mutual
California Cleaner Freight Coalition
California Community Colleges, Advanced Transportation and Renewable Energy Sector
California Cotton Ginners Association
California Cotton Growers Association
California Department of Transportation
California Electric Transportation Coalition
California Farm Bureau Federation
California Fresh Fruit Association
California Grain & Feed Association
California Independent Oil Marketers Association
California League of Food Processors
California Manufacturers and Technology Association
California Natural Gas Vehicle Coalition
California Police Chiefs Association
California Refuse and Recycling Council
California Retailers Association
California Rice Commission
California Seed Association
California State Association of Counties
California State Sheriffs' Association
California State University Maritime
California Teamsters Public Affairs Council
California Transportation Commission
California Trucking Association
California Warehouse Association
CALSTART

Center for Climate Change and Health
Center for Sustainable Energy
Central Coast Coalition
Chemical Industry Council of California
City of Solana Beach
Clean Energy
CleanFleets.net
Coalition for Responsible Transportation
Coalition for Responsible Transportation Priorities
Coast Longshore Division, International Longshore and Warehouse Union
Construction Industry Air Quality Coalition
County of San Diego
Diesel Technology Forum
Endangered Habitats League
Engineering Contractors' Association
EPS Industry Alliance
Far West Equipment Dealers Association
Foreign Trade Association
Fresno Deputy Sheriff's Association
General Electric
Harbor Trucking Association
Home Depot
Inland Empire Economic Partnership
International Longshore and Warehouse Union, Local 13
International Longshore and Warehouse Union, Local 63
International Longshore and Warehouse Union, Local 94
International Safe Transit Association
International Warehouse Logistics Association
League of California Cities
Los Angeles Area Chamber of Commerce
Maersk
Methanol Institute
Metropolitan Transportation Commission
Milk Producers Council
Monterey County Farm Bureau
National Association of Industrial and Office Properties- Southern California Chapter
National Carrier Exchange
National Center for Sustainable Transportation
North River Energy
Northern California Trade Corridors Coalition
Orange County Business Council
Owner-Operator Independent Drivers Association
Pacific Coast Renderers Association
Pacific Gas & Electric
Pacific Merchant Shipping Association
Peace Officers Research Association of California
Placer County Transportation Planning Agency
Port of Hueneme
Port of Long Beach
Port of Los Angeles
Propeller Club of Northern California
RAIL Solution
Riverside County Transportation Commission
Rural Counties Task Force
Sacramento Metropolitan Air Quality Management District
San Diego Association of Governments
San Diego Unified Port District
San Gabriel Valley Economic Partnership
San Joaquin Valley Regional Planning Agencies' Directors' Committee
Siemens Corporation
South Coast Air Quality Management District
Southern California Association of Governments

Southern California Contractors Association
Southern California Gas Company
Target
TransportiCA
Union Pacific Railroad
Volvo Group North America
Walmart Stores Incorporated
West Coast Lumber & Building Materials Association
Western Agricultural Processors Association
Western Growers Association
Western United Dairymen
Western Wood Preservers Institute
YRC Worldwide

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