

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. Establish a sustainable freight think tank to provide foresight into the innovative future of freight transport and identify the transformative technologies, solutions, partnerships, and critical steps for implementation.
6. Convene stakeholders to identify and deploy strategies that consider commercial viability and promote the competitiveness of California's statewide and local freight transport system, develop tools and share data to analyze benefits and impacts of actions, including costs, and develop and implement a quantitative metric to track progress.

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.
9. Develop a process involving the Office of Planning and Research, along with federal, regional and local partners, and industry and environmental stakeholders, to identify regulatory or permitting process improvements to expedite the delivery of projects identified as meeting the objectives of this plan.

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.

The State agencies have identified associated implementation steps for Actions 3, 4, 6, 7, and 8. 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.

Originally, the State agencies planned to develop quantified cost and savings for each of the proposed actions included in the Action Plan and then use that information to model how the Action Plan could influence the behavior of California's economy. This economic analysis would have been conducted by the State agencies and informed by stakeholder and industry input. The analysis would have also been linked to other economic modeling efforts in California, including the estimation of economic impacts of the ARB 2016 Mobile Source Strategy.¹

As the process has unfolded, the State agencies have been able to develop estimates of the costs and savings associated with only some of the implementation steps

¹ Given that these evaluations measure statewide economic impacts, they will not include an assessment of how costs and benefits are distributed amongst the different cargo owners, freight logistics providers, and owners of freight facilities. The potential impacts of these actions on employment, production, personal income and wages, as well as other indicators of economic health in California will be quantified. Consistent with the economic modeling process of regulatory programs, the economic evaluations in these planning programs will also address the potential impacts of the recommended actions on State fiscal costs and investments.

Draft

included in this Draft. Without developing detailed costs and savings for all of the potential actions, the State agencies cannot apply an economic model to the Action Plan.

Should the proposed actions be included in the final 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, and economic and environmental reviews.

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

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.....	C-9
1. Electric Charging Infrastructure for Parked Trucks	C-9
2. Transportation Electrification Planning.....	C-10
3. Regional and Statewide Energy Resource Planning	C-10
4. Hydrogen Fueling Infrastructure	C-11
5. Electric Charging Infrastructure Incentives	C-12
B. Coordination with Local and Regional Partners on Freight Facilities, Siting, Design, and Operations	C-13
1. Freight Transportation and Land Use Coordination	C-13
2. Freight Handbook for Freight Facility Siting, Design, and Operations	C-14
3. Regional Zero Emission Vehicle Readiness Plans	C-15
4. Regional Medium- and Heavy-Duty Zero Emission Vehicle Infrastructure.....	C-16
C. Research Efforts to Support Sustainable Freight Transport System Development.....	C-17
D. Freight Data Collection and Modeling Tool Development to Enhance Knowledge and Planning for Freight Corridor Improvement and State Investments	C-17
E. Highway Freight Network Design, Planning, Maintenance and Operations Improvements.....	C-19
1. Freight Highway System Preservation through Asset Management	C-19
2. Bridge Performance through Asset Management	C-20
3. Pavement Technology	C-21
4. Bottleneck Relief.....	C-22
5. Expand Truck Scale Technology Use	C-23
F. Feasibility Assessment of Developing Dedicated Freight Lanes Along High Capacity Corridors.....	C-24

- G. Inland Facility, Short-haul Rail Shuttle, and Inland Seaports Utilization with Less Impact on Nearby Communities..... C-25
- H. Freight Rail Network Improvements..... C-26
 - 1. Short Line Rail Improvements Through Infrastructure Upgrades and Advanced Technologies..... C-26
 - 2. Freight Rail Efficiencies C-27
 - 3. Freight/Passenger Rail Conflicts..... C-28
 - 4. Positive Train Control..... C-29
- I. Aviation Efficiencies: National Satellite-Based Air Traffic Management System..... C-30
- J. Freight Network Safety Improvements..... C-31
 - 1. Freight Safety Enhancements..... C-31
 - 2. Freight Resiliency and Security Enhancements..... C-32

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 C-34
- B. Cleaner Combustion Truck Standards..... C-36
 - 1. Lower In-Use Emission Performance Level for Heavy-Duty Vehicles..... C-36
 - 2. Innovative Technology Certification Flexibility C-37
 - 3. Medium- and Heavy-Duty Greenhouse Gas Emissions Standards Phase 2..... C-38
 - 4. Low-Nitrogen Oxides Engine Standard..... C-40
- C. Freight Technology and Fuels Data Collection and Analysis C-41
 - 1. Freight Hub Data Collection..... C-41
 - 2. Zero Emission Vehicle Market Forums C-42
- D. Low-Carbon Renewable Fuels Development and Requirements C-43
 - 1. Renewable Electricity Resources C-43
 - 2. Natural Gas Vehicle Research Roadmap C-43

- 3. Assess Inclusion of Aviation, Interstate Locomotive, and Marine Fuels in the Post 2020 Cap-and-Trade Program C-44
- 4. Assess Inclusion of Aviation, Interstate Locomotive, and Marine Fuels in the Post 2020 Low Carbon Fuel Standard Program..... C-45
- 5. Low-Emission Renewable Diesel Fuel Requirement C-46
- E. Vehicle-Grid Integration Technology Research and Technical Assistance C-47
 - 1. Advanced Transportation Electrification Technologies C-47
 - 2. Vehicle-to-Grid Incentive and Funding Programs C-48
- F. Heavy-Duty Zero Emission Vehicle Fueling Infrastructure Research, Development, and Demonstration C-49
 - 1. Medium- and Heavy-Duty Electric Vehicle and Equipment Charging Infrastructure..... C-49
 - 2. Standardize Medium- and Heavy-Duty Vehicle and Equipment Charging Standards and Protocols..... C-49
- G. Oceangoing Vessel Standards and Incentives C-50
 - 1. Tier 4 Vessel Standards..... C-50
 - 2. Incentivize Super Low Emission Efficient Ship Visits C-51
 - 3. At-Berth Regulation Amendments C-52
- H. Zero Emission Freight Vehicle and Equipment Requirements and Incentives..... C-53
 - 1. Last Mile Delivery..... C-53
 - 2. Off-Road Forklift Regulation Phase 1 C-54
 - 3. Airport Ground Support Equipment..... C-55
 - 4. Transport Refrigeration Units Used For Cold Storage C-56
- I. Stricter National Locomotive Emission Standards and Remanufacture Requirements C-57
- J. Further Deployment of Cleaner Technologies Through Regulations, Partnerships, and Incentives..... C-58
 - 1. On-Road Heavy-Duty Vehicles C-58
 - 2. Off-Road Federal and International Sources C-59
 - 3. Off-Road Equipment C-60

- K. Partnership with Seaports to Advance Freight Vehicle and Equipment
Technology Demonstrations C-61
 - 1. Seaport Electrification Demonstration Projects C-61
 - 2. Terminal Cost-Sharing C-61
 - 3. Opportunities to Coordinate with Department of Defense..... C-62
- L. Outreach and Advocacy to Increase Awareness of Advanced Vehicle and
Equipment Technologies and Clean Energy Generation Options for Freight... C-63
 - 1. Freight Fleets C-63
 - 2. International Partners..... C-63

ACTION 6: Convene stakeholders to identify and deploy strategies that consider commercial viability and promote the competitiveness of California’s statewide and local freight transport system, develop tools and share data to analyze benefits and impacts of actions, including costs, and develop and implement a quantitative metric to track progress.

- A. Competitiveness Data Development..... C-65
- B. Marketing Campaign for California’s Freight Transportation System C-66

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 C-67
 - 1. Truck Platooning C-67
 - 2. Truck Route Designation C-68
 - 3. Compatible Roadway Design..... C-69
 - 4. Truck Parking..... C-70
 - 5. Drayage Truck Optimization C-72
 - 6. Freight Corridor Traffic Management..... C-73
- B. Freight Intelligent Transportation Systems Enhancements..... C-74
- C. Off-Hour Delivery/Pick-Up Strategy Development C-75
- D. Cross-Jurisdictional Information Sharing C-76

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.

A. Regional Workforce Development Initiatives C-78

B. Training Models C-79

C. Community Workforce Agreements C-79

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. Multiply those numbers by the number of stations per corridor and one

would have a very rough cost approximation. 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

²U.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: Because these proposed activities consist of unknown future actions, estimated costs are not identified at this time.

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: The Alternative and Renewable Fuel and Vehicle Technology Program will provide up to \$100 million per year for projects that will transform California's fuel and vehicle types to help attain the State's climate change policies and develop and deploy technology and alternative and renewable fuels in the marketplace.

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 freight improvement decision-making.
- 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 building energy 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 policy and decision-making at the local level.
- Working with regional agencies to determine actions needed to integrate freight into the policy process at the regional level.
- 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. Data creates the foundation for informed decisions and is essential for good freight transport system development planning and critical analysis. However, many data gaps exist. In particular, there is an increasing need for private sector freight data that does not compromise proprietary rights.

In addition, need exists for new data to support development of intelligent transportation systems applications that can enable increased coordination amongst truck drivers, cargo owners, marine terminal operators, etc. 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 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

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.

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 programmed 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

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.

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.

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.

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

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>.

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. 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

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.

⁸ Cambridge Systematics, "The Role of Rail in Achieving Freight Efficiency Goals", December 2015.

- 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 and near-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 and near-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 only agree to share trackage with passenger service when it is viable with their operations. 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. Burlington Northern Santa Fe Railway estimates their 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.

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.

⁹ Cambridge Systematics, "The Role of Rail in Achieving Freight Efficiency Goals", December 2015.

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: The Alternative and Renewable Fuel and Vehicle Technology Program will provide up to \$100 million per year for projects that will transform California's fuel and vehicle types to help attain the State's climate change policies, and develop and deploy technology and alternative and renewable fuels in the marketplace.

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 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.

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 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 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/2016mobsr.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 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. EPA

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. EPA 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 late 2016 or early 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/2016mobsr.htm> and <http://www.arb.ca.gov/planning/sip/sip.htm>.

4. Low-Nitrogen Oxides Engine Standard

Overview: Significant 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 U.S. EPA to establish new federal emission standards for heavy-duty engines.

Implementing Agency: ARB and U.S. EPA

Type of Action: Regulation and petition

Timing:

ARB petition to U.S. EPA:	2016
U.S. EPA 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 U.S. EPA in 2016 to establish new federal heavy-duty engine emission standards. If U.S. EPA 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 U.S. EPA 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 U.S. EPA 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/2016mobsrsrc.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, or other approaches to increase efficiency, reduce emissions, and further reduce health risks.

Implementing Agency: ARB

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 Renewable Diesel Fuel 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 renewable 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 standard low-emission renewable 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 renewable 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 renewable 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 renewable 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/2016mobsr.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 they 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. EPA, U.S. Coast Guard, 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.

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/2016mobsr.htm> and <http://www.arb.ca.gov/planning/sip/sip.htm>.

2. Incentivize Super 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 Super-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 Super-Low Emission Efficient Ship, targeting nitrogen oxides, diesel particulate matter, greenhouse gas, and sulfur oxide emissions. 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 Super-Low 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 auxiliary engines at-berth. 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. The initial ramp up of zero emission trucks will consider the ability of the new technology to meet the operational needs of the users

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/2016mobsr.htm> and <http://www.arb.ca.gov/planning/sip/sip.htm>.

2. 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 forklifts with lift capacities equal to or less than 8,000 pounds. 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/2016mobsr.htm> and <http://www.arb.ca.gov/planning/sip/sip.htm>.

3. 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.

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/2016mobsrsrc.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 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. Compliance options include the use of commercially available hybrid electric transport refrigeration units, transport refrigeration units equipped with electric standby motors, and cryogenic transport refrigeration systems. Use of zero emission all-electric plug-in transport refrigeration systems, hydrogen fuel cell transport refrigeration, and cryogenic transport refrigeration would be encouraged, as well as adequately-sized cold storage facilities, and more efficient appointment scheduling.

ARB staff anticipate bringing this measure to the Board between 2017 and 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/2016mobsrsrc.htm> and <http://www.arb.ca.gov/planning/sip/sip.htm>.

I. Stricter National Locomotive Emission Standards and Remanufacture Requirements

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. EPA to promulgate by 2020 new Tier 5 national locomotive emission standards and more stringent national requirements for remanufactured locomotives to achieve reductions in criteria and toxic pollutants, and greenhouse gas emissions.

Implementing Agency: ARB and U.S. EPA

Type of Action: Petition to U.S. EPA for federal action

Timing:

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

Proposed Actions: ARB would petition U.S. EPA for new Tier 5 national locomotive emission standards for significant additional reductions in criteria and toxic pollutants and greenhouse gas emissions (based on after treatment, liquefied natural gas, and/or zero emission track miles). 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. EPA could require manufacturers to implement the remanufactured locomotive emission regulations as early as 2023, and new locomotive emission regulations by as early as 2025.

ARB staff anticipate petitioning U.S. EPA 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/2016mobsr.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.
- Additional expansion and enhancement of 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 equipment.
- Additional regulatory mechanisms to require zero emission vehicles in applications, beyond transit buses, airport shuttles, and last mile delivery.
- Support for additional demonstration 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/2016mobsrsrc.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: ARB will develop a suite of additional actions that targets 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. EPA, 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/2016mobsrsrc.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: ARB 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 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.
- Support for development and demonstration 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 this action, 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 6: Convene stakeholders to identify and deploy strategies that consider commercial viability and promote the competitiveness of California's statewide and local freight transport system, develop tools and share data to analyze benefits and impacts of actions, including costs, and develop and implement a quantitative metric to track progress.

A. Competitiveness Data Development

Overview: There is a need for data and information to support the freight transportation system's competitiveness. The type of information needed includes a 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 on a regional scale.

Implementing Agency: GO-Biz

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

Timing:

Agency Development Work: 2016+
Implementation: 2017+

Proposed Actions: Go-Biz will convene necessary private and public sector partners to further assess freight transport system competitiveness data needs. Strategies may include:

- Developing a quantitative metric to measure and track State freight industry competitiveness.
- Providing for consideration, necessary details to complete an economic analysis of the costs and benefits of State actions under development, including identifying the costs for potential stranded assets.
- 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 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. 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, outreach, 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.¹³ 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).¹⁴ 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

¹³ Thomas O'Brien, "White Paper: Operational Modernization at Distribution Hubs", Freight Efficiency Strategies Development Group, February 2016.

¹⁴ 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.¹⁵

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 capacity increases are possible if safe movement of larger/heavier vehicles were feasible—perhaps only along some key corridors.

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 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.

¹⁵ 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.
- Identifying freight corridors where there may be significant gains in efficiency if overweight loads were allowed.
- 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.¹⁶ 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

¹⁶ 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.

exacerbated the parking issue. The federal hours of services rule requires drivers to stop driving to rest. Some drivers face the dilemma of illegally 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).¹⁷

¹⁷ 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. Caltrans will leverage funds to implement deployment of drayage optimization.

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.¹⁸

¹⁸ 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.

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.¹⁹

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

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.²⁰

¹⁹ Gen Giuliano, et al, “White Paper: Information Technology”, Freight Efficiency Strategy Development Group - IT Working Group, January 2016.

²⁰ Washington State Department of Transportation, “Freight Mobility Joint Report on Washington State Freight Highway and Rail Projects”, September 2008.

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.²¹ 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 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 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

²¹ Mid-Ohio Regional Planning Commission, "Advanced Traveler Information System Study: Task 3 Findings", May 2009.

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 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 would increase to \$69.17 per 20 foot equivalent unit and \$133 per 40 foot container.²²

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, more predictable transit time, and improved air and environmental quality. 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 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 participants.

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

²² 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.

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.

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.

Draft

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.