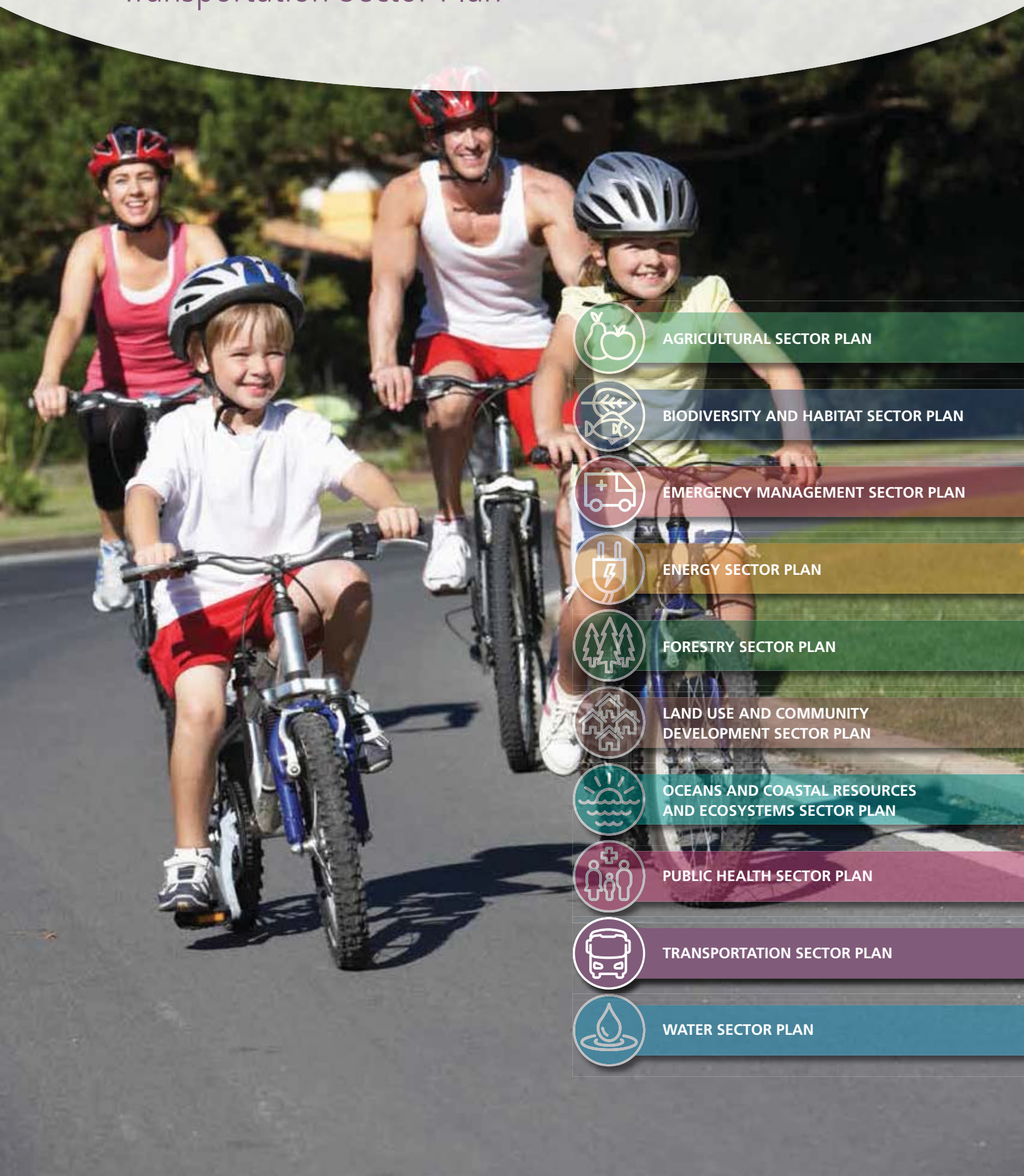
Transportation Sector Plan



- AGRICULTURAL SECTOR PLAN
- BIODIVERSITY AND HABITAT SECTOR PLAN
- EMERGENCY MANAGEMENT SECTOR PLAN
- ENERGY SECTOR PLAN
- FORESTRY SECTOR PLAN
- LAND USE AND COMMUNITY DEVELOPMENT SECTOR PLAN
- OCEANS AND COASTAL RESOURCES AND ECOSYSTEMS SECTOR PLAN
- PUBLIC HEALTH SECTOR PLAN
- TRANSPORTATION SECTOR PLAN
- WATER SECTOR PLAN

Transportation Sector Plan

Introduction

California's residents rely on a robust multi-modal transportation system to gain access to destinations, goods, and services, but the ongoing and inevitable effects of climate change present challenges to managing the productive networks the state depends on. California state government owns and maintains central components of this complex and crucial system. The State's Department of Transportation (Caltrans) owns and operates 50,000 miles of roads and three of the busiest intercity rail lines in the country. The High-Speed Rail Authority has started construction on an 800-mile system that will link major metropolitan regions by 2030. The State also provides critical assistance and funding to support the 140,000 miles of roads, 500 transit systems, 245 public-use airports, and 11 major ports owned and maintained by local and regional governments.

California also relies on many airports, seaports, and pipelines owned by the private sector. While much of the transportation sector's physical infrastructure is publicly-owned, vehicles and the freight they carry rely nearly completely on the private sector. Thus, at each stage of adaptation planning, coordination across modes of travel, as well as between the public and private sector, is imperative.

The state's climate adaptation strategy, which was updated in July 2014 with the document *Safeguarding California: Reducing Climate Risk (Safeguarding California)*, details several recommended actions to enhance the state's transportation system's resiliency to climate impacts and and improve its ability its ability to provide access to places, goods, and services. This implementation plan builds on the foundation provided by *Safeguarding California* by describing climate-related vulnerabilities of the transportation sector, outlining current activities, identifying next steps, and proposing monitoring and evaluation metrics.

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Vulnerability Assessment

This overview of the future impacts that face the state's transportation infrastructure highlights the ways that government agencies are proactively moving to assess the effects of climate change. California's transportation infrastructure is increasingly vulnerable to climate change impacts such as sea level rise, flooding, erosion, extreme heat, extreme storm events, land subsidence, and energy and fuel disruptions, so careful study is needed to plan and prepare for these impacts, which can be categorized under three broad categories:

INCREASED TEMPERATURES AND EXTREME EVENTS

Rising global temperatures are projected to continue rising throughout the rest of the century even if greenhouse gas emissions are sharply curbed compelling transportation managers to understand the effects of heat on transportation infrastructure. Climate projections for California show that the rise in temperatures will be accompanied by more extreme hot days and prolonged heat waves as well (*Indicators of Climate Change in California*, OEHHA, 2013). In fact, by the end of the century the number of days with temperatures over 95°F will likely double or even triple (Rogers et. al. 2015).

While precise costs related to heat stresses on infrastructure are still unknown, many impacts of climate effects can already be estimated. Extreme heat events cause road surfaces to expand, creating pressure that leads to the pavement buckling. Asphalt pavements under higher temperatures typically age faster and develop ruts from wheel loads, while the expansion joints on bridges and highways also suffer stress. Railroad tracks are more likely to buckle under higher temperatures as well (Schwarz et. al. 2014).

While current maintenance costs have proven to outstrip current allocated funds, climate change will certainly lead to greater infrastructure repair needs, especially if adaptive measures are not taken.

PRECIPITATION CHANGES AND EXTREME EVENTS

While California currently suffers from a historic drought that scientists have linked to anthropogenic climate change, climate impacts on transportation could also implicate the other side of changing precipitation patterns: heavier rainfall and extreme winter storms (Williams et. al. 2015). Flooding, landslides, and drought-related impacts could all have profound economic and public safety impacts on California's transportation system.

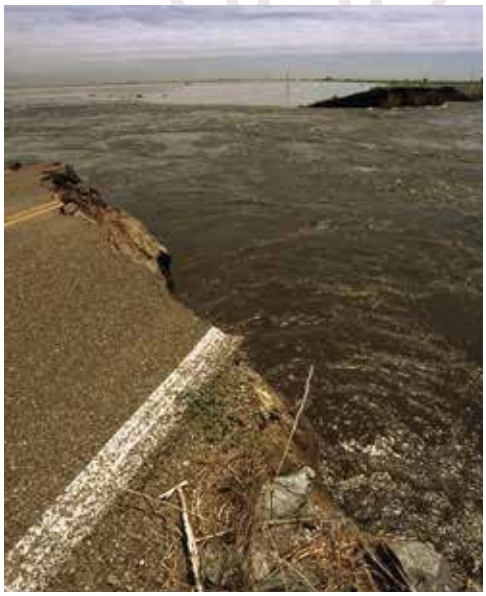
The primary perils to roads by flooding are landslides and erosion that wash them away as well

as inundation that prohibits passage. A study by the United States Geological Survey found that a single extreme winter storm could cause all traffic to be cut off to Los Angeles from the north and east for 1 to 2 weeks, while Sacramento would be cut off from the north, south, and west for around 1 week. Some parts of the state would have to wait for at least one year for complete recovery (Porter et. al. 2011).

Increased wildfire risk—which is leading to more frequent, more intense, and larger wildfires—is related to rising temperatures and changing precipitation events. Heavy rainfall following the effects of drought and wildfire can lead to increased erosion and landslides, leading to extremely costly destruction to transportation infrastructure and the people who use it.

SEA-LEVEL RISE AND EXTREME EVENTS

Sea-level rise (SLR) will result from ongoing climate change even if greenhouse gas emissions are drastically reduced, driven primarily by melting polar land ice and the expansion of the world's oceans as they warm. Rising sea-levels will result in inundation of low-lying areas and their roads, but the complex climate-related interplay of SLR, coastal erosion, and more extreme storm events in coastal areas are likely to cause more sudden and risky impacts. A 100-year coastal storm event combined with the 1.4 meter sea-level rise that could be seen by the end of the century would leave 250 miles of highways, 1,500 miles of roads, and 110 miles of railways vulnerable to flooding—a drastic increase from current coastal flood-prone infrastructure (Heberger et. al. 2009).



The primary perils to roads by flooding are landslides and erosion that wash them away as well as inundation that prohibits passage.

These vulnerabilities are extensive and complex and require coordination and planning. During emergencies, a safe and dependable network of airports, roads, transit, bicycle and pedestrian paths are necessary for evacuations. A comprehensive vulnerability assessment of California's transportation assets – and how to redesign and prioritize more resilient infrastructure moving forward – is needed to safeguard Californians from natural disasters and other emergencies. Mobility needs of communities with limited transportation options is a measurement of vulnerability to climate change. Populations without cars and without access to reliable public transit are less likely to find safety in the event of a climate disaster; such was the case during Hurricane Katrina and Super Storm Sandy. As California experiences more extreme hot days and prolonged heat waves, those neighborhoods experiencing the heat island effect will be hit first and worst without adequate options for affordable mobility.[44]

[44] https://dornsife.usc.edu/assets/sites/242/docs/The_Climate_Gap_Full_Report_FINAL.pdf

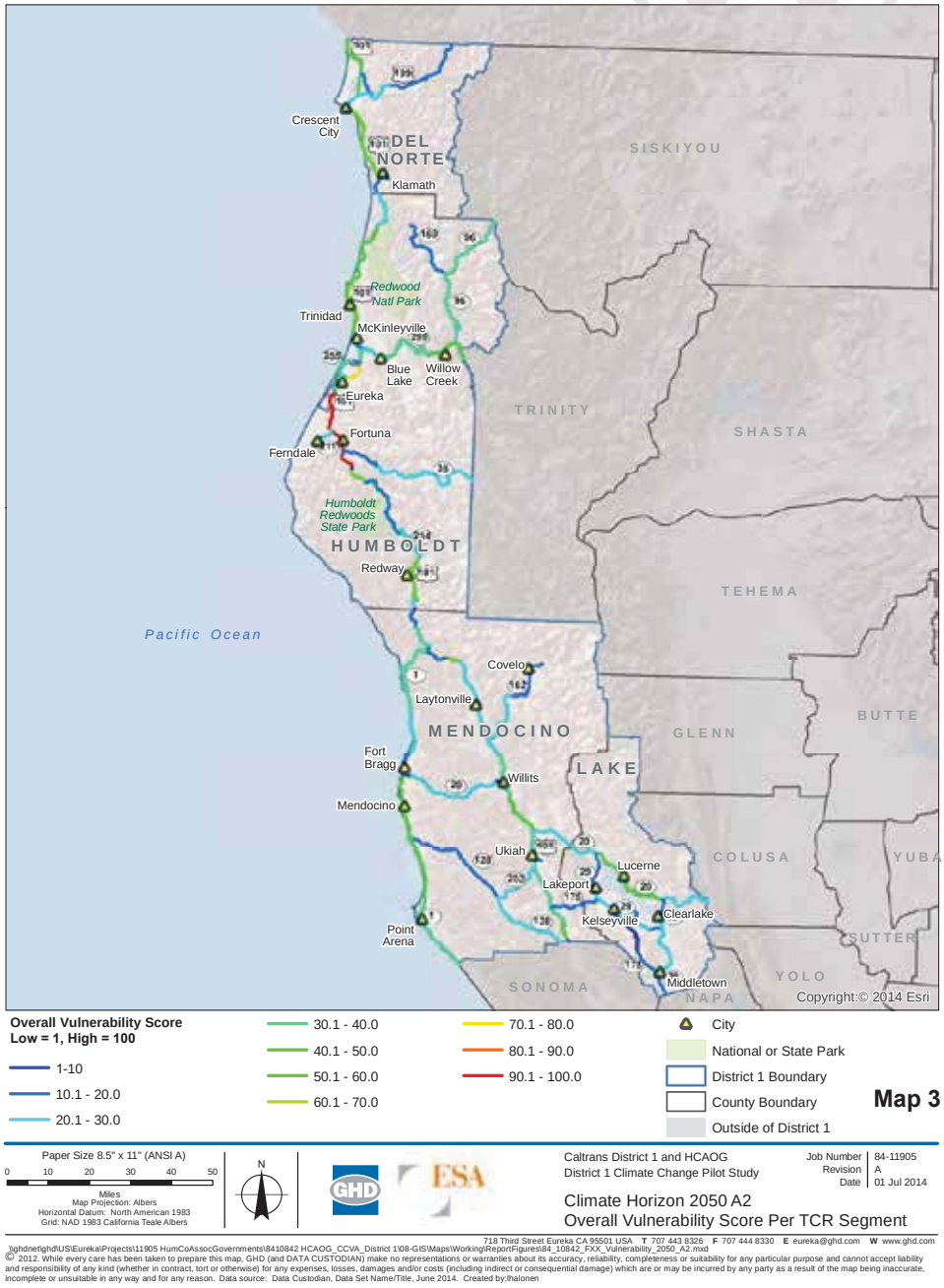
The departments in California government responsible for elements of the state's transportation system are on their way to understanding and addressing these crucial issues.

STATE EFFORTS TO ADAPT TO CLIMATE CHANGE

Caltrans

Caltrans is currently conducting a vulnerability assessment of the State Highway System infrastructure to impacts due to climate change and extreme weather events. The assessments will be conducted in each of the 12 Caltrans Districts, and completed by 2017.

District 1 Vulnerability Assessment (the north-west corner of the State) was the first to be completed in 2014. This assessment inventoried and analyzed over 16,000 Caltrans assets against years 2050 and 2100 climate change scenarios. Ninety-three road segments representing almost 980 miles were ranked for vulnerability using weighting and scoring criteria.



Roads were evaluated based on a number of factors, including "criticality" or the relative importance of a facility considering Criticality Scoring Factors, which include:

- the degree to which a facility provides socioeconomic functions (e.g. access to major employment centers or business districts)
- use and operational characteristics (e.g. average daily traffic or functional classification)
- health and safety functions (e.g. access to medical facilities or evacuation routes)
- replacement costs (e.g. number of large bridges or length/width of highway segment)
- degree of redundancy (i.e. parallel assets that can provide similar functions)

A vulnerability map was created and each road evaluated. Adaptation strategies explored include "defend," "accommodate," "retreat" and policy changes (see Table 1).

Three primary actions identified to build on the results of this District 1 study were: 1) enhanced collaboration with other local and state agencies, 2) updating design and maintenance policies, and 3) more site-specific risk analyses.

Expanding this model to the rest of the state places California on the cutting-edge of assessing transportation infrastructure vulnerabilities. A sub-consultant for the vulnerability assessments is a team of climatologists who are further performing downscaling of Global Climate Models to develop cutting edge climate projections at a regional level. As appropriate, they are utilizing the same data sources as Cal-Adapt.

Table 1: CalTransAdaptation Option Categories Developed from District 1 Vulnerability Assessment

APPROACH	ADAPTATION OPTION
Defend	Provide major structural protection Provide protection at existing elevations/locations
Accommodate	Elevate the infrastructure above the impact zone Enhance drainage to minimize closure time and/or deterioration levels
Retreat	Abandon infrastructure Relocate infrastructure (horizontally) Temporarily restrict use of infrastructure
Changes in policies or practices	Increase the infrastructure's maintenance and inspection interval and continue to monitor/evaluate Modify land use and development policies to account for future impacts

High-Speed Rail Authority

The High-Speed Rail Authority (HSRA) has completed an identification of potential climate issues of relevance to the future system infrastructure. During 2015-2016, the HSRA will continue with a more detailed vulnerability assessment and integration of life-cycle cost adaptation measures into design, as well as into operations and maintenance as delivery progresses.

California Highway Patrol

The California Highway Patrol (CHP) participates in two of the Governor's Office of Emergency Services (CalOES) California Emergency Function meetings monthly: 1) Transportation and 2) Resources. The Transportation Emergency

Function supports the coordination of transportation across various modes, including surface, maritime, railroad, aviation, and pipelines – and is tasked with monitoring and reporting the status of damage to the transportation system during an emergency. The Resources Emergency Function is charged with identifying, acquiring, allocating and tracking state and private sector resources that can be utilized during an emergency.

Regional and Local Transportation Agencies

In addition to state departments, regional transportation agencies have adopted climate action plans or are leading vulnerability assessments, such as the Bay Area's Adapting to Rising Tides and Climate Change & the Future of Southern California. Regional entities receive federal and state formula funds for the development of their regional transportation plans. Caltrans' sustainable planning grant program further supports regional and local entities in adaptation planning. HSRA's station-area grants to jurisdictions along the network also support planning climate resilient communities. Some local governments are also studying adaptation options to address their vulnerabilities. For example, Marin County has identified their assets vulnerable to sea level rise, and is creating an adaptation plan. The Alliance of Regional Collaboratives for Climate Adaptation (ARCCA) is compiling lists of local and regional adaptation efforts, and has a focus on transportation in 2016.

National and International Collaboration

California further collaborates with US federal government agencies and international entities to gain information, tools, and lessons learned from elsewhere that will provide efficiencies in meeting climate change challenges in California. For example, Gulf Coast conducted studies and utilized tools developed by the FHWA. The Dutch Rijkwaterstaat (Ministry of Infrastructure and the Environment), where 20% of the territory is below average sea level, has extensive experience with sea-level challenges and extreme events. For example, the 1953 North Sea flood and storm surge killed nearly 2,000 people and caused widespread damage in the Netherlands. Other European member countries also are preparing for impacts from climate change that might benefit California.

Current Actions to Prepare for Climate Impacts

Safeguarding California lays out five primary recommended actions to move towards a more resilient and adaptive transportation system: 1) Understand Climate Trends that Impact Transportation, 2) Improve Transportation System Reliability, 3) Further Enable Incorporation of Anticipated Climate Impacts in Transportation Plans, 4)

Inform Transportation Planning, and 5) Information Sharing and Education. Together, these recommendations create a framework for understanding the State's progress in making transportation systems more resilient to climate change.

At Caltrans, the High-Speed Rail Authority, and the California Highway Patrol, many actions are being taken that build adaptive capacity and promote resilience against climate effects in the transportation sector. These actions are presented here.

1. UNDERSTAND CLIMATE TRENDS THAT IMPACT TRANSPORTATION

Using the best available climate science gives decision-makers actionable information to help plan the transportation infrastructure of the future, but those future systems will also certainly evolve in a myriad of ways due to California's world-renowned innovation and entrepreneurship. Adaptation policy must be forward-looking to anticipate the unknowns and uncertainties that might affect transportation.

For example, anticipating how emerging technologies can transform transportation over the next century can allow for better adaptation options in both the energy and transportation sector. Caltrans is engaged in helping spur innovation and implementation of clean vehicle technology. This effort will make mobility in California less dependent on volatile fossil fuels, have important public health and air quality benefits, and promote the integration of renewable energy sources into the grid; Caltrans is ensuring that these key goals for climate adaptation are paired with infrastructure that is itself resilient to climate change.

Anticipating how emerging technologies can transform transportation over the next century can allow for better adaptation options in both the energy and transportation sector.

Safeguarding California also highlights land subsidence issues as a critical trend to understand, as increasing subsidence from heightened groundwater use during the current drought has emphasized. The High-Speed Rail Authority is following up an initial literature review of subsidence issues in the Central Valley with further study carried out with the United States Geological Survey. Caltrans is also partnering with other state agencies on CalEPA's mapping of urban heat island index for California.

While future technological advances and geophysical phenomena are hard to predict, it is important to ensure that the studies on the trends of tomorrow—like driverless cars and a changing physical environment—are incorporated into a holistic effort to transform transportation systems.

2. IMPROVE TRANSPORTATION SYSTEM RELIABILITY

Action is needed to translate vulnerability assessments into reasoned, validated, cost-effective and environmentally-sound actions that reduce climate-related risks. Much of this work is already underway.

Through various programs, Caltrans is investing in transportation modes that reduce fuel dependency and serve disadvantaged communities in a changing climate, including an annual investment of over $120M for Active Transportation Program projects to increase biking and walking. Through the GHG Reduction Fund (GGRF), Caltrans invested in Low Carbon Transit Operations Program (LCTOP) expenditures of over $22M in 2015. These investments target state of the art improvements; examples include:

- **Expanded Service for the 38-R Geary and 44-O'Shaughnessy Lines:** $2,592,022 to the San Francisco Municipal Transportation Agency to expand transit service and make transit more convenient and comfortable for customers across San Francisco, including those living in nearby or adjacent disadvantaged communities
- **Perris Valley Line Feeder Bus Service – Operating Assistance:** $460,410 to the Riverside Transit Agency to implement feeder bus service for seamless transfers between bus and commuter rail and the Metrolink service in the cities of Perris, Moreno Valley and Riverside.
- **Fresno Area Express System Capacity Increasing Tripper Service:** $249,311 to the City of Fresno Department of Transportation to help Fresno Area Express (FAX) expand bus service via tripper services to relieve overcrowding on key routes during peak service periods.

Caltrans further provides staff support for other GGRF transportation related program investments, including the Strategic Growth Council's Affordable Housing and Sustainable Communities (AHSC) and CalSTA's Transit and Intercity Rail Capital Program (TIRCP). These investments totaled nearly $350M in 2015.

Caltrans is making an annual investment of over **$120M** for projects to increase biking and walking.

Caltrans is also working with ARB, CEC, GO-Biz, and others to comply with Governor Brown's Executive Order B-32-15 by developing an action plan to meet a goal of zero and near zero emissions freight system that is more resilient to the effects of climate change. Both industry leaders and the California Freight Advisory Committee (CFAC) are providing input to Caltrans on methods to achieve efficiencies that will be included into the action plan. Caltrans has set an internal sustainability goal of 10% increase in freight system efficiency by 2020.

In some transportation infrastructure projects, Caltrans is incorporating natural systems such as allowing for tidal flow and facilitating wildlife connectivity. [EXAMPLE]

Regarding its own internal operations, Caltrans is greening its own vehicle fleet to reduce dependency on volatile fuel sources and improve fuel availability. Likewise, it is using state of the art LEDs in street lighting and facilities to reduce energy dependency and has undertaken widespread retrofitting efforts to replace incandescent bulbs.

Caltrans/CHP Emergency Preparedness

Caltrans co-leads the Governor's Office Emergency Function for Transportation with California Highway Patrol and participates in emergency management-related exercises. Through this Function, Caltrans identifies emergency supply chains to ensure crucial supplies will not be cut off from impacted areas in emergencies, establishes redundant emergency communications systems to improve the resilience of emergency communications infrastructure, and provides transportation management centers to coordinate responses with local and federal partners. Caltrans further broadcasts public information through changeable message signs and highway advisory radio. Finally, 800 Caltrans engineers are on-call 24/7 to assess State and local infrastructure in emergencies.

High-Speed Rail Authority

The HSRA is responsible for the development and delivery of a high-speed rail system connecting the mega-regions of the state. Construction of the first segments is underway in the Central Valley, and initial operation is scheduled for 2022. High-speed rail is the backbone of electrified transportation in California, and contributes to a resilient transportation network by shifting trips from fossil-fuel dependent modes, while reducing dependency on highways and airport for long-distance trips.

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To address fuel reliability, the High-Speed Rail is committed to procuring 100% of electricity for operations from renewable sources and is working with utilities to complete studies and initiate upgrades transmission network to serve the rail.

High-Speed Rail has set net-zero energy performance criteria for station facilities and, as a means of exploring redundancy, is working with station communities on net energy positive opportunities, where feasible. High-Speed Rail also requires life-cycle analysis in design-build procurement documents, and is exploring logical ways to require bidders to address resilience as a component of design-life and safety considerations.

3. INCORPORATE CLIMATE IMPACTS IN TRANSPORTATION PLANS

Caltrans seeks to incorporate climate resilience into all long-range system planning activities, including the California Transportation Plan 2040

to be completed by end of 2015. This federally required 25-year Plan provides a policy framework to meet transportation needs and reduced greenhouse gas emissions. The CTP defines goals, performance-based policies, and strategies to achieve a collective vision for California's future statewide, integrated, multimodal transportation system. Caltrans Strategic Management Plan 2015 calls for completing 25 sustainable, multi-modal corridor masterplans that include climate resiliency components by 2020.

In partnership with OPR and the Department of Finance, the Transportation Agency is helping re-frame the State's Five-Year Infrastructure Plan to include climate resilience considerations into all new transportation investments.

4. INFORM TRANSPORTATION PLANNING

The vulnerability assessments underway at Caltrans are crucial steps in making the state's transportation sector more resilient to climate change. This action is a central element of a broader effort underway at Caltrans to better understand and plan for climate impacts.

Caltrans is undertaking a statewide vulnerability assessment to be complete by 2017. Drawing from the findings of the assessments, Caltrans is considering how to include climate adaptation strategies into planning and design documents. Caltrans depends on other state and national agencies studies to adjust Caltrans' design and construction activities. For example, the Caltrans "Sea Level Rise Guidance" is based on sea level rise projections from CO-CAT and will be updated with the estimates from the National Research Council's Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future. Similarly, Caltrans refers to the Federal Emergency Management Agency to adjust assumptions in federal flood plain maps.

Caltrans' new Strategic Management Plan 2015 calls for the development of a resiliency score taking into account climate change impacts. Work is underway to define the score and expected to be completed by end of 2017. Caltrans supports national Transportation Research Board research related to climate change and is utilizing simulation tools (such as ShakeCast) to integrate big data and predictive capabilities to prioritize recovery efforts.

5. INFORMATION SHARING AND EDUCATION

Both Caltrans and HSRA are implementing climate change information and education with partners.

In March 2015, CalTrans hosted a workshop with transportation stakeholders throughout the state on "Enhancing the Climate Change Resiliency of California's Transportation System"

With the Office of Emergency Services, Caltrans is developing a Guidance Plan for Emergency Management and Infrastructure Protection, including climate impacts, and supports the State Hazard Mitigation Plan.

The High-Speed Rail Authority requires contractor education to ensure climate adaptation and resilience knowledge.

Next Steps

While ongoing efforts to build resilience into California's transportation sector through innovative climate adaptation initiatives are far-reaching, there is a need for more coordinated and comprehensive action, especially among state government entities. *Safeguarding California* recommended convening an interagency task force on reducing risks to California transportation, and next steps to continue the implementation of California's adaptation strategy will be channeled through this new group as it is formed.

In early 2016, the California Transportation Agency (CalSTAwill convene a cross-departmental Transportation Sector Adaptation Team to address climate impacts. The proposed members of this group are:

- Caltrans
- High-Speed Rail Authority
- California Highway Patrol
- California Air Resources Board (ARB)
- California Department of Forestry and Fire Protection (CAL FIRE)
- California Energy Commission (CEC)
- California Natural Resources Agency (CNRA)
- California Public Utilities Commission (CPUC)
- Governor's Office of Planning and Research (OPR)
- Ocean Protection Council (OPC)
- State Lands Commission (SLC)
- Strategic Growth Council (SGC)

The Transportation Sector Adaptation Team will tackle the key next steps through a work plan that prioritizes certain actions under each of the five recommendations presented in *Safeguarding California*. An outline of the proposed work plan is detailed here:

1. UNDERSTAND CLIMATE TRENDS THAT IMPACT TRANSPORTATION

- Identify increased role of clean transportation networks, including clean cars, transit, biking, and walking in reducing fuel dependency, connecting communities, and providing equitable evacuation routes. (2016)
- Identify how fish and wildlife connectivity across the transportation system may shift as climate changes and incorporate findings into California Essential Habitat Connectivity Project: A Strategy for Conserving a Connected California. Identify actions to preserve habitat connectivity and reduce fragmentation, including retrofitting existing transportation infrastructure that are current barriers to migration.

2. IMPROVE TRANSPORTATION SYSTEM RELIABILITY

- Enhance emergency preparedness during climate events for all transportation modes, particularly for disadvantaged communities who are less likely to own cars. (2016)
- Utilize information from vulnerability assessments and other data to inform new policies and practice of transportation:
  - **Planning** – resiliency in multi-modal corridor planning
  - **Funding** – long-term life-cycle cost-benefit analysis in project selection, including anticipated climate impacts and accounting for ecosystem service and habitat benefits provided by natural solutions
  - **Project Design** – multi-modal access to destinations, natural system enhancements
  - **Materials** – cost-effective and climate-adaptive materials
  - **Contracting** – resiliency strategies in all design and construction contracts
  - **Project Delivery** – efficient and clean construction
- Scale vulnerability criticality factors and scoring statewide and establish consistency for application at a project level to prioritize investment funding and integrate with asset management
- Ensure vulnerability assessments are followed by development of adaptation plans
- Integrate local and regional vulnerability assessments and adaptation plans with the State's vulnerability assessments and adaptation plans, through partnering with organizations such as the Alliance of Regional Collaboratives for Climate Adaptation
- Integrate "big data" and shared geospatial information to better assess impacts of the State, regional and local transportation adaptation plans to automate and modernize information that can be assessed across sectors

3. INCORPORATE CLIMATE IMPACTS IN TRANSPORTATION PLANS

- Provide grant funding to regional governments as part of Regional Transportation Plans (2016)

4. INFORM TRANSPORTATION PLANNING

- Continue improving Cal-Adapt and support research to complete downscaling of climate projections (2016)
- Analyze the vulnerability of fuel and electricity networks
- Analyze the vulnerability of projects on the Primary Freight Network (ports, airports, highway, etc.)
- Develop a transportation "hot-spot" map to identify where the mixture of climate impacts, population increases, transportation demand

and demographics make communities most vulnerable to climate change impacts (2017)

- Complete economic assessment for projecting climate impacts on state's transportation system, and integrate into benefit-cost project analysis (2017)
- Complete all Caltrans districts detailed vulnerability assessments (2017)

5. INFORMATION SHARING AND EDUCATION

- Establish statewide comprehensive GIS and data manager to ensure all state agencies are using the same data and reports/studies are consistent
- Convene climate adaptation educational forums with academia and partners
- Encourage collaboration between state, regional, and local adaptation efforts
- Create climate change transportation blog for agency interaction and skill sharing
  - o Include space for any agency to post new documents, videos, or comments

To achieve these ambitious goals, the first steps for the California State Transportation Agency (CalSTA) will be to carry out the following:

- o Formation of a steering committee
- o Steering committee elected
- o Meeting schedule agreement
- o Regular reporting

Monitoring and Evaluation

Tracking the efficacy of state efforts will be crucial to successfully continuing to adapt to intensifying climate impacts. The following metrics could help monitor the status of state efforts and how well they are contributing to a more resilient transportation system.

Metrics to evaluate the progress of state adaptation efforts include:

- Percentage complete by district of regionally downscaled Global Climate Models incorporating sea-level rise, precipitation, and heat projections.
- Number of Caltrans districts vulnerability assessments completed, and a rolled-up system-wide resiliency assessment and criticality scoring.
- Transportation partners vulnerability assessments completed
- Number of Caltrans districts vulnerability adaptation plans completed
- Number of transportation partners adaptations plans integrate with Caltrans districts adaptation plans.

- Number of economic assessments for projecting climate impacts completed.
- Complete vulnerability study of Primary Freight Network
- Complete vulnerability study of fueling infrastructure
- Complete vulnerability study of electric utilities that support transportation
  - Resiliency of electric vehicles and network
- Funds allocated to regions for Regional Transportation Plans climate resiliency planning
- Number of projects combining local/regional and State funding to identify or implement adaptation solutions
- Number of transportation-sector major infrastructure capital investments that consider climate change
- Number of transportation facilities impeding natural systems and habitat connectivity

Metrics to evaluate the overall resiliency of the transportation sector include:

- Transit, bicycle and pedestrian network level of connectivity and completion
- Number of miles of state highways that are vulnerable to flooding with 1.4 meters of SLR during a 100-year storm event
- Improved natural system and habitat connectivity

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