



Land Use & Natural Resources Committee

Item #15-8-3
Information

July 30, 2015

Sacramento Region Transportation Climate Adaptation Plan

Issue: SACOG staff recently completed a Climate Adaptation Plan for the region.

Recommendation: For information only. The Transportation Committee will take action on this item.

Discussion: Potential climate change impacts could negatively affect the region's transportation infrastructure. Damage from extreme weather events can be expensive and difficult to repair. Identifying which infrastructure is most at risk, and how managing agencies could prevent or reduce impacts, better prepares the region for these possible events, and aligns it with federal and state executive orders.

Working with Civic Spark members, SACOG authored a transportation climate adaptation plan. The plan includes a base-level analysis of climate impacts to the region's transportation infrastructure, an adaptation policy framework, and outlines steps necessary to begin implementing the plan.

The potential climate change impacts considered in the plan include: extreme temperatures; increased precipitation, runoff and flooding; increased wildfires; and landslides. Although landslides are not a direct result of climate change, these events are expected to increase in frequency due to increased rainfall, runoff, and wildfire.

While each of these potential impacts affects transportation infrastructure differently, there are several key adaptation measures and policies that if used help eliminate or reduce impacts from climate change. These policies, outlined in the plan, are divided into focus areas for the impacts described above. These areas include proposed adaptation measures that can be addressed in the planning, design, and maintenance phases of a project.

The Climate Action Plan contains a vulnerability assessment, policy recommendations, and a series of implementation actions. The findings from this work are being incorporated into the MTP/SCS chapter dealing with climate change. If the plan is adopted by the Board, staff would begin implementing the actions from the plan, which include: 1) creating a technical advisory committee to help steer future efforts; 2) identifying critical transportation assets and conducting an asset-level vulnerability assessment; 3) working with the SACOG Board to incorporate climate adaptation into future funding rounds, beginning in 2017; and 4) creating a system to monitor climate conditions and the region's transportation system and its ability to adapt to climate risks.

Attachment A provides an executive summary of the plan. The full report may be found on the SACOG website at

<http://www.sacog.org/mtp/pdf/Climate%20Vulnerability%20Assessment.pdf>.

Approved by:

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MM:RP:ds
Attachment

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Adaptation Sacramento Region Transportation Climate Plan

Executive Summary

Climate adaptation can be defined as: adjusting to changing climate conditions in a way that minimizes negative effects and takes advantage of new opportunities. Through adaptation planning, the Sacramento Area Council of Governments (SACOG) can identify how climate change is likely to impact the region's ability to achieve its mission, operate efficiently, and meet its policy and program objectives. By integrating climate change adaptation strategies into planning, SACOG can ensure that resources are invested wisely, operations remain effective in current and future climate conditions, and the region is well positioned for any forthcoming regulations or incentives related to climate change.

In conjunction with Civic Spark, SACOG has authored a plan to address how potential climate change impacts affect the region's transportation infrastructure. The plan discusses:

- potential impacts the region could face over the next 100 years due to climate change,
- how different climate related events impact transportation and supporting infrastructure,
- how managing agencies can begin to prepare for these impacts through the planning, design, and maintenance phases of a project,
- and outlines the steps necessary to help make the region's transportation infrastructure more adaptable to climate risks.

Target Audience

This plan is intended to be a framework to inform subsequent climate adaptation work on the region's transportation investments. This work will help inform the SACOG Board of Directors about the potential impacts from climate related events, and how the region can best prepare its transportation assets to be adaptable to a changing environment. As outlined in the next steps portion of the plan, subsequent work includes: working with identified stakeholders to conduct asset criticality and vulnerability assessments, and further refining climate adaptation policies.

Climate Risks and Vulnerabilities

A climate related risk is the combination of the likelihood that an event will happen and the consequences of that event. These events have the potential to cause injuries or fatalities, environmental damage, property damage, infrastructure damage, and interruption of operations. Climate risks have their own characteristics, like geographic extent, impacts and severity, and seasonality. A climate related event also has the potential to create multiple hazards: heat is a factor in increased wildfires and wildfires can lead to landslides. Therefore, it is necessary to identify the potential primary and secondary hazards from climate risks.

	Extreme			
	Temperature	Precipitation	Wildfire	Landslides
Roadways	Fatigue cracking, expansion joint buckling, thermal cracking, rutting/softening	Substructure erosion, washout, localized and major flooding	Rutting/softening	Washouts, blocked roads, destabilization, cracking,
Railways	Rail buckling, forced delays	Substructure erosion, forced delays, inundation	Blocked routes, forced delays	Washouts, blocked routes
Bridges	Expansion joint buckling	Increased scour, decreased safety (visibility, traction), possible inundation	Weakening of steel bridge material	Washouts, destabilization
Walking & Biking	Decreased comfort, health risks	Decreased safety (visibility, traction), decreased comfort	Decreased air quality	Loss of life, injury
Drainage	Little/No consequence	Drainage overflows, clog drains with leaves	Failure of plastic drains and HDPE or PVC culverts	Clogged/blocked drainage systems
Traffic Flow	Vehicles overheating	Slowdowns, increased accidents	Slowdowns, congested traffic	Slowdowns, congested traffic
Public Transit	Decreased comfort, transit vehicles overheating, delays	Decreased comfort, delays	Route closures, trip delays	Route closures
Buildings & Facilities	Construction and maintenance forced to halt or slowdown	Inundation of electrical boxes/equipment	Construction forced to halt	Buildings/facilities buried or washed out, maintenance crews diverted for landslide cleanup
Traffic Controls	Power outages to signals	Power outages to signals, reduced sign visibility	Power outages to signals, reduced sign visibility	Damage to infrastructure

	High likelihood or Damage
	Moderate likelihood or Deterioration
	Medium likelihood or Disruption
	Low likelihood or No Consequences

Figure 1 Potential Climate Risks and their Impacts on Vulnerable Transportation Infrastructure

For this plan, members of the Sacramento Civic Spark team worked to disaggregate international climate change scenarios into regional climate risks in order to identify particular climate events and the likelihood of their occurrence in the Sacramento region throughout the horizon years of the Metropolitan Transportation Plan/Sustainable Communities Strategies (MTP/SCS) and beyond. This effort identified the following major climate related risks to our region: extreme heat; precipitation, runoff and flooding; increased wildfires; and landslides.

Four categories of consequences cover most eventual impacts to transportation assets. Some events may have multiple possible consequences, while some may not have any notable consequences at all. The four categories of consequences are: No Impact, Disruption of Services or Operation, Deterioration of Infrastructure or Property, and Damage to Infrastructure or Property.

Figure 1 outlines the likelihood and consequences of the identified climate risks and how they may impact vulnerable transportation assets.

Adaptation Approaches

Actions toward climate change adaptation range widely, from relatively low-effort infrastructure management policy changes to expensive and disruptive asset

retrofits and replacements. These actions can be broadly categorized into three sectors: Planning, Design, and Maintenance.

Within each of these sectors, actions can be taken toward four types of adaptation strategies: maintain and manage, strengthen and protect, enhance redundancy, and retreat.

Figure 2 provides an overview of these strategies and how they address the different climate related impacts.

Actions

In order to implement this plan, SACOG is proposing a series of action steps.

Action 1. Engage Stakeholders

Create a Technical Advisory Committee (TAC) made up of private, public, non-profit, and research entities. This group will be involved in all aspects of implementation of the climate adaptation plan, including additional analysis of climate impacts, identifying the most critical transportation assets, and overseeing the ongoing monitoring of infrastructure.

Action 2. Conduct Asset Level Assessment

With input from the TAC, carry out an asset level vulnerability assessment on the region's most critical transportation investments. Determine impacts and best possible adaptation strategies.

Action 3. Set Policy for Future Funding Rounds

Work with the SACOG Board of Directors to determine how climate adaptation should be addressed in the biennial regional funding round given the outputs from the asset level assessment.

Action 4. Monitor

Continue to track how the region's transportation investments are adapting to potential climate risks, and define which components are critical and vulnerable.

ADAPTATION STRATEGIES

Maintain and manage:

Enhance maintenance and repair policies to improve severe event preparedness and response. Manage procedures for monitoring infrastructure and create/update emergency action plans.

Strengthen and protect:

Retrofit existing infrastructure and build new structures that better withstand extreme climate events.

Enhance redundancy:

Identify and create alternatives to vulnerable routes. Utilize different modes of transportation to enhance redundancy.

Retreat:

Relocate or abandon infrastructure located in highly vulnerable areas. Avoid building new infrastructure in vulnerable locations.

	Extreme Temperature			Precipitation, Runoff, Flooding			Wildfire			Landslides		
	plan	design	maintenance	plan	design	maintenance	plan	design	maintenance	plan	design	maintenance
Roadways		Use heat and rut-resistant materials	Implement asset management system, increase monitoring and maintenance schedules	Identify alternative routes to vulnerable and critical routes, limit development in floodplains, conduct risk assessments	Protect evacuation routes, use different asphalt/concrete mixtures, pavement grooving and sloping	Implement asset management system, increase monitoring and maintenance schedules	Identify alternative to vulnerable and critical routes, update emergency improvement plans,	Use heat resistant materials, protect electrical equipment		Identify alternative to vulnerable and critical routes, update emergency improvement plans		
Railways	Change design standards on maximum temperatures	Design joints for higher maximum temperatures	Increase monitoring and maintenance schedules, lighten train loads and reduce speeds		Upgrade drainage system and increase culvert capacity				increase monitoring and maintenance schedules, repair damage as needed		Protect evacuation routes, ensure adequate drainage on roadbed surfaces and shoulders, incorporate rock fall protection, implement slope hardening	Implement asset management system, increase monitoring and maintenance schedules, ensure roadway is clear of rocks, debris, vegetation, minimize repair backlogs
Bridges		Design joints for higher maximum temperatures, use heat and rut-resistant materials	Implement asset management system, increase monitoring and maintenance schedules	Identify alternative routes to vulnerable and critical routes, limit development in floodplains, conduct risk assessments	Protect bridge piers and abutments, protect evacuation routes, use different asphalt/concrete mixtures, pavement grooving and sloping	Implement asset management system, increase monitoring and maintenance schedules	Identify alternative to vulnerable and critical routes, update emergency improvement plans,	Use heat resistant materials, protect electrical equipment				
Walking & Biking		Provide shade, create safe alternative routes										
Drainage				Restrict development in floodplains, conduct risk assessments	Upgrade drainage systems/ increase standard drainage capacity, increase water storage systems	Increase monitoring and maintenance schedules, ensure systems are clear during extreme precipitation, increase capacity of pumps, minimize repair backlogs		Use heat resistant materials				Implement asset management system, increase monitoring and maintenance schedules, minimize repair backlogs
Traffic Flow	Incentivize alternative modes and teleworking				Identify alternative to vulnerable and critical route					Identify alternative to vulnerable and critical routes, update emergency improvement plans	Protect evacuation routes	
Public Transit	Provide shade, use alternative fuels, encourage carpools						Identify alternatives to vulnerable and critical routes					
Buildings & Facilities			Increase monitoring schedule, shift to evening work schedules		Weatherproof equipment and install higher	Increase monitoring and maintenance						
Traffic Controls	Plan alternative traffic control measures			Plan alternative traffic control measures								

Figure 2 Possible Adaptation Strategies to Address Potential Climate Change Impacts