



TESTIMONY OF

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and
Chair, American Association of State Highway
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Security and Resilience

REGARDING

Climate Resiliency Within the Transportation Industry

BEFORE THE

**Subcommittee on Transportation, Housing and Urban
Development, and Related Agencies
of the United States Senate**

ON

Thursday, May 13, 2021

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INTRODUCTION

Chair Schatz, Ranking Member Collins, and Members of the Subcommittee, thank you for the opportunity to testify regarding climate resiliency within the transportation industry.

My name is Ed Sniffen. I am Deputy Director of Highways for the Hawaii Department of Transportation (HDOT) and I chair the American Association of State Highway and Transportation Officials (AASHTO) Committee on Transportation System Security and Resilience (CTSSR). As part of the agency responsible for ensuring the people of Hawaii are connected through our multimodal transportation system, I believe I can provide a credible first-hand account of the need for climate resiliency in transportation. Hawaii is separated by 2,000 miles from the nearest state. When disasters strike, there is no trucking goods or people across state lines.

Currently, 70 percent of the state highways system in Hawaii is vulnerable to a stressor or hazard. In 2018, we had \$94 million in damages from flooding, landslides, hurricane, earthquakes, volcanic eruption, and lava flow that qualified for the Federal Highway Administration (FHWA) Emergency Relief (ER) program. However, we're planning within all modes for greater impacts in the future as sea levels continue to rise.

The 2017 Hawaii Sea Level Rise Vulnerability and Adaptation Report forecasts one meter of sea level rise affecting the Hawaiian Islands by 2100. If we took a traditional approach of relocating transportation facilities, we'd be looking at an estimated \$30 billion to relocate or elevate state roads and bridges, address impacts to airports, and protect the state's commercial harbor facilities.

Facing this reality as well as seeing the impacts of climate change on our neighbors in the Compact of Free Association States, Hawaii is compelled to act. Hawaii Governor David Ige committed to a goal to generate 100 percent clean energy by 2045. HDOT is contributing to this effort through its energy savings performance contract and by greening operations whenever possible.

This subcommittee possesses the ability to act to amplify the transportation resiliency efforts of Hawaii and the other states and territories. As the chair of the CTSSR, I work with my counterparts across the country to address climate change and energy issues. Based on communications with CTSSR members and my own experiences operating and maintaining Hawaii's state highways system, I respectfully recommend:

- Support for investment to improve infrastructure resilience through the American Jobs Plan.

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- Support for increased coordination between resource agencies, researchers, and those engaged in day-to-day airport, port, and highways operations on resilience and adaptation.
- Support for expediting the federal project delivery processes so needed resiliency and adaptation projects can be implemented now.

ADAPTATION IS CRUCIAL FOR THE TRANSPORTATION INDUSTRY: HAWAII'S CASE IN POINT

When your transportation systems are surrounded by water, climate adaptation is a must. However, I would like to make the argument that climate adaptation is necessary for all, regardless of their geography. Transportation resilience is about balancing today's needs with the future and setting the plans and processes so that addressing adaptation is the default.

To that end, all HDOT operational divisions have initiated climate adaption studies in response to ongoing and forecasted climate change.

Airport Vulnerabilities

The 15 airports managed by HDOT are an important driver for Hawaii's economy. To plan for the needed actions to protect and preserve these resources, HDOT studied the system's vulnerabilities to sea level rise. Accepted sea level rise forecast is that inundation would occur at 10 of Hawaii's airports.

Adaptation strategies considered for airports are:

1. Construct shoreline revetment/sea walls, elevate runways and taxiways, retrofit facilities.
2. Retrofit all facilities by reconstruction and modification to at least one foot above the projected sea-level rise elevation over the next 100 years.
3. Relocate the airports to higher elevations.

Based on construction costs of current projects, we are looking at a need for approximately \$8 billion to address anticipated sea level rise at Hawaii's airports.

Commercial Harbor Considerations

Commercial harbors cannot retreat from the shoreline, so HDOT is working with stakeholders to plan for increased pier freeboard as new facilities such as the Kapalama Container Terminal in Honolulu are built. The pier elevation for the new facility will be at nine feet, which should provide 0.34 feet of clearance at high tide at the time of projected one meter sea level rise.

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Another potential strategy to address the vulnerability of Hawaii's major port is through controlling the water level within the bay. HDOT Harbors Division is pursuing funding for a feasibility study in conjunction with the U.S. Army Corps of Engineers for use of a lock and dam system at the harbor channels to keep water levels at desired levels and allow ship movement. Estimated cost of the joint feasibility study is \$3 million and estimated cost of a lock and dam system would be \$3 billion.

A water control system at Honolulu Harbor would not only protect the port where the majority of commercial goods from toilet paper to spam enter the state, it could potentially protect surrounding neighborhoods and provide insight into the use of such systems to protect seaside populations and assets. Honolulu Harbor also serves as a distribution point for goods transported to Guam, the Commonwealth of the Northern Mariana Islands, American Samoa, and the Compact of Free Association nations.

For commercial harbors not suited to such modifications (e.g., broad bays) HDOT is also planning on replacing pile supported piers with bulkhead piers to increase survivability of the structures. The cost to replace all current pile supported piers is approximately \$8 billion.

Highways Climate Adaptation Action Plan

Highways Climate Adaptation Action Plan provides a roadmap for HDOT's Highways Division to improve the system's resilience to climate-related effects. It includes locations along state highway facilities that are at risk from natural hazards and recommendations to incorporate resilience measures into programs and policies.

Understanding and pre-emptively addressing how roads are exposed to climate-related hazards helps inform state agencies and communities about changing environmental conditions that may strain highways infrastructure.

Hazards analyzed include:

- Rockfalls and landslides
- Inland floods
- Wildfires
- Coastal inundation due to sea level rise
- Storm surges
- Tsunamis
- Coastal erosion
- Groundwater inundation
- Lava flows (not climate related but a major consideration for Hawaii)

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Actions HDOT is taking going forward for resilience include formation of working groups to consider climate adaptation and environmental impacts before projects start and making resilience a consideration for design. To create designs that will be more resilient to future stresses from extreme weather or other sources, HDOT will plan for 30 years into the future, avoid setting blanket policies, and incorporating adaptation design making and risk based scenarios.

Multimodal Considerations

Examining these vulnerability studies, coastal inundation due to sea level rise is the greatest climate adaptation consideration for Hawaii. Given the limited land mass and considerable costs for acquiring land and construction, relocation of the facilities that will be inundated is cost prohibitive. Considering that airports and harbors are not likely to be relocated, highways and connector roads leading to these facilities must be protected to maintain service and keep the flow of commerce going.

HAWAII'S RESILIENCE INITIATIVES

Based on fuel consumption alone, transportation is a large contributor to the release of carbon dioxide into the environment. The carbon emissions from vehicles, ships, boats, and aircraft account for about 28 percent of total U.S. greenhouse gas emissions and have been increasing from 2008 to 2018. With global carbon dioxide levels higher now than at any time in the past 3.6 million years, this is an unacceptable trend.

In 2013 HDOT entered an 18 year Energy Savings Performance Contract to replace lighting and other infrastructure with energy efficient technologies. To date through the contract, over 161,000 light fixtures have been replaced with Light Emitting Diode lamps and 40,000 photovoltaic systems have been installed at state airports, harbors, and along state highways.

Other HDOT resource savings initiatives include design of the Consolidated Rental Car Facility at the state's second busiest airport to Leadership in Energy and Environmental Design Silver standards and the procurement of electric vehicles (EV) and charging infrastructure as a service through a contract available to all state and county agencies. The EV service contract will allow Hawaii agencies to convert or right-size their fleets with minimal upfront investment.

These initiatives were only possible because of the networking, resource sharing, and coordination encouraged at all levels of government in Hawaii. On the national level we encourage sharing of resilience initiatives and results through CTSSR activities such as webinars and peer exchange. Support from the Senate for transportation resilience would encourage more collaboration, research, and implementation of effective resilience initiatives.

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The support of this subcommittee for additional funding and an expedited project delivery process would greatly aid in getting more resilience initiatives out of the theoretical stages and into practice on our streets, bridges, runways, and harbors. HDOT is currently approaching building resilience into our systems using a variety of approaches, including pursuing green infrastructure such as carbon mineralized concrete and adding recycled plastics to asphalt mixes. Investing in resilient infrastructure on a federal level will enable us and other transportation agencies to implement better and greener infrastructure.

RECOMMENDATIONS FOR SUPPORT OF RESILIENCE AT THE FEDERAL LEVEL

As the CTSSR Chair, I believe that the definition of resilience is critical and should not be related simply to the ability of an asset to not fail during certain events (e.g., a bridge strike or a category five hurricane); rather, it needs to involve the ability of a state DOT to:

- Anticipate, plan and adapt to potential risks,
- Withstand, respond to, or recover when an event occurs, and;
- Construct and maintain assets that decrease project vulnerability risks.

When considering funding for resilience, the current core formula program eligibility could be expanded to consider resilience improvements; formula funding could be set aside to focus on resilience-related planning, coordination, and evacuation; or, a discretionary grant program for adaptation strategies could be established. Additionally, I am advocating for support of managed relocation to address the needs of underserved and rural communities.

In general, AASHTO recommends avoiding new plans, programs, and analysis processes as this increases cost and burden to state DOTs.

SUPPORTING RESILIENCE EXAMPLES FROM AASHTO MEMBER STATES

California Resilience Example

A period of heavy rainfall beginning Jan. 5, 2019, resulted in the movement of a landslide along Route 101 in Mendocino County. Continued movement resulted in damage to the southbound lane and shoulder ultimately requiring closure of the southbound lane. Due to signs of continual movement, forecast of heavy rain, and to avoid further loss of the roadway Caltrans determined that immediate "permanent restoration repairs as EO" were necessary to minimize the extent of damage, protect the remaining facilities and achieve resilience. Such work includes providing immediate traffic control, conducting geotechnical investigation, repairing damaged drainage system and providing final slope and roadway stabilization via a Soldier Pile Ground Anchor Wall. Final Geotechnical investigations indicated that soldier pile wall at PM 95.85 was the only possible permanent repair solution.

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Another Caltrans example comes from Rat Creek, Highway 1, Big Sur. In the summer of 2020, the 125,000-acre Dolan Fire in Monterey County left 20 miles of Highway 1 on the Big Sur coast downslope of the Dolan Fire burn scar. Even before the fire was extinguished preventative work was initiated. In anticipation of debris flow during winter rain events, Caltrans augmented its already robust winter prep efforts along Highway 1 and analyzed 61 drainage systems along this stretch of coast while making improvements at 37 locations. In late January 2021, an intense, 3-day rain event, referred to as an atmospheric river, dropped up to 17 inches of rainfall and created post-fire debris flows that impacted over 60 cross drainages. Of the 37 drainage sites improved during preventative winter prep efforts, 23 performed as intended and minimized damage to the roadway. At Rat Creek on Highway 1, the debris flow overwhelmed the drainage infrastructure and overtopped the highway embankment. This caused erosion and head-cutting that eventually washed out a 150-foot long section of roadway. Once the site at Rat Creek was assessed, a multi-functional team including engineers from all fields of civil engineering began developing a reconstructed, enhanced embankment to restore the highway. The repair was designed for a large rain event such as a 100-year storm. It is also designed for a combination of a large-scale fire (similar to the Dolan Fire) and a large rain event such as 50-year storm. The repair design provides increased hydraulic and bulking capacity, which incorporates a larger diameter culvert and redundancies, which serve to make the highway more resilient in the future. The roadway was able to be opened to traffic just 86 days after the event occurred.

Missouri Resilience Example

Flooding along the Missouri River in northwest Missouri resulted in the closure of several roads and highways along with subsequent major damages to some of those routes. This area had flooding in 2010, 2011 and 2019. The flooding for these three events cost \$14.8 million in damages to US 136, \$7.8 million in damages to US 159, and \$5.6 million in damages to MO 111. Flooding events in 2011 and 2019 included complete washouts of the pavement and roadway embankment resulting in holes up to 60 feet deep and about 200-300 feet long.

After the second significant flood event in less than ten years, Missouri looked at developing resiliency projects to protect these routes from future flood events. The option that was decided on for all three routes was to install tied concrete block mats on the downstream in-slopes with more robust shoulders on each side. The estimated resiliency project costs for each route are \$8.0 million for US 136, \$11.4 million for US 159, and \$2.0 million for MO 111. These projects are to be funded from the FHWA ER Program.

Missouri is also experiencing other issues with resilience. For example, the Federal Emergency Management Agency (FEMA) recently denied \$9.5 million in repairs of 2019 roadway flood damage due to what they call “deferred maintenance” issues. Basically, since the roadway surface was not in a condition they considered acceptable (due to lack of available state and federal funds) they are denying all damage on the route. In many cases this includes ditch erosion, pipe washouts and many other non-surface related damages. This is an example of

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how funding issues can compound a problem and make it even more difficult to build resilience. Missouri may be 100 percent responsible for taking care of the repairs, which in turn reduces ability to invest in additional improvements or resilience projects.

With the ongoing pandemic it has taken over a year for FEMA to make this determination. Delayed determinations can reduce a state's confidence and ability to quickly let repair projects, especially in cases where additional funds are being considered for resilience and where there is a chance the state may be on the hook for 100 percent of the cost. This is not a risk most states will be willing to take.

Maine Resilience Example

FHWA, Army Corps of Engineers, and MaineDOT have a programmatic Endangered Species Act consultation for effects to Atlantic salmon and its Critical Habitat. The agreement has improved fish passage for MaineDOT projects and also contributes to future resilience of MaineDOT's infrastructure. In the agreement, MaineDOT committed to specific design standards that seek to reconnect waters for endangered salmon, with benefits to other fish and wildlife. To meet these fish passage design standards, MaineDOT is typically required to increase the size of culverts and bridges when the structures are replaced; culverts sized for fish passage routinely have capacity for the 100-year event or larger.

The increased structure size improves the ability of infrastructure to withstand the more frequent and larger precipitation storm events that have occurred in recent years. MaineDOT's culvert design standards require culverts to be designed for a 100-year storm event. Additionally, the bridge design guidance requires bridge replacements to be designed to have at least 2-foot freeboard during the 50-year storm event and consider effects of the 100-year storm event or the flood of record during design. The fish passage design standards typically exceed the size requirements of the hydraulic standards and, therefore, result in more resilient structures.

CONCLUSION

The American Jobs Plan provides a call to build our infrastructure—the roads, bridges, airports, ports, and other facilities that allow us to connect and live together as a nation—to be safer, stronger, and sounder. My intention as a witness was to share the impacts of the climate crisis in Hawaii and the resilience and adaptation we are building into our system now. It is crucial that we work collaboratively to research and implement solutions to increase our systems' resilience to extreme weather and climate-related disaster events.

An increased investment in infrastructure resilience could spark innovation in engineering for sea level rise, protection of coastal assets, stabilization of slopes to reduce landslides and rockfall risk, decarbonization of construction materials and other potential solutions. I would

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also like to take the opportunity to advocate for increased flexibility in existing programs such as Transportation Alternatives that encourage development of pedestrian and bicycle facilities and other small scale projects with community benefits. Consideration of removal of the local match for community Transportation Alternatives projects could encourage improvements for nonmotorized users of our systems.

Thank you again for the honor and opportunity to testify today, and I am happy to answer any questions.