

Partnering Transportation and Coastal Zone Management Agencies: The California Example of Success

Joint Caltrans and California Coastal Commission presentation for the Congressional Briefing, *Protecting Coastal Roads: Using Nature Based Solutions to Protect Transportation Infrastructure from Sea Level Rise and Flooding* held on September 9th, 2021.

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Introduction

Thank you for the opportunity to share information about the value of our unique partnership between our state transportation department and coastal zone program. The following narrative describes how we are working together to approach the pressing challenges that climate change presents to critical infrastructure along the California coast, particularly the impacts of sea level rise.

Federal Counterparts – Coastal Zone Management Program and Transportation

Let us begin by noting that the California Coastal Commission (typically referred to as the “Coastal Commission”) is one of three state agencies that implement our federally-certified program under the federal Coastal Zone Management Act (CZMA). Our sister agencies are the State Coastal Conservancy and the Bay Conservation and Development Commission. We work closely with the National Oceanic and Atmospheric Administration (NOAA) Office of Coastal Management, on a variety of issues, including coastal hazards. Except for San Francisco Bay, the Coastal Commission oversees the land use planning and permitting aspects of our program in partnership with local governments who develop their own Local Coastal Programs for certification by the Coastal Commission under the California Coastal Act. The Commission also implements the CZMA requirements for federal actions to be consistent with our certified State coastal program.

Similarly, the California Department of Transportation (typically referred to as “Caltrans”) has long interacted with the Federal Highway Administration (FHWA) in a number of capacities. Relative to the recent FHWA implementation guide for Nature-Based Solutions, Caltrans is currently working to determine how transportation adaptation approaches might incorporate nature-based responses along the coast. We welcome the opportunity to work more closely with FHWA as we understand that they are undertaking a similar guidance effort for design-level approaches.

Caltrans – California Coastal Commission History

Over 20 years ago we mutually realized that we were repetitively experiencing interagency tensions and costly delays in getting transportation projects designed and permitted along our over 1,200 miles of shoreline. We realized that much of this was due to not coordinating early enough in the planning and design of projects as well as to misunderstandings about each other's statutory program requirements.

For example, the Devil's Slide project along Highway 1 was extremely controversial and took over 30 years of work with stakeholders to reach agreement on how to adapt the highway to the threats of landslides exacerbated by climate change—and doing so without causing significant impacts to resources. The public reoccurring costs of losing this vital link from the San Mateo peninsula into the San Francisco area were severe. For example, road closures from damage in the mid-1990's lasted half a year and changed 40-minute commute times into 2 to 3 hours each direction. Ultimately, the project, completed in 2014, included climate resilient tunnels as well as, a new portion of the California Coastal Trail,

repurposed on the former highway alignment. This experience was a turning point for our agencies to pivot toward focusing on a collaborative approach to our respective missions and developing successful legacy projects.

We have done this by giving high priority to both meeting the State’s multi-modal transportation needs and protecting coastal resources. Key to this is integrating coastal policies throughout transportation project planning, design, and environmental review. Importantly, this also leads to smoother permitting processes. We believe that other coastal states might benefit as well from similar approaches. With this partnership foundation, the Commission and Caltrans are now working with other stakeholders to address the threats and uncertainties that climate change poses along our shorelines.

Climate Change Threats, Especially Sea Level Rise

As we speak today, our State is battling one of its earliest and most destructive wildfire seasons ever and experiencing other related climate change threats such as increased temperatures, drought, and fluctuating intense precipitation events. Most significant for our interagency partnership is sea level rise (SLR) that will, and already is, exacerbating the hazards of storm surge, cliff erosion and landslide events along the coast. Caltrans and other asset owners in the coastal zone are continuously being called to action for repairing and protecting many sections of transportation systems from flooding and erosion, on both shorter- and longer-term timelines.

For this presentation, we will go into more detail about our joint efforts with other stakeholders to improve California’s ability to cope with severe threats posed by current sea level rise effects as well as the projections for those impacts to dramatically increase over the next 100 years. We’ll first highlight some of the sea level rise related threats, and then some of the insights that our partnership has revealed as being necessary for approaching these threats moving forward.

At the statewide level, California is working to address climate change through legislative, executive, guidance documents, science-based actions, and scientific research. Caltrans and the Coastal Commission have been working together to incorporate legislative requirements, the latest science, and best practices into our work to guide critical transportation infrastructure and land use planning and decision-making.

Vulnerability and Adaptation Reports and Guidance

Caltrans and the Coastal Commission have jointly provided input on each other’s efforts to advance information and develop guidance for their plans and operations. CZMA funding allowed the Coastal Commission and our partners to develop a draft sea level rise planning document focused on water and transportation infrastructure. The draft, released for public review in August 2021, is expected to work in concert with Caltrans’ operations guidance that is under development. Federal funding for efforts such as these will continue to be important for both our agencies.

As the Coastal Commission has funded grants for local governments to prepare vulnerability assessments and develop policies for land use adaptation, Caltrans has similarly conducted initial climate change vulnerability assessments and adaptation priority reports for the entire State Highway System. Hundreds of miles of highways are exposed—and approximately 700 prioritized assets like bridges and culverts need attention. As new scientific information continues to develop, we realize that all of these assessments will need to continue to be updated as well.

Given these threats to our infrastructure, it’s clear that we cannot adequately identify and pursue solutions without partnering with Federal, regional, and local entities.

Key Insights

We next want to review with you 5 key insights that our experience has taught us so far about dealing with sea level rise. We'll then conclude with some of the huge challenges that our state faces, which we believe are similarly multiplied by all coastal states around the country.

Key Insight 1: Corridor Approach is Essential

Through our partnership, Caltrans and the Coastal Commission have learned much about the complexities of necessary responses to current and anticipated sea level rise impacts. A first key insight of this work is that we cannot sufficiently approach the sea level challenge from a project-by-project basis when individual assets are threatened, but instead we must address and plan for transportation infrastructure adaptation from a corridor perspective. This is often distinct from transportation planning that is centered on specific assets—such as bridges or culverts. The interconnectedness of transportation systems demands a corridor approach as does the need to ensure that investments in individual assets like bridges will be cost effective by ensuring that the adjoining highway sections will also be resilient to sea level rise.

One example from our partnership where we are integrating individual asset needs into a corridor approach to adaptation planning is the Eureka-Arcata Highway 101 corridor in Northern California. This roughly six-mile stretch of highway is a major transportation corridor for upper coastal California and connects two primary cities within the region. It also runs directly along Humboldt Bay and is very exposed to sea level rise, with major sections of the highway exposed to as little as 1 foot of sea level rise. Knowing that specific assets along this corridor will become vulnerable to sea level rise effects at different times, we are working together on a phased adaptation plan that will integrate the individual asset needs with a long-term vision for the entire corridor.

More recently, the Commission approved short-term repair and protection of minor segments of the Pacific Coast Highway in Ventura County until Caltrans can complete a comprehensive Corridor Management Plan for the entire affected area. As required by the project's coastal development permit, the Corridor Management Plan will be the first to more broadly consider the long-term resiliency of Highway 1 in this highly constrained corridor. Both of our agencies expect to gain many important insights from the effort.

Key Insight 2: Avoid “Coastal Squeeze” of Resources

A second key insight over the years is that the long-term health and vitality of our shorelines requires that we carefully factor in the potential effects of adaptation responses on the surrounding environment. Like other states, California's coast, bays, estuaries, and ocean are critical to the state's environmental and economic security and are an iconic part of the state's legacy, but they face threats from climate change and sea level rise. Many segments of highways and railways are located in close proximity to the shoreline and can act as barriers, especially if they are reinforced by hardened structures. If the State does not proactively plan and act, coastal areas will be lost to inundation as they are caught between rising seas and this lateral infrastructure or other hardened shoreline development. This “coastal squeeze” would result in the loss of beaches, wetlands, and other valuable coastal habitats and public accessways, causing profound impacts to those resources and the roles that they play in both the environment and our economy.

To illustrate these challenges, a recent project along Highway 1 in north central California near Gleason Beach had to address chronic and accelerating erosion along the bluffs, which undermined homes and sections of the highway. Despite many failed attempts of seawall protections, structures collapsed - and transportation along this single corridor connecting rural communities was frequently disrupted. What is now a three-minute drive here would require an hour detour for travelers if something wasn't done to ensure the continuity of this corridor. Caltrans, the Coastal Commission, and Sonoma County spent many years working with stakeholders on a solution, ultimately deciding that the best adaptation choice was to incorporate several natural resource restoration components, along with public access

improvements, and raise and realign nearly one mile of the highway inland, where this \$40 million project will be safe for the next 100 years. In addition to raising and relocating the highway eastward, the project began this summer and includes a number of improvements that will restore a creek and wetlands, mitigate endangered species habitat, as well as improve bike and pedestrian access with a new coastal trail along the old highway alignment. Safe transportation and natural processes can continue along this stretch of highway by not building massive shoreline protection structures that would eventually squeeze out the beach below the bluffs as the relentless Pacific surf continued to eat away at the highway's viability.

Key Insight 3: Rural Versus Urban Options / Approaches are Different

A third important insight is that any options for adapting and maintaining a resilient transportation system will be vastly different depending on the urban, rural, and geologic setting. However, even when the choices seem more limited along urbanized shorelines, asset managers will be extremely pressed to discern the engineering limits of attempting to hold back the forces of a rising Pacific Ocean with structures. As we approach these situations, it is vital that a full range of other alternatives are examined. Less developed areas open up more opportunities to retreat critical infrastructure in ways that allow the space for coastal resource processes to continue as they naturally react to rising sea levels. Some urban or rural areas also offer opportunities to raise or tunnel critical infrastructure, depending on the landforms and adjacent development. Communities up and down the coast will need to work with their local, regional, State and Federal partners to reimagine the opportunities for redesigning themselves and their coastal resource areas in light of the numerous and difficult-to-predict climatic changes underway.

An example of an urban area includes a famed surfing spot at Pleasure Point in Santa Cruz County; the Pacific waves had eroded away the bluffs over the decades to such an extent that the adjacent trails, county road, public utilities, and other development were severely threatened. After years of technical studies, it was determined that the construction of full-bluff sculpted concrete seawalls with upgraded drainage and water quality facilities as well as public recreational improvements, was the most advantageous approach in this urban setting at this point in time.

In contrast, the Scott Creek lagoon system in rural northern Santa Cruz County has been degraded due to historic land use changes, particularly from the filling and diking associated with construction of Highway 1 decades ago. Now, past their useful lifespans, the bridge and connecting highway corridor are vulnerable to coastal erosion and increasingly threatened by projected impacts from sea level rise. This rural location allows for a broader range of considerations for responding to climate change and flooding concerns in ways that integrate public access improvements and ecological restoration. A significant number of local, state and federal entities have partnered together to develop technical studies and initial designs for the lagoon restoration, which is a number one priority for NOAA's Central Coast Coho salmon recovery plan. The effort is shifting to the initiation of a highway resiliency project that will reorient the bridge and highway approaches to facilitate the restoration of the lagoon and prepare for anticipated sea level rise. Advancement of this effort is one of the projects identified within the current federal infrastructure bill proposals.

Key Insight 4: Phased Approaches to Resiliency Over Time are Necessary

Another insight is that phased adaptation is essential for protecting critical infrastructure given the complexity of adapting infrastructure, the accelerating pace of sea level rise, and the significant vulnerability that is expected. Phased adaptation is the concept that short-term, incremental measures can be taken to provide additional time to plan for resilient future adaptation strategies. The Coastal Commission and Caltrans are undertaking a number of phased adaptation projects. One of the earliest was at Piedras Blancas near Big Sur in northern San Luis Obispo County. This \$40 million project included a 3-mile-long section of Highway 1 that was relocated inland in response to chronic shoreline erosion. Initially, it was decided to install temporary rock slope protections along sections of the highway while devising long-term alternatives. This allowed us to explore a full range of adaptation options, resulting in relocation of the highway inland with a 100-year design life. When the new inland highway segment (including bridges and other components) was completed, the temporary rock protections were removed, and natural beach processes were able to return. Along with making the new highway climate resilient—the project also improved a number of natural, scenic,

and recreational resources. Wetland and lagoon systems were restored, creating habitat for many important coastal species, including the endangered elephant seal, which is a major draw for the local tourism economy. It is worth emphasizing that phasing also allows for alignment with long-term land use decisions so that development and infrastructure in hazardous areas can be addressed concurrently. The significant costs of adapting critical infrastructure, and the uncertainty over the timing of sea level rise, also makes this approach an attractive method to systematically address climate change vulnerability in collaboration with local communities.

Key Insight 5: Considerations for Nature Based Strategies

A final insight is that nature-based adaptation strategies increasingly appear to hold promise as a more resilient approach to sea level rise adaptation. Incorporating ecological principles into nature-based shore protection strategies supports multiple benefits, including hazard adaptation and mitigation, natural resource enhancement, and recreation and scenic resource preservation. When circumstances allow, the Coastal Commission encourages nature-based solutions, comprised of natural or mostly natural elements, as a preferred alternative to traditional hardened shoreline protective devices that can have serious deleterious impacts on coastal resources.

An example of a nature-based adaptation strategy includes the Cardiff State Beach Living Shoreline Project, which was constructed in the winter of 2018-2019 in northern San Diego County. This stretch of Highway 101 in San Diego County was experiencing flooding and erosion, and the project consisted of an engineered dune system and cobble toe on top of a buried revetment which is planned to accrete and erode with the seasons until approximately 2050 and provide a natural buffer for the corridor, a critical component of the region's transportation network. Other factors applied to the design included preserving coastal views, improving access, and creating habitat. Since implementation, the project has experienced several challenges, the first being the erosion of dry sand into un-filled air voids in the buried rip rap. In addition, relatively high waves during construction caused runup to occur through the accessways from the pedestrian path to the beach, threatening potential structural damage. And, then during last winter's storm events concurrent with high tides, much of the sand overlay was stripped away. All of these events inform the necessary adaptive management of the overall project. Different construction techniques will be required and the regular dredging of the adjacent lagoon to maintain tidal function will be critical to continually supply necessary sand replenishment. Continued monitoring also will be necessary to determine if these events will adequately sync up for the project to succeed over time. Ultimately, this project, through use of a nature-based adaptation solution, has provided additional time to plan for longer term adaptation.

While nature-based adaptation strategies to increase resilience of transportation infrastructure is becoming more common around the country, as discussed earlier by NOAA and FHWA representatives, we do note that constraints exist for their application, particularly in the high-energy wave environments that characterize much of the West Coast. Nature-based approaches may also require a larger footprint or a greater upfront cost than more traditional armoring, but their long-term effectiveness and reduction of impacts may be more cost effective.

As practitioners, we welcome additional technical support for nature-based approaches that can meet federal and state transportation design standards. We also continue to develop grant applications for federal assistance to better test and design nature-based solutions that might be applied in California and look forward to building stronger partnerships with NOAA and FHWA on this front.

Conclusions: Need for Federal Support and Long-Term Strategies

Thank you again for the opportunity to share some of the benefits of California's coastal zone and transportation agency partnership. Hopefully this discussion has improved your understanding of the tremendous challenges sea level rise poses to our state, with potential resource damage having far-reaching effects on California's economy, identity, and quality of life.

We would like to leave you with two final thoughts: The first should be obvious—the costs of infrastructure adaptation are enormous and funding levels are currently inadequate. A recent Caltrans’ plan set rough, preliminary adaptation costs in 2030 to range from \$9 to \$11 billion and costs for 2100 projected to be as much as \$45 billion in current dollar construction costs. Additional right of way, maintenance expenses, mitigation costs, and other related requirements will increase estimates substantially. As the transportation system operates within the context of local communities, it is also useful to consider statewide estimates that \$150 billion in property is at risk of flooding from SLR by 2100, and it could cost the San Francisco Bay Area \$450 billion to be resilient to 6.6 feet of SLR.

As all coastal states grapple with the magnitude of risks and adaptation costs, it is clear that the need is beyond state and local resources, and we urgently need federal support. Research indicates that taking action now to address long-term planning needs can significantly reduce ultimate costs. However, these efforts will need significant planning, funding, and action well before structures are threatened to be successful. We are hopeful that the new federal infrastructure legislative package will help us on this front and that the need for addressing climate change will be well integrated into the appropriation of those funds.

Our final note is to remember that thinking beyond short-term solutions also offers opportunities for social and economic improvements. Managed retreat and nature-based solutions can improve the resilience of our critical infrastructure and offer improved multi-modal opportunities, enhanced coastal habitats and safer land use patterns for the populace at large. We believe it would be extremely useful to ensure into the future that climate-change adaptation projects factor in a corridor approach that supports the long-term health of coastal environments and communities, including helping us equitably realize important public access and environmental benefits. One aspect of achieving long term solutions is meeting the needs for additional scientific research projects through federal programs like NOAA and FHWA. Another aspect of this is to shift federal transportation programs from an asset-by-asset focus to a *corridor-at-risk focus* so that decision-making is based on the vulnerability of interconnected assets. We can also build on existing levels of federal support, including exploring additional creative funding mechanisms and nature-based solutions. In all such cases, we look forward to working with our national leaders and federal agency counterparts to meet these challenges—and opportunities—together.

Thank you.