Testimony of Aimee Flannery, Ph.D., PE
Global Principal - Transportation Risk & Resilience
Jacobs

Before the
Senate Committee on Environment and Public Works

Hearing on
"Examining the Effects of Extreme Heat and Weather on Transportation"

Wednesday, September 13, 2023

Good morning, Chair Carper, Ranking Member Capito and Members of the Senate Committee on Environment and Public Works.

My name is Aimee Flannery, and I am a Global Principal for Transportation Risk and Resilience for Jacobs Solutions.

I want to thank you for this opportunity to testify today as you examine the effects of extreme heat and weather on transportation systems and how private industry is helping our communities prepare. I would also like to thank the American Council of Engineering Companies (ACEC) for their leadership and for helping to make my testimony possible.

My career to date has provided me the opportunity to serve as an educator of tomorrow's Civil Engineers at George Mason University where I was a tenured member of the faculty. I have also worked for a small woman-owned business, have been a business owner myself, and have had the privilege of working with U.S. Department of Transportation in the Office of the Secretary, Office of Research and Technology prior to joining Jacobs.

We like to say at Jacobs that we're "*challenging today to reinvent tomorrow by solving the world's most critical problems*," and there may be no better example than infrastructure resilience. As America's largest engineering firm, Jacobs is investing in people and technology to address resilience challenges alongside communities across the nation.

My experience incorporating climate resilience into highway decision-making began a decade ago while working with the Colorado Department of Transportation. In September 2013, a stalled cold front clashed with a warm, monsoonal air mass from the south that dropped 20 inches of rain on Northern Colorado. The extensive rainfall and duration resulted in flow surges damaging or destroying major sections of roadway, along with access bridges and retaining walls. Numerous residents were isolated and cut off with no access out of the Big Thompson River Canyon. The operational response involved over 19,000 evacuations including over 2,000 air rescues. The event resulted in 9 deaths and caused nearly $4 billion in damages to public and private infrastructure, including damage to 50 major bridges and 485 miles of roadways.

Changes in Federal Highway Administration's (FHWA) Emergency Relief Program policy in May of that year (2013) allowed Colorado DOT to pursue more resilient designs to address major damage to some of their facilities. Changes in the policy suggested that agencies consider the long-term resilience of damaged facilities and allowed for the consideration of resilient design to reduce probable losses from future similar events[1]. FHWA's ER Program underwent further revision within the *Infrastructure Investment and Jobs Act* (IIJA) to expand the consideration of resilience when building back post-disaster on Federal-Aid highways. The revisions allow for the use of ER funding to make improvements to infrastructure that will mitigate the risk of recurring damage from extreme weather, flooding, and other natural disasters (§11106(3)(A) of P.L. 117-58; 23 U.S.C 125(d)(2)(A)).

[1] Emergency Relief Manual, Update May 31, 2013 (fhwa.dot.gov)

(Above, photo of “Horseshoe Curve” days after the peak of the 2013 floods)
(Below, photo of “Horseshoe Curve” after project completion)

One specific area was the “Horseshoe Curve” of the US-34 corridor which was destroyed by flash flooding in 2013 and previously in 1976. Thankfully, changes to FHWA’s ER Program

allowed for innovative designs and methods including soil cement mixing, installing matrix riprap, moving the roadway onto bedrock, swapping the alignment of the road and the river, and a unique approach to traffic control to achieve maximum resiliency within the project budget. This led to a more resilient US-34 corridor that allows access to first responder vehicles during emergency events and will minimize damages in future events. As the lead design firm and prime consultant, the Jacobs' Project Team was recognized alongside the Colorado DOT by Engineering News-Record when the US-34 Permanent Repairs Project won National Project of the Year in 2018[2].

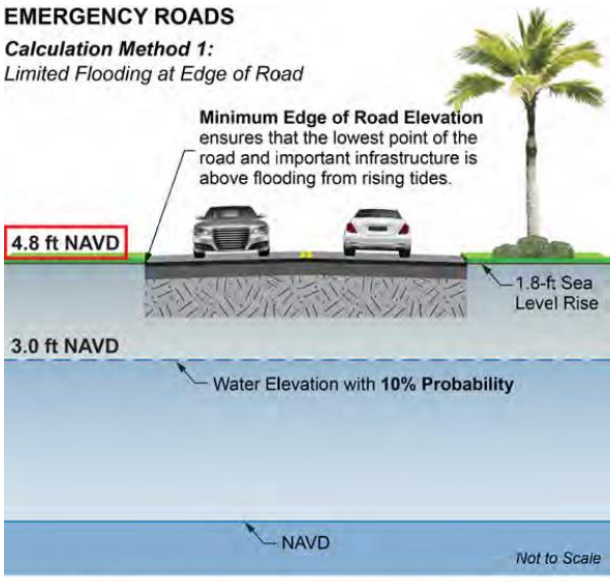
In 2013, addressing extreme weather events and climate stressors, such as increased and extended periods of heat, were emerging as new areas of concern within the highway industry. Today, nearly two years since the passage of the bipartisan *Infrastructure Investment and Jobs Act* in 2021, the transportation industry has, for the first time, dedicated funding to address resilience from natural hazards. The *Promoting Resilient Operations for Transformative, Efficient, and Cost-saving Transportation (PROTECT)* Formula Program includes over $7 billion in funding along with $1.4 billion in the *PROTECT* discretionary grant program. Jacobs and the industry applaud this Committee for their work in passing these dedicated funding sources, along with other new programs that address system resilience, as they provide much-needed funding to begin addressing the vulnerabilities of our transportation system, while allowing states and communities to address their own unique resilience needs. These programs

[2] Engineering News-Record, Best of the Best Projects 2018 (enr.com)

proactively address system vulnerabilities prior to major natural hazards and will reduce costs to taxpayers down the road.

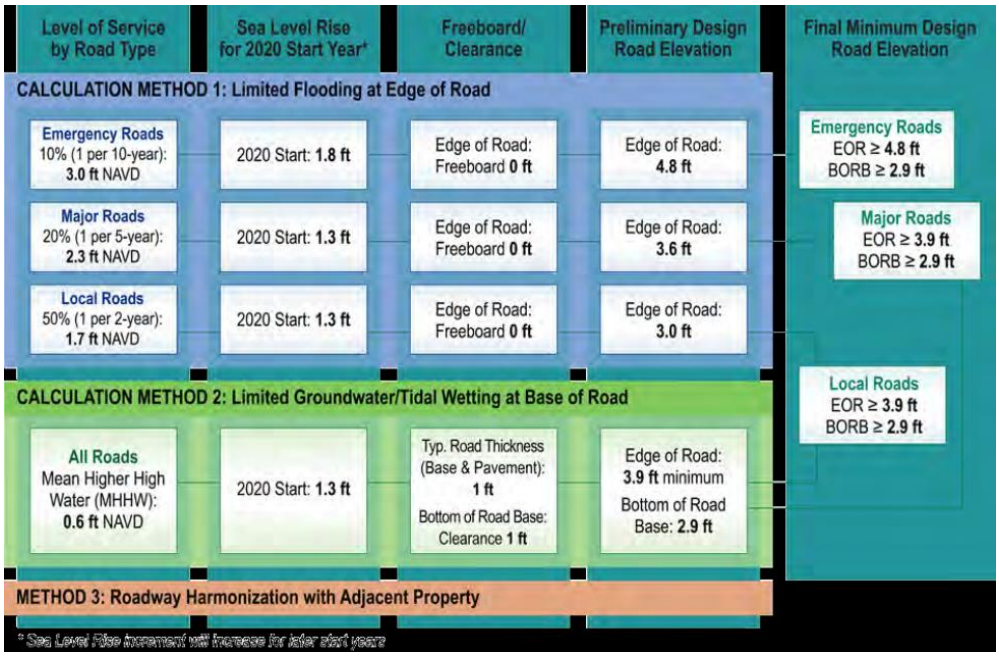
State agencies and their partners such as Metropolitan Planning Organizations, cities, and counties have been working diligently to develop Resilience Improvement Plans and prioritized lists of projects for their highway systems to reduce risk from natural hazards and improve system resilience. We at Jacobs are pleased to be working with several states represented here on this Committee, including Delaware and Maryland, on their resilience improvement plans. We are also working with multiple agencies on resilient designs and emergency evacuation corridor planning activities including the Wyoming 22 Corridor in which preliminary design addresses multiple natural hazards including flooding, landslides, avalanches, and wildfires. Jacobs is also providing final design services to the City of Elk Grove, California for the Kammerer Road Extension project, which will provide an evacuation route within the Sacramento Valley floodplain.

Some agencies are also beginning to develop methods to increase the design criteria for critical and vulnerable assets in the absence of broader national changes to design standards. Jacobs is assisting agencies with revisions to their design standards to address the recurrence of stressors and shocks to roadway systems including the cities of Miami Beach and Key West.



For Emergency Roads, Method 1 results in higher Minimum Elevation at the Edge of Road for projects built in 2020.

These two figures include information on the types of functional classification agencies are considering when revising their design standards. In this case, the City of Miami Beach has established higher minimum elevations for three classifications of roadways ranging from emergency routes to local neighborhood streets.



While we are beginning to see movement, in particular at the local level, to address climate resilience in design standards, there is still room for improvement to support transportation professionals. The transportation industry has continued to make investments in research, training, and guidance to support transportation engineering and planning professionals. Agencies and organizations like the Transportation Research Board (TRB), Federal Highway Administration (FHWA), and the American Association of State Highway and Transportation Officials (AASHTO) have published guidance on a range of topics related to climate resilience. For example, research is underway to develop resilience metrics (National Cooperative Highway Research Program (NCHRP) Report 23-26)[3], standardize methods of assessing system risk and resilience from natural hazards (NCHRP 23-32)[4], and estimate the level of effort required to update national design standards (NCHRP 15-80)[5].

Additionally, while research, policy, and pilot programs have been underway for several decades, moving research into practice does not happen quickly or easily. Prior to the passage of IIJA, agencies did not have a dedicated source of funding to address climate resilience. The state agency professionals I work with note that this is a game changer and allows them to begin to establish programs and processes to integrate resilience into their day-to-day practice, while ensuring that their solutions meet the needs of their individual resilience challenges. States also appreciate the flexibility of existing and new programs such as PROTECT to allow them to combine funding streams to accomplish greater returns on investments made. A few

[3] Measuring Impacts and Performance of State DOT Resilience Efforts, NCHRP 23-26
[4] Transportation Asset Risk and Resilience, NCHRP 23-32
[5] Design Guide and Standards for Infrastructure Resilience, NCHRP 15-80

challenges noted by professionals include the need to increase training for their staff to improve workforce awareness of resilience strategies, including Nature-Based Solutions; economic assessment methods for resilient design alternatives; best practices for incorporating resilience into design; and federal aid requirements of new programs.

Incorporating climate resilience into our standard practice has yet to be fully integrated but change is happening. To that end, future transportation reauthorization efforts from this Committee to spur the incorporation of resilience into practice could include supporting the industry to better understand risk tolerance and what is the acceptable level of resilience for the range of facilities that serve our surface transportation needs. Establishing such criteria would help to better understand what potential changes to design standards and material specifications may be needed to address climate resilience.

Fundamental research to understand asset performance under extreme weather events and climate stressors is also needed. For example, how do asset condition, age, and design standards play into asset failure curves? Utilizing our University Transportation Centers, and academic and federal laboratories to model such performance would improve our ability to estimate asset performance under a range of conditions and asset deterioration scenarios.

As a former educator, I will also note the need to integrate infrastructure resilience into our undergraduate degree programs to ensure the next generations of transportation engineers, planners, and professionals are well-versed in these concepts.

Thank you again Chair Carper, Ranking Member Capito and Members of the Committee for the opportunity to testify.

I look forward to your questions.