

AASHTO 2015 EXTREME WEATHER SESSIONS

AASHTO'S CONFERENCE ON 21ST CENTURY MOBILITY FOR FREIGHT AND PASSENGER
TRANSPORTATION

BREAKOUT 6: FLOODING, VULNERABILITY AND RISK, OH MY!

JULY 8, 2015
4:00-5:30 PM
SALT LAKE CITY, UTAH

SESSION SUMMARY

This session took the form of a “mini peer exchange” focusing on how departments of transportation (DOTs) can identify and manage their flood risks. Kevin Walsh of Massachusetts DOT introduced the session, the Federal Highway Administration (FHWA) shared information on an upcoming vulnerability assessment framework, four states—Maryland, Colorado, Virginia, and Vermont—shared their experiences, and Mike Savonis of ICF International facilitated a group discussion.

Attendance at the session included representatives from at least 18 state DOTs, along with individuals from FHWA and private sector consultants.

Presentations

Mark Ferroni, Federal Highway Administration

Mark Ferroni gave a brief presentation introducing the “International Climate Change Adaptation Framework for Road Infrastructure,” soon to be released by the World Road Association (PIARC). The Framework is a decision-making and assessment tool to help transportation agencies determine how to respond to climate change impacts on roads. The Framework includes four overarching steps: (1) identify scope of impacts, (2) assess and prioritize tasks, (3) develop and select adaptation responses and strategies, and (4) integrate findings into decision-making processes. The Framework is scheduled to be released by early September 2015.

Elizabeth Habic, Maryland State Highway Administration

Elizabeth Habic presented on Maryland State Highway Administration's (SHA's) recently-completed flooding vulnerability assessment pilot project, funded through the FHWA Climate Resilience Pilot program. The impetus for the project is that Maryland is one of the areas in the United States projected to be most affected by sea level rise. After the governor signed the state's climate action plan in 2008, Maryland SHA began its initiative to assess its vulnerabilities and started by collecting Geospatial Information System (GIS) data. Maryland's pilot project focused on flooding in two counties from three drivers: sea level change, storm surge, and precipitation. Maryland gathered projections of how flooding from these drivers may change by using the U.S. Army Corps of Engineers methodology for sea level rise projections, a bathtub model for storm surge, and downscaled climate model data for precipitation—with time horizons of 2050 and 2100.

First, Maryland compared projected flooding locations with their roadway network and “screened” for assets that could be exposed to flooding. To those exposed assets, they applied the U.S. DOT’s Vulnerability Assessment Scoring Tool (VAST) to assess vulnerability of bridges and created a Hazard Vulnerability Index to assess vulnerability of roads. This process produced vulnerability ratings (Low, Moderate, High, or Critical) for all exposed roads and bridges in those counties.

Maryland has begun to integrate those results into several processes. First, the sea level change mapping results are included with NEPA screening, such that as part of the NEPA screening process, project managers must explain what they would do about sea level rise if the project is in an affected area. Second, Maryland is using the results in their regional planning processes, so that when the Office of Structures is doing a bridge replacement, they see the VAST results. Third, Maryland is incorporating the results in to MOSAIC, a tool the state uses to screen all of their projects for environmental, economic, safety, and mobility considerations.

Maryland has completed its pilot project focusing on two counties, has begun to replicate the process for another six counties, and hopes to complete six counties per year.

[Jeff Sudmeier, Colorado Department of Transportation \(CDOT\)](#)

Jeff Sudmeier from CDOT presented on Colorado’s experience with severe flooding and its aftermath. Colorado experienced a severe flood event in September 2013 in which about 400 miles of roadway were flooded. Roads were severely damaged and several communities were completely cut off. CDOT moved quickly to implement temporary solutions so that all roads were passable by December 1, then turned to the question of whether and how to increase resilience as they moved forward with permanent repairs.

CDOT developed an approach to help them determine, for each facility, whether A) to restore or replace the asset in kind, or B) to make improvements to the facility to make it more resilient to future flooding. CDOT did a “risk and resilience analysis” to answer these questions, and developed a framework based on the existing Risk Analysis and Management for Critical Asset Protection (RAMCAP) framework. The CDOT risk and resilience analysis consisted of seven steps: 1) asset characterization, 2) threat characterization, 3) consequence analysis, 4) vulnerability analysis, 5) threat analysis, 6) risk/resilience analysis, and 7) risk/resilience management (see Jeff’s slides for details on these steps). As part of the process, CDOT also developed a criticality score for its facilities, based on six criteria (e.g., road classification, redundancy).

Jeff noted four challenges associated with the process. First, timing was challenging because CDOT wanted to begin repairs as soon as possible. Second, CDOT struggled with a lack of data, especially about the effectiveness of alternate designs. Third, this analysis focused on flooding but several other threats affect CDOT facilities, including wildfire. And finally, CDOT cited federal policy constraints as a challenge.

Moving forward, CDOT’s Futures Forward Initiative has created an extreme weather work group that is developing a CDOT Risk and Resiliency Plan, and CDOT will be incorporating their criticality assessment into its asset management systems.

Wayne Davis, Virginia Department of Motor Vehicles

Wayne Davis of Virginia Department of Motor Vehicles (DMV) (which handles all freight-related issues in the state) spoke about Virginia's challenges with flooding, especially in the Hampton Roads area. Virginia has seen an increase in severe events in Hampton Roads. That area has experienced eight Presidentially-declared disasters since 1972, and five of those have occurred since 2003.

Virginia is focusing on vulnerabilities in the Hampton Roads areas because it is clearly vulnerable. It is flood-prone, and also has limited accessibility—one interstate (I-64) is the only way in and out of the area. The area is also host to the Port of Virginia, which is responsible for over 500,000 jobs, as well as many large naval bases that need to remain operational. Virginia DMV is focused on questions to how to maintain movement of goods to and from the area.

Challenges associated with increasing resilience include a lack of accurate data points, and the inherent difficulty of assigning a probability of occurrence to extremely rare events. Nevertheless, Virginia is using its comprehensive transportation plan (VTrans 2035 update and VTrans 2040) and establishing working groups to address these problems. Finally, Virginia is also focused on non-flood risks in the area, such as security threats.

Gina Campoli, Vermont Agency of Transportation (VTrans)

Gina Campoli of VTrans presented on changes (“transformations”) taking place at VTrans in the aftermath of Hurricane Irene (2011) in order to save money and keep the traveling public safe.

VTrans defines resilience as building and acting in such a way as to mitigate the problem in the future. The outcome of resilience is no disruptions to transportation needs. After Irene, the first priority was to restore access to flooded communities. Then VTrans shifted focus to determining how to increase the resilience of the state's extensive transportation system.

Vermont is using several strategies to do this. First, VTrans is fostering “interagency love” and established bi-weekly meetings between VTrans staff and their counterparts at other state agencies. Second, Vermont updated the VTrans Hydraulic Manual. Where the old manual focused on hydraulic capacity of the structure for water only, the new manual focuses on hydraulic capacity, sediment, and debris. The new manual also sets a stream alteration standard to reduce flooding vulnerability of roadways build alongside rivers and streams.

VTrans also did flood vulnerability mapping using a HEC-RAS model to quantify river erosion potential along the highway corridors, plus LiDAR slope mapping and investigation of roadways susceptible to erosion. VTrans supplemented the modeling with field work to identify sites as either known damage sites, unknown erosion site, or previously armored sites. This helped prioritize future work.

Finally, VTrans is working to spread the knowledge of flooding vulnerability and Vermont's changing design paradigm across the organization. VTrans runs a three-tiered “roads and rivers” training. All design and operations staff are required to take at least the first level, and the third level certifies engineers. VTrans' goal in these efforts—the revised hydraulics manual, expanded LiDAR coverage, trainings, and a statewide vulnerability assessment—is to be able to improve their project prioritization process so they can consider resilience just as they consider safety, capacity, and economic development.

Discussion

The group discussion following the presentations focused around two key topic areas. In each, the group discussed the question overall and identified specific challenges they face and needs to overcome them.

1) Does it take a disaster?

Participants acknowledged that often times it does take a disaster—though not necessarily in your state—to spur action in the public and in legislative bodies. Disasters also bring dollars, so the incentives are perverse. There are still insufficient incentives or resources to encourage proactive action.

Development patterns have increased vulnerability, and transportation agencies have to serve those development patterns.

On a positive note, “disasters” – or even minor challenges – can provide a learning experience. One DOT shared that a minor “disaster” over a project helped build relationships and collaboration across departments and agencies. Those relationships then became critical tools when it came time to respond to a flooding emergency.

Challenges and Needs Identified:

- Federal Emergency Management Agency (FEMA) funding is still very difficult to use for betterments, especially the FEMA Public Assistance (PA) program. The FHWA Emergency Relief (ER) program is better now. What do we need to do to show FEMA that this is good science, good engineering?
- In many cases, investment hasn’t kept up in recent years, and that’s where you’re seeing some of the “betterments”, but it’s just getting it up to code (which is better than it was), but not *better*.
- Federal policies (funding after a disaster) can disincentivize proactive action to increase resilience.

2) How can transportation agencies build the business case for resilience?

Sometimes it doesn’t take much to build the business case because it is readily apparent that the agency is wasting money fixing the same problems repeatedly. However, it can still be difficult for DOTs to meet the burden of proof for some required benefit cost analysis because they don’t have good data on historical maintenance costs.

Building risk into asset management practice can help.

Challenges and Needs Identified:

- Agencies have trouble completing the benefit-cost assessment requirements for some FEMA funding because they do not have good data on historical costs. Often when DOTs make repairs, it is in a “patchwork” approach, so they do not have good information to include in the BCA on historical maintenance costs.

- Agencies often do not have the resources to keep the detailed records needed to fill out the FEMA Benefit-Cost Analysis. DOT's need to have systems in place to be tracking this information and, where they don't, start building those systems.
- Redundancy is an important, but difficult data point for DOTs to measure and incorporate in these analyses.
- DOTs need ways to factor in avoided social costs in analyses of the "business case" for resiliency investments.