



Federal Highway Administration

Resilience and Transportation Planning and Project Development Peer Exchange: U.S. EPA Region 5

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CONTENTS

Executive Summary.....	1
Background Presentations	2
Group Discussions.....	5
Peer Presentations.....	8
Breakout Sessions	11
Takeaways.....	13
Appendix A: Agenda.....	14
Appendix B: Peer Exchange Participants	15

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EXECUTIVE SUMMARY

This report summarizes the major themes discussed during a peer exchange on resilience in transportation planning and project development that the Federal Highway Administration (FHWA) and U.S. Environmental Protection Agency (EPA) Region 5 jointly organized and convened April 3–4, 2017 in Chicago, Illinois.

The objective of the meeting was to foster among practitioners primarily in EPA Region 5 states a meaningful exchange of ideas on issues and approaches for addressing greenhouse gas (GHG) emissions analysis and resilience in transportation planning and project development process. It was anticipated that the event would help increase awareness among peers of how analyses of GHGs and future climatological conditions completed during planning stages might be incorporated in environmental documents. The meeting also offered stakeholders in neighboring states the opportunity to meet and connect with others working on resilience in transportation planning and project development. Appendix A provides the peer exchange agenda, while a complete list of participants is in Appendix B.

Takeaways

- There was general agreement that a detailed GHG emissions analysis as part of the NEPA process likely would not add much value to decision making due to the relatively small differences in emissions between alternatives.
- The group discussed the need to assess vulnerabilities and plan for resilience. Some participants believed that climate change and extreme weather considerations could emerge as more common elements in NEPA Purpose and Need statements, while playing bigger roles in alternatives analyses and project selection.
- Photos of post-event are compelling and can foster greater support for resiliency efforts. Using photos can be an effective way to frame resilience discussions.
- The peer exchange provided a good forum for practitioners to learn about how others had conducted their vulnerability analyses.
- Try to be as concrete as possible about climate risks and vulnerabilities, even when considering long range planning options. One idea is to record and track the costs of responding to and recovering from emergency events.
- The group thought the topics discussed at the peer exchange might benefit from greater participation of the American Association of State Highway and Transportation Officials.

BACKGROUND PRESENTATIONS

The peer exchange began with opening remarks from EPA Region 5 on current resilience policy, initiatives, and projects from a national perspective and from FHWA Headquarters on resilience in transportation planning and the National Environmental Policy Act (NEPA).

National Perspective: Resilience Policy, Initiatives, and Projects—U.S. EPA

EPA Region 5 gave an overview of March 28, 2017 Presidential Executive Order on *Promoting Energy Independence and Economic Growth*. Despite the withdrawal of the Council on Environmental Quality's "Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews" (CEQ Guidance),¹ agencies are at varying stages of developing GHG analyses or analysis approaches and resilience plans. Peer exchange attendees were encouraged to read the Executive Order to understand better the current landscape, while also taking the opportunity of the peer exchange to share any useful information they have on successful approaches to assessing and addressing vulnerabilities to extreme events.

EPA is following developments related to the Continuing Resolution that most agencies are currently operating under, as well as the proposed fiscal year 2018 budget. Regardless of any resource changes that may occur, EPA noted that the National Environmental Policy Act (NEPA) still exists and calls on Federal decision-makers to take a hard look at significant issues. This has created a space for the peer exchange conversation: what are ideas for how practitioners can fulfill present requirements in the absence of clarifying guidance? Case law has helped to define federal agencies' responsibilities with respect to GHGs and extreme weather and will likely continue to provide direction while confronted with other uncertainties.

Overview of Climate Resilience in Transportation Planning and NEPA—FHWA

While the U.S. Department of Transportation evaluates the effects of the President's March 28 Executive Order, FHWA continues to recognize the importance of integrating consideration of climate change and extreme weather events into agency planning, operations, policies and programs through its own Order 5520: Transportation System Preparedness and Resilience to Climate Change and Extreme Weather Events. The Order established FHWA policy and responsibilities related to preparedness and resilience to climate change and extreme weather events, and provided a common set of related definitions.² Over recent years, FHWA has supported state and regional transportation agencies to assess vulnerabilities and develop approaches to improving resilience, with many of the results now integrated with the transportation planning and project development processes.

FHWA Order 5520 Definitions

Preparedness means actions taken to plan, organize, equip, train, and exercise to build, apply, and sustain the capabilities necessary to prevent, protect against, ameliorate the effects of, respond to, and recover from climate change related damages to life, health, property, livelihoods, ecosystems, and national security.

Adaptation is adjustment in natural or human systems in anticipation of or response to a changing environment in a way that effectively uses beneficial opportunities or reduces negative effects.

Resilience or resiliency is the ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions.

For more information, see:

www.fhwa.dot.gov/legregs/directives/orders/5520.cfm

¹ 81 Fed. Reg. 51866 (August 5, 2016).

² See FHWA Order 5520 at.

Additionally, The Fixing America's Surface Transportation (FAST) Act, which was signed into law on December 4, 2015, includes new requirements for state departments of transportation (DOTs) and metropolitan planning organizations (MPOs) to integrate resilience into the transportation planning process. Following the authorization of the FAST Act, FHWA and the Federal Transit Administration (FTA) updated their planning regulations³ with a requirement that metropolitan transportation plans assess capital investment and other strategies that reduce the vulnerability of the existing transportation infrastructure to natural disasters (23 CFR 450.324(f)(7)). MPOs now should coordinate with officials responsible for disaster risk reduction when developing a metropolitan transportation plan and the Transportation Improvement Program (23 CFR 450.316(b)). The planning final rule also added improving the resilience and reliability of the transportation system as a new planning factor for states and MPOs to consider and implement in the transportation planning process (23 CFR 450.206(a)(9) and 23 CFR 450.306(b)(9)).



Landslide in 2012 along Interstate 75 in Tennessee

FHWA's website includes any resources relevant to these new requirements and resilience more generally, including:

- **Memorandum on Eligibility of Activities to Adapt to Climate Change and Extreme Weather Events Under the Federal-Aid and Federal Lands Highway Program** at www.fhwa.dot.gov/federalaid/120924.cfm
- **Climate Change and Extreme Weather Vulnerability Assessment Framework**
This document is a guide for transportation agencies interested in assessing their vulnerability to climate change and extreme weather events. It gives an overview of key steps in conducting vulnerability assessments and uses in-practice examples to demonstrate a variety of ways to gather and process information. An updated version of this framework should be available soon.
www.fhwa.dot.gov/environment/climate_change/adaptation/publications/vulnerability_assessment_framework/.
- **Vulnerability Assessment Pilots**
Between 2010 and 2015, FHWA partnered with 24 state DOTs and MPOs to conduct vulnerability assessments based on the framework.
www.fhwa.dot.gov/environment/sustainability/resilience/pilots/

³ The Final Rule for Statewide and Nonmetropolitan Transportation Planning and Metropolitan Transportation Planning can be accessed at www.federalregister.gov/documents/2016/05/27/2016-11964/statewide-and-nonmetropolitan-transportation-planning-metropolitan-transportation-planning.

- **Resilience and Transportation Planning Fact Sheet** at www.fhwa.dot.gov/environment/sustainability/resilience/publications/ratp/fhwahep17028.pdf
- **Engineering Guidance**
FHWA has also produced engineering guidance related to assessing the effects of climate change and extreme weather events on highways in both coastal and riverine environments ([Hydraulic Engineering Circular 25](#) and [Hydraulic Engineering Circular 17](#)).

FHWA also has resources to assist with GHG emissions analysis, including:

- **Infrastructure Carbon Estimator (ICE)**
ICE is a spreadsheet tool that estimates the lifecycle energy and GHGs from the construction and maintenance of transportation facilities. ICE requires limited data inputs and is designed to inform planning and pre-engineering analysis. FHWA has begun a pooled fund study with Minnesota DOT to update the ICE tool.
www.fhwa.dot.gov/environment/sustainability/energy/tools/carbon_estimator/
- **Handbook for Estimating Transportation Greenhouse Gases for Integration into the Planning Process**
This a guide that provides information on how to analyze on-road greenhouse gas emissions at the state and regional level, and how to incorporate those analyses into transportation planning efforts.
www.fhwa.dot.gov/environment/sustainability/energy/publications/ghg_handbook/index.cfm

Other tools are EPA's MOVES model and Argonne National Laboratory's GREET model.

Moving forward, FHWA expects to continue to support state and local transportation agencies in their efforts to improve the state of the practice regarding integrating GHG analysis and resilience into the transportation planning and project development processes.

Questions, Answers, and Comments

Comment: Ohio DOT has referred to the results of the vulnerability assessment pilots to inform its work. Peer exchange participants are encouraged to review the final report, which includes individual case studies on each pilot. FHWA tried to support a variety of project types and locations; some pilots focused on vulnerability assessments in a broad sense, while others focused on specific assets, or did both.

Question: Are qualitative analyses of GHGs acceptable?

Answer: If a project is expected to have a significant impact on GHGs, there is controversy related to the topic, or there is public interest, there is nothing preventing an agency from doing a GHG analysis. However, a GHG analysis is not required, nor does FHWA have guidance on how to conduct an analysis. Agencies have flexibility to address (or not address) the topic in support of the decision-making process as appropriate. The U.S. DOT's Office of the Secretary may issue additional guidance in the future.

Question: Will FHWA issue any guidelines for doing GHG analyses?

Answer: Some draft resources have been developed that could be released in some form in the future. Even if there are no requirements to analyze GHGs at the planning or project levels, an agency may decide that it is prudent to do so. Tools such as EPA's MOVES model for tailpipe emissions, FHWA's ICE tool for fuel cycle emissions, or Argonne National Lab's GREET model can help.

Question: Would FHWA and FTA consider developing *de minimis* criteria regarding when to do a quantitative versus qualitative analysis of GHGs that is similar to air toxics analysis?

Answer: FHWA has developed a spreadsheet tool based on ICE and MOVES indicators for carbon dioxide that allows users to use average annual daily traffic (AADT) information to estimate GHGs for various alternatives. It was designed to provide a user-friendly way to analyze GHGs for small projects without doing a full-scale traffic analysis.

Comment: There is a performance measure on GHGs that has been put on a 60-day holding period that ends in May 2017.

GROUP DISCUSSIONS

Peer exchange attendees participated in several moderated group discussions throughout the meeting. This section provides an overview of themes from the discussions.

Incorporating GHG analysis in the transportation planning process and NEPA

The conversation began with a discussion about whether the participants' agencies had conducted a GHG analysis. Most agencies indicated that they had not. Exceptions were the Southeastern Wisconsin Regional Planning Commission (SEWRPC), which recently completed a scenario-based quantitative analysis of GHGs for the transportation system using the MOVES 2014 model, and the Chicago Metropolitan Agency for Planning (CMAP). SEWRPC's analysis considered three scenarios: an existing trends scenario, an increased infill development scenario, and an improved transit scenario. SEWRPC ultimately found the differences in terms of transportation GHGs among the scenarios to be marginal. However, the exercise was worthwhile from SEWRPC's perspective as the information learned can help educate public regarding the environmental impacts of the transportation system and the types of changes that might be expected with different transportation futures. Similarly, CMAP used vehicle miles traveled (VMT) data coupled with different land use strategies such as more efficient housing development to run the MOVES model as part of its long range transportation plan (LRTP) alternatives analysis to evaluate GHGs. Like SEWRPC, CMAP found it difficult to identify specific actions that would particularly impact overall GHGs. The peer change group then discussed how future fuel efficiency standards or technologies, such as autonomous vehicles, may affect analyses such as these.

In another example, during 2015 Minnesota DOT (MnDOT) and other state agencies participated in a process to provide opportunities for stakeholders to share ideas, information, and perspectives to inform near-term actions to reduce GHGs. The result of the project was a [Climate Solutions and Economic Opportunities report](#) that provides the foundation for state climate planning. The study considered all forms of transportation emissions and different strategies for reducing those emissions at the planning level. MnDOT has now reviewed its own operations and set targets for emissions and recently ran FHWA's ICE model for a full year, an activity it plans to do on an ongoing, annual basis. Finally, MnDOT has been working with Smart Growth America to assess returns on investment for various smart growth strategies. One activity was a study that considered how adding a new high-occupancy toll lane might affect air emissions. Results suggested that the effect on emissions was corridor dependent. Nevertheless, beginning summer 2016, the agency added health and the social cost of carbon into vehicle emissions benefit-cost factors.

In January 2017, the Federal Transit Administration (FTA) published a programmatic assessment that serves to report on whether certain types of proposed transit projects merit detailed analysis of their GHG emissions at the project level. It also provides a source of data and analysis for FTA and its grantees to reference in future environmental documents for projects in which detailed, project-level GHG analysis would provide only limited information beyond what is collected and considered in this programmatic analysis. The report is available at www.transit.dot.gov/research-innovation/greenhouse-gas-emissions-transit-projects-programmatic-assessment-fta-report-no along with an accompanying [estimator tool](#).

Planning and Environment Linkages (PEL) Processes

Most peer exchange participants indicated that their agencies do not currently have a formal PEL process. Some pointed out that draft PEL process proposals had been prepared but not ever operationalized. There was general agreement among the group that most PEL focus has been on the

environmental side but that a prevalent challenge is determining what discipline—planning or environment—should be the primary reviewer of documents prepared for PEL. The group also commented that outcomes from FHWA’s peer exchanges on PEL lessons learned have been helpful references.

EPA Region 8 described an agreement in place in Colorado to involve a variety of agencies at the PEL stage. Colorado DOT and FHWA recognized that local, state, and federal agencies needed a forum in which to discuss state transportation decisions and plan for environmental stewardship. Accordingly, a Transportation Environmental Resource Council (TERC) was formed to establish and enhance the working relationship among federal, state, and local agencies in Colorado. TERC members routinely look ahead at transportation needs and encourage collaboration at the earliest planning stages. EPA Region 8 commented that it has become involved with a number of PEL studies after receiving notices from the FHWA. A recent example is a section of Interstate-25 south where a PEL study has started. A fast-tracked NEPA project will likely drop out of the PEL and be completed concurrently. From the NEPA standpoint, being involved early in planning has allowed practitioners to become familiar with proposed projects, identify potential environmental concerns, and begin cross agency discussions on ways to address the concerns.

The peer exchange group generally did not believe that including GHG analysis in the planning stages would change the way agencies implement PEL. The prevalent thought was that GHG analyses may be useful for disclosure but likely will not currently drive NEPA decisions given the small expected differences among alternatives. Some commented that it is not good practice to add analyses to a NEPA document only for the sake of doing them; the analyses should add value. For this reason, several DOTs noted that they have focused more on adaptation than mitigation to date.

Emissions Mitigation during Construction

Analyses of construction emissions are sometimes referenced in NEPA analyses. EPA Region 5 noted that it routinely uses a clean diesel checklist for project construction, since construction may offer a good opportunity for achieving emissions reductions for a project; contract specifications can be written in a way that encourages emissions reductions that do not adversely affect contract performance or project schedules. Similarly, FTA pointed out that it frequently includes a line item in contracts regarding reduced idling and/or use of well-tuned machines during construction as part of mitigation commitments.

Analyzing impacts from future climatological conditions

Several peer exchange participants indicated that they had or were in the process of analyzing expected impacts from future climate conditions on their transportation systems. For example:

- MnDOT was one of FHWA’s climate resilience pilot participants. In conjunction with state, local, and MnDOT stakeholders, the project team assessed the vulnerability of 1,819 assets (including bridges, large culverts, pipes, and roads paralleling streams) on Minnesota’s trunk highway system to flash flood risks from increased heavy precipitation. The project focused on two MnDOT Districts that have experienced particularly severe flooding in recent years: District 1 in northeast Minnesota and District 6 in the southeastern portion of the state. A system-wide flash flood vulnerability assessment was conducted for the entire trunk highway network in both districts. Following this, one highly vulnerable facility in each district was selected to serve as a case study on how cost-effective decision-making can be made in the context of a changing climate.
- Ohio DOT (ODOT) used FHWA’s Vulnerability Assessment Scoring Tool (VAST)⁴ to complete its [Infrastructure Resiliency Plan](#). The plan identifies the vulnerability of ODOT’s transportation infrastructure to climate change effects and extreme weather events. The analysis includes a

⁴ www.fhwa.dot.gov/environment/sustainability/resilience/adaptation_framework/modules/

discussion and analysis of the type of transportation assets vulnerable, the degree of exposure, sensitivity, adaptive capacity, and the potential approaches to adapt to these changes. ODOT devised an inventory of potential impacts by looking at what surrounding states with similar environmental factors and weather conditions are experiencing. In general, the analysis has been somewhat of an investment protection exercise, as agency was seeking ways to increase the durability of its infrastructure.

- Illinois DOT (IDOT) also referred to FHWA's pilots in developing its vulnerability assessment, which considered both natural (e.g., earthquakes) and human-made (e.g., homeland security issues) occurrences. As part of the assessment, IDOT rated assets in terms of criticality and relied heavily on the state climatologist for weather data. The agency has since identified flooding to be a primary concern and brought together district bridge and highway engineers to discuss relevant issues. Now, IDOT is currently developing a study that considers the 500-year flood and whether any design changes should be made.
- Michigan DOT (MDOT) has done a statewide vulnerability assessment of its assets, including bridges, culverts, weigh stations, etc. The agency did not believe its LiDAR elevation data to be resolved enough to be integrated with data available on assets for associated decision-making. Future phases of the vulnerability assessment process will better tie elevation data to information on assets, as well as create a dynamic online tool that incorporates vulnerability and risk information by asset into MDOT's asset management database.

Changing Climate Conditions in Long Range Transportation Plans

To date, few of the peer exchange agencies have considered changing climate conditions in their LRTPs. One example is CMAP, which described activities it is currently doing as part of its next LRTP update. Several years ago CMAP produced guidance for municipalities on high-level actions they could take over time to make their infrastructure more resilient. The agency brought in stakeholders with different perspectives, including private industry and the public, to get their input and to discuss issues such as where flooding outside of the floodplains is occurring in region. That information is being used to help guide decision-making regarding land use changes. Now, as the LRTP is being updated, CMAP is conducting a similar trend analysis that will include "alternative futures" in regards to climate and seek input from the public via an information kiosk and mobile app.

For others that have considered extreme weather in the LRTP process, it has typically been an activity done more in terms of response to emergencies, such as hurricanes or acts of terrorism, than to changes in climate. For emergency responders, extreme weather events are realities to which they must react. Some participants indicated that they coordinate with the Department of Homeland Security and the Federal Emergency Management Agency to identify potential vulnerable areas and then use that information to improve decision-making when considering projects planned in those corridors. MDOT noted that it had worked with partner agencies to develop a common set of definitions related to near- and long-term hazards.

Vulnerability Lessons Learned

Identify data needs early. Choosing climate projection data sets and translating them into a format useful for transportation vulnerability assessment can be difficult. Many global climate models were not designed to model extreme participation well, for example. The group emphasized the importance of taking time to identify data gaps and potential analytical approaches.

Obtaining buy-in from internal and external stakeholders is a worthwhile effort. Scenarios can sometimes be hard for people to conceptualize, especially when asked to consider a range of potential futures. Some disciplines may focus on current conditions and not consider potential futures. Look for opportunities to close gaps between policy makers and engineers. Keep a multi-disciplinary approach and

consider how changing conditions may affect all disciplines; it may also be worth talking to non-transportation groups, such as health, pollution control, and public safety organizations.

Resilience or vulnerability assessments are worthwhile. There was consensus that a system-wide assessment can help identify factors that should be taken into consideration when making normal maintenance upgrades. By combining information on which assets are most vulnerable and which are the most critical to the network, better decisions about what projects to prioritize, what actions to take, and when it might make most sense to take them are possible.

Consider the effects of changing climate conditions on species ranges in terms of roadside plantings and maintenance activities. The U.S. Forest Service and Department of Agriculture have done a lot of work on the impacts of climate change on vegetation patterns, which may be a useful resource upon which state DOTs might draw when considering revegetation plantings.

PEER PRESENTATIONS

The second day of the peer exchange began with presentations from select attendees. This section provides overviews of the remarks.

Benefits of Warm Mix Asphalt, U.S. EPA

U.S. EPA Region 5 staff discussed the environmental and economic benefits of warm mix asphalt (WMA), including the potential for using WMA to lower air emissions. Warm mix asphalt, which was first used in the 1970s, is the generic term for a variety of technologies that allow producers of hot mix asphalt pavement material to lower temperatures at which the material is mixed and placed on the road. Its use is increasing across the United States. At least 14 State Highway Agencies have adopted specifications to accommodate WMA, and more than 40 States have roads paved with WMA. In 2011-2012, FHWA featured WMA in its first round of the Every Day Counts (EDC) Initiative as an innovation that could facilitate greater efficiency and save time and resources that could be used to deliver more projects for the same money.⁵

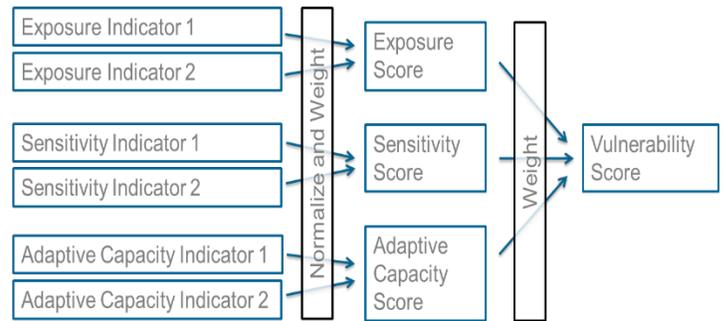
EPA noted that it could work together with FHWA to promote WMA's benefits and reduce barriers to adoption. FHWA staff added that the agency likely would not specify a particular pavement method, but rather leave design details to engineers and contractors in order to leave them latitude for making competitive bids.

Ohio DOT's Resilience Plan, Ohio DOT

A variety of studies from agencies such as the National Oceanic and Atmospheric Administration (NOAA), USACE, and the Transportation Research Board have projected changes for Ohio's climate. Expected changes include a gradual increase in temperature and drought duration, reduced volume of water in Lake Erie, and an increase in rain events. From ODOT's perspective, these changes have pros and cons. On the upside, economic and environmental costs associated with snow and ice management will likely be reduced; the construction season will likely be longer; and goods will likely be more easily moved. On the other hand, summers may become too hot for construction crews; load restrictions during the hottest part of the seasons may increase; pavements may be more likely to buckle and warp; and cars may breakdown more often during high temperature summer days.

⁵ www.fhwa.dot.gov/innovation/everydaycounts/edc-1/wma.cfm

With these tradeoffs in mind, ODOT worked with a consultant to apply FHWA’s VAST and develop infrastructure resiliency plan that was motivated by the higher number and frequency of extreme storm and emergency events that the state has experienced over recent years relative to the past. The study assessed exposure, sensitivity, and adaptive capacity. By applying different weights to different stressors and giving each asset a score that shows how at risk it is, ODOT was able to identify highway segments that are at the most risk—information that is helping the agency to prioritize projects and special design considerations that may need to be incorporated.



Process flow for assessing vulnerabilities

ODOT now plans to update and improve its model over time so that it can be more seamlessly integrated into the agency’s planning program and adjust its design standards where necessary, e.g., areas around the Ohio River and basin. ODOT also continues to work with its operations staff to understand what they are seeing in the field regarding localized events, which provides a good check on the model and encourages local areas to start thinking about assets and infrastructure in regards to different future conditions.

2016 Flooding and Recovery, Wisconsin DOT

Staff from Wisconsin DOT (WisDOT) reviewed the damage, costs of, and recovery actions taken following three major flooding and recovery events that occurred in 2016. The events, which affected 24 counties (three of them twice), resulted in severe damage and required significant repairs to the roadway network. The table below describes characteristics of the three events.

Event Date	Characteristics
July 12, 2016	<ul style="list-style-type: none"> • Storm included straight line winds and some tornados, 8-12 inches rain • Involved four road fatalities, helicopter evacuations • Severity, which was a 1,000 year flood event, was due to location/geography: Lake Superior basin has a significant drop in elevation, fine grained red clay over bedrock made for mudslides and erosion; river course changed in Saxon Harbor • Approximately \$25M in damage to public infrastructure. <ul style="list-style-type: none"> ○ Damage included completely destroyed bridges; highways that are the sole access points to harbors/areas (main way across the northern part of the state); severe flooding; loss of 1500 ft of road core, etc.; deeply buried pipeline destroyed ○ Department of Natural Resources closed 10 parks; U.S. Forest Service closed roads and bridges; bridge destroyed by red clay run-off • Recognized as a Federal emergency • 18 counties assisted with repairs • Typically, the State contracts with county highway agencies for snow plowing and some highway work, so was able to use those contracts to address the flooding issues quickly • WisDOT involved tribes and Federal agencies very early on • Roads rebuilt very fast <ul style="list-style-type: none"> ○ Within a week only the hardest hit roads left to repair ○ All roads open by September
Second event, August 10-11, 2016	<ul style="list-style-type: none"> • Shared event with Minnesota • Extent not enough for Federal emergency funding • 32 highway and structure projects damaged <ul style="list-style-type: none"> ○ Mostly repairs to shoulders, abutments, riprap, culverts, slope repair and stabilization ○ \$8M needed for repairs

	<ul style="list-style-type: none"> • No fatalities
Third event, Month of September (Unusually wet and warm)	<ul style="list-style-type: none"> • Severe damage because of terrain (highly eroded, Wisconsin River drainage) • Mudslides along four main highways affects • Many communities impacted along highway 35 <ul style="list-style-type: none"> ○ Two fatalities (one under mud and one drowned in a truck) ○ Mudslide led to a two-car crash • Near miss on the I-39 and I-90/94 interchange <ul style="list-style-type: none"> ○ Series of wetlands in area; flooding approached road shoulders but did not cover them • Certain aspects of Section 7 coordination relaxed due to emergency status

WisDOT stressed the importance of partnering with public agencies at all levels of government, as well as tribes. Staff also suggest that transportation agencies should consider having assets, such as detour signs, on hand and available for use at any time to avoid delays in helping to get people, goods, and services moving again after similar events.

Questions, Answers, and Comments

Question: Will the repairs withstand 1000-year or 500-year flood?

Answer: Not generally. Some repairs involved upsizing, but due to the geography, oversizing some culverts may not improve performance.

Question: Based on the described experience, can generalizations be made regarding how WisDOT will approach resiliency design differently? Or does it really rely on the specifics of each situation?

Answer: WisDOT has not decided yet.

Illinois All-Hazards Transportation System Vulnerability Assessment, *Illinois DOT*

Illinois DOT (IDOT) staff presented information on the department’s work to complete an “All Hazards Transportation System Vulnerability Assessment and Response Plan.” It was stressed that the assessment, which will consider natural and non-natural (e.g., terrorism) disasters, will benefit multiple sectors. The project team defined the following seven tasks: develop asset inventory, develop all-hazards list, develop vulnerability index, develop potential alternatives list, develop an action plan, prepare draft and final project report, and program administration.

To determine asset criticality IDOT-owned assets were divided into four categories—bridges, roadway corridors, railway corridors, and all of IDOT’s operational facilities. The team then assessed the operational, socioeconomic, and health and safety impacts that different disasters might create. Operational impacts were based on factors such as average daily traffic and roadway functional class. Socioeconomic impacts took into account characteristics such as population sizes and densities. Health and safety impacts were based on considerations such as proximity to hospitals and essential services, and whether environmental justice communities were present.

Weighted vulnerability scores were then calculated to create a generalized risk index. Vulnerabilities were defined by best available data on assets’ susceptibilities to extreme weather events. Flooding variables, for example, were based on information compiled from previous peer meetings, USACE staff, and the state climatologist for Illinois. Risk scores were ultimately combined with criticality rankings to provide an overall score that was then shared with stakeholder groups at the local level to allow them to evaluate exposure.

The all-hazards vulnerability assessment has helped to shed light on where better data is necessary, as well as where project priorities might be. Accordingly, in summer or fall 2017 IDOT plans to release a list of potential projects that takes the all-hazards vulnerability assessment into account.

Questions, Answers, and Comments

Question: Who is envisioned as the tool's end user? Who will update it?

Answer: This is a primary concern. It is expected that operations staff will use the tool for maintenance activities and that planners will use it in project selection. IDOT is moving toward a performance based selection project process, which may help ensure the tool's incorporation into typical workflows.

Question: What is the level of buy in and support from executive management?

Answer: Both the former and current Governors have supported the effort. The current Secretary of Transportation was CMAP's previous director and is also supportive.

Question: What might the fact that some lower level staff who did not fully appreciate the applicability of an analysis like this ultimately "came around"?

Answer: When they were able to see maps, they began to appreciate the analysis. It was also important to involve them in the decision-making regarding what they viewed as the critical assets.

BREAKOUT SESSIONS

On the second day of the peer exchange, participants broke into three groups to separately talk about a common set of questions. The groups then each reported out to the larger group. This section synthesizes the larger group's collective thoughts and comments on the following questions:

- How might climate change considerations be incorporated into NEPA? What does it make sense to do?
- How might information from planning-level vulnerability assessments be incorporated into NEPA?
- How are agencies addressing new requirements to integrate resilience into the transportation planning process?

How might climate change considerations be incorporated into NEPA? What does it make sense to do?

Participants discussed how NEPA is clear in its requirements for considering and emphasizing the review and discussion of impacts that are significant and important to the decision-making process and the alternative selection. The context and intensity of potential impacts should be weighed. To that end, the group mentioned how practitioners should determine what the value added would be for incorporating climate change considerations into NEPA. If the difference in emissions between alternatives is not a deciding factor, perhaps less attention could be given to the topic. With that said, the group believed it may be most appropriate to compare the GHG emissions of the no build and preferred build alternative, if such analysis is incorporated into the NEPA review. It may also be possible for agencies to consider ways to parse out GHG emissions from construction.

The group generally agreed that having current data regarding the potential impacts that may be significant on a given project is also important. For example, having current data on dam and levee status, hydraulics, soil types, floodplains, and upstream land uses is critical to helping determine what climate change-related information might be incorporated into NEPA. This likely entails developing close working relationships with other counterpart agencies and local municipalities.

Other ideas that peer exchange attendees had include:

- Incorporate redundancy in system to ensure access and mobility during and after emergencies.
- Consider a practical, performance-based design approach to "right-size" a project. It may be possible to get a significant and acceptable level of performance out of a project at a lower cost and lower risk of impacts if risks are adequately assessed.

- Think about using mitigation strategies that have co-benefits, such as using plantings that prevent erosion, are pollinators, and can facilitate wildlife passage.
- FHWA might consider general guidance on the characteristics of a project that might make a GHG analysis particularly helpful and/or the factors to consider when deciding whether or how to incorporate climate change into NEPA. Guidance on related issues, such as adding capacity in a heavily urbanized area, might also help transportation agencies better address questions about potential impacts.

How might information from planning-level vulnerability assessments be incorporated into NEPA?

The second breakout group discussion question focused on how information from planning-level vulnerability assessments might be incorporated into NEPA. One group thought a first step might be to frame vulnerabilities in terms of natural disaster or hazard risk. Another group listed the kinds of activities that could effectively make the consideration of resilience concepts during transportation project delivery more commonplace, including:

- Identifying the costs associated with not being resilient;
- Taking a “back to basics” approach where topics such as land-use, zoning, flood storage for retention, and smart growth principles are considered;
- Consulting with other agencies on emergency management and homeland security concerns, for example adding emphasis on flooding to existing plans, procedures, and projected needs. Transportation agencies could make a point of discussing vulnerability assessments at any annual (or recurring) interagency meetings in which they participate.
- Tailoring the message based on the audience;
- Identifying the vulnerable populations early on and coordinating with transit and cycling stakeholders to ensure that all communities are being served; and
- Consistently ground-truthing or updating the assessment

A third group reported out that project proponents should be able to cite vulnerability assessments in their NEPA documents; however, there was a discussion about whether the assessments would give sufficient information for meaningful inclusion. This group mentioned it might be hesitant to put vulnerabilities into the Purpose and Need statement. They believed that information gleaned from a vulnerability assessment would not likely be a driver for selecting a project but could be another tool among many used to help to justify a project and understand the risk within the community/project area.

All groups thought that incorporating planning-level vulnerability assessments into NEPA might be best accomplished through the asset management plan process. MAP-21 required each State to develop a risk-based asset management plan for the NHS to improve or preserve the condition of the assets and the performance of the system. These “Transportation Asset Management Plans” (TAMPs) include, at a minimum:

- Pavement and bridge inventory and conditions on the NHS;
- Objectives and measures;
- Performance gap identification;
- Lifecycle cost and risk management analysis;
- A financial plan; and
- Investment strategies.

The risk mitigation strategies developed for the TAMPs can focus on the risks that extreme weather events pose. The plans might also afford transportation agencies the opportunity to develop methods for tracking repeat extreme weather events and options to avoid repeated repair to help state DOTs implement the requirements of MAP-21 Section 1315(b).

A challenge that was cited is determining whether it is reasonable to engineer to a 1,000-year storm event in the aftermath of having experienced a 1,000-year storm. Low-frequency events do not usually instill confidence among engineers to design to those events. It is important for practitioners to consider what is reasonable for the area and the assets in that area. The group stated that a question transportation now face is whether there are certain network elements that are so valuable that building to a 500- or 1,000-year standard is justified?

How are agencies addressing new requirements to integrate resilience into the transportation planning process?

The FAST Act requires state DOTs and MPOs to integrate resilience into the transportation planning process. Peer exchange participants met in breakout groups to talk about how their respective agencies were addressing the new planning factor, as well as how the provision might be best addressed moving forward. They also discussed how their agencies are planning to address requirements for metropolitan transportation plans (MTPs) to assess capital investment and other strategies to reduce vulnerability for natural disasters.

One group point out that the requirements do not go into effect until May 2018, and thus some agencies are just now beginning to communicate information to staff about the revised planning process.⁶ In general, participants thought it would helpful for MPOs to track the state DOT efforts to develop TAMPs and potentially mimic the state processes at the local level. Another idea was that resilience could be incorporated as a planning factor in terms of travel time reliability in the Transportation Improvement Program—a concept that is a function of mechanical reliability and closely tied to overall investment in the system. It was noted that most MPOs do not have large staffs, however, and that they will likely turn to state agencies to supply the data they need.

TAKEAWAYS

In general, the group agreed that as many factors as possible, including but not limited to GHG analyses and vulnerability assessment information, should be considered early on in order to ensure the most effective decisions possible about what is reasonable for project implementation given resource constraints and competing needs. Other takeaways were:

- There was general agreement that a detailed GHG analysis likely would not currently add much value, but that does not undermine the urgent sense of the need to assess vulnerabilities and plan for resilience. Some participants believed that climate change and extreme weather considerations could emerge as more common elements in NEPA Purpose and Need statements, while playing bigger roles in alternatives analyses and project selection.
- Photos of post-event are compelling and can foster greater support for resiliency efforts. Using photos can be an effective way to frame resilience discussions.
- The peer exchange provided a good forum for practitioners to learn about which agencies had conducted vulnerability analyses, as well as how they had been done.
- Try to be as concrete as possible about climate risks and vulnerabilities, even when considering long range planning options. One idea is to record and track the costs of responding to and recovering from emergency events.
- The group thought the topics discussed at the peer exchange might benefit from greater participation of the American Association of State Highway and Transportation Officials.

⁶ One breakout group mentioned that the Minneapolis MPO has recently been conducting a vulnerability assessment with the assumption that its results would be incorporated into the MTP when complete.

APPENDIX A: AGENDA

April 3–4, 2017
U.S. EPA Region 5 Office
77 W. Jackson Blvd., Chicago, IL
Room 2205, 22nd Floor

Day 1

Welcome and Introductions	12:30 pm
National Perspective: Resiliency Policy, Initiatives, and Projects (<i>U.S. EPA</i>)	12:45
Overview of Climate Resilience in Transportation Planning and NEPA (<i>Becky Lupes, FHWA</i>)	1:15
Analyzing GHG Emissions (<i>Group</i>)	1:45
<ul style="list-style-type: none">• State/agency activities, methods, and data• Key issues, challenges, and notable examples	
<i>Break</i>	3:15
Incorporating GHG Analysis in the Transportation Planning Process and NEPA (<i>Group</i>)	3:30
<ul style="list-style-type: none">• How can planning-level GHG emissions analysis be incorporated in NEPA?• What is being done? Opportunities and expectations	
<i>Adjourn</i>	5:00 pm

Day 2

<i>Recap Day 1</i>	8:30 am
Warm Mix Asphalt Presentation (<i>EPA Region 5</i>)	8:35
Ohio DOT's Resilience Plan (<i>Ohio DOT</i>)	
2016 Flooding and Recovery (<i>Wisconsin DOT</i>)	
Illinois All-Hazards Transportation System Vulnerability Assessment (<i>Illinois DOT</i>)	
<i>Break</i>	10:00
Breakout Sessions (<i>Small Groups</i>)	10:15
<ul style="list-style-type: none">• How might climate change considerations be incorporated into NEPA? What does it make sense to do?• How might information from planning-level vulnerability assessments be incorporated into NEPA?• How are agencies addressing new requirements to integrate resilience into the transportation planning process?	
Takeaways and Next Steps (<i>Group</i>)	11:45
<ul style="list-style-type: none">• Summarize key takeaways• Identify possible next steps	
<i>Adjourn</i>	12:00 pm

APPENDIX B: PEER EXCHANGE PARTICIPANTS

Name	Organization
Niles Annelin	Michigan DOT
Mark Assam	FTA Region 5
Bethaney Bacher-Gresock*	FHWA Wisconsin Division
Michael Batuzich	FHWA Wisconsin Division
Nora Beck	CMAP
Elizabeth Breiseth	FTA Region 5
Ian Chidister	FHWA Wisconsin Division
John Donovan	FHWA Illinois Division
Dana Doubler	Lima-Allen County RPC
Jesse Elam	CMAP
Andrew Emanuele	FHWA Minnesota Division
Sophie Finlayson-Schueler	Lima-Allen County RPC
Caraline Griffith*	Ohio DOT
Chris Hiebert	SEWRPC
Tim Hill*	Ohio DOT
Jeff Houk*	FHWA Resource Center
Kathy Kowal	EPA Region 5
Lisa Lloyd*	EPA Region 8
Becky Lupes	FHWA Headquarters
Kevin Magerr*	EPA Region 3
Patrick Marchman	FHWA Michigan Division
Alexandra Markiewicz	USDOT Volpe Center
Roy Nunnally*	Indiana DOT
Janice Osadczuk	FHWA Indiana Division
Alex Oster	USDOT Volpe Center
Janis Piland	FHWA Illinois Division
Carson Poe	USDOT Volpe Center
Philip Schaffner	DOT Minnesota Division
Chris Schmidt	DOT Illinois Division
Carmen Stemen	FHWA Ohio Division
Jim Thorne	FHWA Resource Center
Amber Tilley*	EPA Region 7
Betsy Tracy	FHWA Illinois Division
Patricia Trainer*	Wisconsin DOT
Ken Westlake	EPA Region 5

*Participated by phone.