

**MnDOT Response:
2021 Sustainable Transportation Advisory
Council Resilience Workgroup
Recommendations**

08/26/2021

Background

In 2020, MnDOT created the Sustainable Transportation Advisory Council (STAC)¹ to invite business, nonprofits, local governments, legislators, and community groups to partner with the agency to provide new ideas for how the state can make progress towards a low carbon transportation future. In March 2021, MnDOT supported a number of recommendations² proposed by two STAC workgroups that were formed in early 2020, Fueling and Powering Transportation and Vehicle Miles Traveled and Transportation Options.

The STAC Transportation System Resilience workgroup formed later in 2020 to explore recommendations related to transportation infrastructure, policies, operations, and material use in Minnesota. The Transportation System Resilience workgroup presented recommendations to MnDOT in May 2021. This document details the MnDOT response to those recommendations.

MnDOT facilitated the STAC process but did not actively participate in the development of the recommendations that came directly from STAC members. It is also worth noting that very few constraints were suggested by MnDOT for STAC members related to transportation climate actions. Both STAC members and MnDOT recognize that some of the recommendations to MnDOT may fall outside of direct agency ability to control, which is described in the MnDOT responses.

¹ <http://www.dot.state.mn.us/sustainability/advisory-council.html>

² <http://www.dot.state.mn.us/sustainability/docs/advisory%20council/stac-recommendations-response-2020.pdf>

MnDOT Response to Transportation System Resilience Recommendations

Recommendation #1: Define and Measure Sustainability and Resilience within the Transportation System

- Define sustainability and resilience as it relates to transportation systems.
- Develop metrics and goals for sustainability and resilience to evaluate new and existing transportation systems. (e.g., Goals could be incorporated into statewide plans, such as MnDOT TAMP.)

MnDOT Related Activities	MnDOT Proposed Action
<ul style="list-style-type: none"> • MnDOT builds on partner agency definitions when applying sustainability and resilience definitions. • MnDOT publishes annual sustainability and resilience targets and metrics. • The Resilience Advisory Team is working on developing a more comprehensive set of resilience measures • Sustainability and resilience are being added to several agency plans, including SMTP and MnSHIP. 	<p>Explore Further:</p> <ul style="list-style-type: none"> • Continue to coordinate with SMTP and MnSHIP update processes to integrate sustainability and resilience metrics and goals. These plans set the direction for all agency efforts. Both plans are currently undergoing an update, with completion scheduled for 2022. • Continue to track and report on sustainability and resilience through annual MnDOT Sustainability Report. Include content in 2021 report that compiles and highlights related agency planning efforts (i.e. add any new measures and goals).

Recommendation #2: Design-Build Project Delivery

- Incorporate sustainability and/or resiliency goals and objectives into Design-Build (DB) projects.
- Increase the use of Design-Build for smaller projects, including sustainability and/or resiliency goals and objectives.
- Encourage sustainable construction practices criteria into Design-Build

MnDOT Related Activities	MnDOT Proposed Action
<ul style="list-style-type: none"> • MnDOT has used environmental factors as part of the scoring criteria for design build. • Previous DB projects have incorporated innovations and identified solutions to unique environmental challenges. 	<p>Support:</p> <ul style="list-style-type: none"> • Work with partners to compile examples of design-build projects that used sustainability or resilience criteria (regionally and nationally) by mid-2022. • Convene temporary workgroup to develop criteria for one (or more) of the focus areas following the action above for the pilot. • Work with staff to identify a project and funding to implement DB with new criteria in next 1-2 years.

Recommendation #3: Proactive Asset Management

- Strengthen communications and share information across organizations (i.e., highway transportation systems versus public works) regarding asset management as it relates to improved infrastructure sustainability and resiliency.
- Educate and partner with local departments to implement a robust, cohesive transportation asset management system that maintains and strengthens both local and state-supported transportation systems.
- Offer peer reviews and information sharing between local, state and (possibly) national asset managers.

MnDOT Related Activities	MnDOT Proposed Action
<ul style="list-style-type: none"> • MnDOT staff are currently engaged in several peer exchanges and best practices workshops. • MnDOT is an active participant in the Institute for Asset Management, America’s Society of Civil Engineer’s (ASCE) report card, and Local Road Research Board (LRRB) related activities. • MnDOT has identified vulnerabilities to the transportation system and is working to incorporate them into asset management. 	<p>Support:</p> <ul style="list-style-type: none"> • Host a convening or workshop on sustainability/resilience in Transportation Asset Management (TAM) with other entities within the state by mid-2022 (e.g., <i>what is working, what other places have done, new innovative solutions/ideas for incorporating more resilience in asset management, identifying where the need is greatest, and how MnDOT’s efforts can benefit smaller entities</i>). • Highlight TAM efforts related to sustainability and resilience efforts on MnDOT’s website.

Additional Transportation System Resilience workgroup recommendations:

- **Review the Design-Bid-Build method for opportunities to incorporate sustainable construction practices into the construction specifications.**
 - **Explore Further** –MnDOT will explore this by researching case studies and opportunities to test, as examples are limited
- **Review existing sustainability measuring systems, such as Greenroads Rating System, for potential applicability of transportation system performance.**
 - **Support** – MnDOT will review existing rating systems to better understand the tradeoffs of using a related rating system and determine their potential benefit to the agency.

TRANSPORTATION SYSTEM RESILIENCE

WORKGROUP:

Recommendations and Response

Workgroup Purpose

The Transportation System Resilience workgroup (TSRWG) was created to develop resilience recommendations related to transportation infrastructure, policies, operations, and material use in Minnesota.

The Transportation System Resilience workgroup identified two key areas for improving resilience of the transportation system:

1. Reduce impacts to the transportation system from extreme weather and climate change.
2. Improve asset management, construction practices and material use to enhance system performance.

The initial information-gathering process revealed that several committees and/or government agencies within the state of Minnesota are actively discussing and providing feedback on reducing impacts to the transportation system from extreme weather and climate change. A summary of these parallel climate resilience committees is in Appendix 1. Several of these committees will share their work product with the Minnesota Department of Transportation (MnDOT). Thus, the TSRWG focused efforts on recommendations related to improving asset management, construction practices and material use to enhance system performance.

Membership

- Tara Wetzel (Co-chair), Mathy Construction
- Greg Ilkka (Co-chair), Steele County, MN
- Dan Schellhammer, Mid-state Reclamation, Inc.
- Chris Sagsveen, Hennepin County (primarily participated in the asset management recommendations)

RECOMMENDATION #1:

Define and Measure Sustainability and Resilience within the Transportation System

Workgroup Recommendation

Why is this important?

Defining parameters that can be used to measure resiliency within the transportation system is the first step to better manage risk associated with climatic change. At the same time, resiliency efforts cannot be successful without increased sustainability in both the construction and operating practices of the transportation systems. The partnership of both parameters is necessary to advance successful outcomes against the effects of climate change. Specifically, targeted definitions of sustainability and resilience related to transportation systems are necessary to define problems and the magnitude of the problems within the system so that purposeful solutions can be developed and subsequently measured to guarantee improved results related to resiliency and sustainability.

How can this move forward?

- MnDOT should define sustainability and resilience as it relates to transportation systems.
- MnDOT should develop metrics and goals for sustainability and resilience to evaluate new and existing transportation systems. (e.g., Goals could be incorporated into statewide plans, such as MnDOT TAMP.)

How does this advance equity and environmental justice?

When developing a definition of sustainability for transportation system and the subsequent metrics, environmental justice and equity will need to be incorporated as one of the core parameters to ensure low-income, minority, and overburdened populations are adequately served as well as included in the transportation project development. Therefore, it will be necessary to consider and, as appropriate, include the human component of the transportation system within the definition.

MnDOT Review and Response

Related Activities

MnDOT prioritizes alignment with partner organizations, and, when possible, uses their definitions for decision-making. While MnDOT does not have an explicitly stated definition of sustainability or resilience as related to transportation, these are priority areas for agency decision-making. The terms are complex enough that MnDOT prefers to use general definitions and pull from partner organizations for more specific situations. Below is a summary of definitions MnDOT relies on.

Sustainability

Generally, sustainability is referred to as the intersection of economy, environment, and society, which directly aligns with the MnDOT Vision of a multimodal transportation system that maximizes the health of people, the environment, and our economy. One key partner definition that MnDOT aligns with is from the Federal Highway Administration (FHWA). FHWA states that [a sustainable approach](#) to highways means *decisionmakers are able to make balanced and efficient choices among environmental, economic, and social values—the triple bottom line of sustainability—that will provide the best benefits to the natural and human environment now.*

To operationalize what sustainability means, the agency has developed measures and goals and reports them annually in the [Sustainability and Public Health report](#). With each iteration of the report, the existing measures and goals are refined and expanded. The table below provides a highlight of key measures. As sustainability is a broad topic, some measures are for the entire sector while others are focused on specific aspects within MnDOT control.

Table of Example Sustainability Targets (full list in [Sustainability and Public Health Report](#))

Sustainability Focus Areas	Category	Targets
Reduce Transportation GHG Emissions	Transportation sector GHG emissions	30% reduction from 2005 levels by 2025
	Electric vehicles	20% of statewide light-duty vehicles are electric by 2030
Lead by Example	Renewable energy	25% of MnDOT agency energy needs met using renewable energy
	Fleet fossil fuel use	30% reduction in use from MnDOT vehicles by 2025
Improve Public Health	Complete Streets	90% of projects with an identified need include bicycling improvements
	Frequency of biking/walking	Increase % of people walking at least a few times per week to 60%
Improve Resilience	Culvert condition	Less than 10% of state-owned culverts in poor or severe condition
	Bridge condition	Less than 2% of NHS bridges are in poor condition

Resilience

MnDOT defines system resiliency³ in the [statewide multimodal transportation plan](#) (SMTP), and more broadly as the capacity of individuals, communities, institutions, businesses, and systems to survive, adapt, and grow, no matter what kinds of chronic stresses and acute shocks they experience. Examples of shocks are fires, drought,

³ “System resiliency refers to reducing vulnerability and ensuring redundancy and reliability to meet essential travel needs. The transportation system is vulnerable to many types of threats and risks, such as severe weather, acts of terrorism and cyber-attacks. Advanced preparation as well as mitigation and adaptation to threats and risks helps to ensure the people and goods are able to continue to travel during emergencies.”

and floods; and examples of stresses are early snow melt in the spring and more winter freeze/thaw cycles. Climate resilience is one aspect of resilience and it does not include broader aspects of the term such as disaster response and cyber security (MnDOT addresses these separately).

MnDOT also pulls resilience guidance heavily from FHWA, which [defines resilience as the ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions](#). Additional versions of the definition are [discussed extensively by the Transportation Research Board \(TRB\)](#) as well (p.16-17).

MnDOT recently started developing a set of targets and metrics for tracking resilience statewide and within the agency. This is an ongoing effort of the Resilience Advisory Team, with the goal to incorporate an updated list into the MnDOT sustainability and public health report annually. Below is a list of the measures under consideration.

Highlights of Measures of Resilience and Proxies

Measure of Resilience or Proxy	Tracking Status
Significant weather-related damage to infrastructure	Currently Tracking
Use of emergency relief funds for repair/rebuild	Currently Tracking
Bridge condition rating	Currently Tracking
Culvert condition rating	Currently Tracking
Bridges with scour plan of action	Currently Tracking
Pavement condition rating	Existing, not tracked with resilience yet
Pavement performance during extreme heat	Not currently tracked
Bridge overtopping location and frequency	Partially existing, not tracked with resilience yet
Wildlife upgraded culverts (aquatic organism passage)	Not currently tracked
Slope failure location and frequency	Not currently tracked
Slope vulnerability rating	Existing, not tracked with resilience yet
Minor flood damage (under \$5k) location and frequency	Not currently tracked
Weather related construction delays and damages	Not currently tracked
Resilience upgrades (slope armoring, raising of roadway, etc.)	Not currently tracked
Road closure location and frequency (when weather related)	Not currently tracked
Installation of green infrastructure (acres, total \$, or projects)	Not currently tracked
Conveyance failures	Not currently tracked
Storm water facility failures	Not currently tracked
Asset vulnerability to projected precipitation events (under development)	Not currently tracked

Beyond the measures listed above, MnDOT is elevating the importance of climate action through its planning efforts. The ongoing updates to the SMTP and MnSHIP are both adding new climate content (objectives, strategies, and actions). The recently completed [Statewide Pedestrian System Plan](#) also added resilience and climate scenario content. These plans are one of the leading avenues through which the Office of Transportation System Management incorporates new priorities in to MnDOT work, including sustainability, resilience, and transportation equity. Adding more clear guidance and goals related to sustainability and resilience to MnDOT’s planning documents will further refine how we define and measure them.

Proposed Action — Explore Further

- Continue to coordinate with SMTP and MnSHIP update processes to integrate sustainability and resilience metrics and goals. These plans set the direction for all agency efforts. Both plans are currently undergoing an update, with completion scheduled for 2022.
- Continue to track and report on sustainability and resilience through annual MnDOT Sustainability Report. Include content in 2021 report that compiles and highlights related agency planning efforts (i.e. add any new measures and goals).

RECOMMENDATION #2:

Design-Build Project Delivery

Workgroup Recommendation

Why is this important?

Design-Build (DB) is a mindset resembling the historic concept of a Master Builder. The Master Builder was not a contractor, architect, or engineer. Instead, the Master Builder represented the integration of all three disciplines into an integrated service. Because DB projects are completed under a single contract, project delivery is streamlined using an integrated team of designers and builders forging an alliance between subject experts to deliver the most innovative project design and construction. DB project delivery allows the owner to set objectives related to transportation system resiliency within the project scope and encourages unified project recommendations and solutions by a team of qualified members incorporating collaborative problem-solving and innovation to deliver a desired outcome. Conversely, traditional project delivery can restrict innovation and problem solving by objective because project designers may (1) not be aware of new technologies, (2) not know if contractors can or are willing to implement new technologies, or (3) be restricted by current specifications. As a result, ability to quickly adapt to climatic change and extreme weather events can be limited. Therefore, increased use of DB project delivery for smaller state DOT and local agency projects could offer innovative solutions for increased resiliency related to climatic change.

How can this move forward?

We recommend that MnDOT should:

- **Incorporate sustainability and/or resiliency goals and objectives into Design-Build projects.**
- **Increase the use of Design-Build for smaller projects, including sustainability and/or resiliency goals and objectives.**
- **Encourage sustainable construction practices criteria into Design-Build.**

How does this advance equity and environmental justice?

The Design-Build (DB) project delivery allows the project owner to set project objectives for construction and design. Thus, projects with the potential to disproportionately impact low-income communities and communities of color can employ specific objectives and project goals to address equity and environmental justice priorities. In turn, the DB entity would provide innovative solutions to meet the project objectives for equity and environmental justice.

MnDOT Review and Response

Related Activities

MnDOT has a framework within the Design-Build program to use scoring criteria focused on innovation. This tool has been used to support innovative sustainability- or resilience-related projects in the past. Two examples are highlighted below:

- MnDOT has previously scored for environmental factors, such as wetlands, noise, etc. This includes numerous projects where criteria asked the contractors to reduce “environmental impacts” in general terms.
- Similar innovative criteria were used for the following projects:
 - St Croix River Crossing: teams were asked to avoid wetlands, avoid contamination, avoid extra phosphorus impacts, etc. Good commitments and ideas were acquired in all areas except phosphorus, where it was determined that phosphorus was too difficult to measure for meaningful commitments.
 - Highway 210 – MnDOT asked contractors to fix and stabilize the slopes in the park while preserving the park character. Teams were scored on both the number of slopes stabilized as well as the maintenance of park character.
 - Crookston slope failure – MnDOT asked the contractors to stabilize the slope (80’) without any particular solution in mind and received four different ideas in response, at least one of which was unexpected, and the unexpected one was selected.

Opportunities and Considerations

Design-build is helpful for identifying innovative, unexpected solutions, and it provides the ability to test or implement solutions quickly. Generally, there are two types or approaches to DB projects: the first is to tweak a regular project, and the second is to solicit solutions to a problem/issue where the best solution is not immediately clear. To determine which specific resilience recommendations would be the most effective, the next step is to consult with other states and agencies.

This process should also work for local governments, although the results or proposed sustainability measures may look different (e.g., pedestrian facilities, rain gardens, etc. vs wetlands and large stormwater solutions for larger projects). A smaller government’s ability to use DB is limited, but having examples from MnDOT could make it a more accessible option. Given the scale of the climate challenge, this is especially important and will likely help address the need for examples of how to fund creative solutions.

Two main aspects of consideration are:

1. If MnDOT attempts to ask for resilience innovation on a project that is not well-suited to such innovation it is possible that no adequate solution will be proposed.
2. If MnDOT uses resilience scoring criteria that are either too specific or too broad, it is possible that contractors will respond with proposals that are not as creative as intended or undesirable, respectively. Selecting the proper project and criteria will be critical for implementing this approach.

Therefore, developing DB criteria for sustainability and resilience is a critical first step. Initial review suggests there are three potential focus areas for sustainability and resilience criteria:

1. Environmental stewardship-related criteria – support wetlands, native plants
2. GHG emissions-related criteria – use of (L)EVs, etc. (though success in emissions reductions can be tough to measure)
3. Stormwater and flood resilience criteria – could include designing for larger storm events with minimal cost increases, increasing resilience without passing more water downstream, etc.

Proposed Action — Support

- Work with partners to compile examples of design-build projects that used sustainability or resilience criteria (regionally and nationally) by mid-2022.
- Convene temporary workgroup to develop criteria for one (or more) of the focus areas following the action above.
- Work with staff to identify a project and funding to implement DB with new criteria in next 1-2 years.

RECOMMENDATION #3:

Proactive Asset Management

Workgroup Recommendation

Why is this important?

Transportation systems are a major financial asset benefitting the community. Efficient and reliable mobility for people, goods and services provide healthy communities, increased market integration, and improved quality of life. Transportation infrastructure is a valuable community asset that must be regularly taken care of and maintained to provide people with the level of service and value they rely on and expect.

Proactive asset management of the transportation system preserves the strength and quality of the systems, which keeps costs down in the long run by reducing the severity of major issues. Early and often scheduled maintenance of transportation systems, especially in areas experiencing extreme climate variability such as the Midwest, often slows the rate of system failure (e.g., freeze/thaw damage caused by water intrusion from cracking), extends the life cycle performance, evaluates if the current system is still relevant or requires re-engineering, and maximizes the financial investment. Effectively, a well-maintained system is more resilient than a poorly maintained system.

How can this move forward?

We recommend MnDOT should:

- **Strengthen communications and share information across organizations (i.e., highway transportation systems versus public works) regarding asset management as it relates to improved infrastructure sustainability and resiliency.**
- **Educate and partner with local departments to implement a robust, cohesive transportation asset management systems that maintain and strengthen both local and state supported transportation systems.**
- **Offer peer reviews and information sharing between local, state and (possibly) national asset managers.**

How does this advance equity and environmental justice?

Effective transportation systems support economic development and growth and provide important social benefits by offering access to employment, social, health and education services. Offering reliable and affordable transportation options for low-income communities and communities of color removes barriers for equitable employment opportunities and other necessary community services.

Proactive asset management could advance equity and environmental justice by using a diverse and inclusive planning process and incorporating socioeconomic indicators in project selection to prioritize infrastructure investments in communities facing disproportionate risk and in environmental justice communities facing disproportionate burden from pollution.

MnDOT Review and Response

Related Activities

MnDOT is actively engaged with asset management improvements and identifying how best to track impacts to the system. Through asset management peer exchanges and professional development networks, staff engage with local partners in supporting the entire transportation system. Asset management staff have recently participated in workshops and conversations related to these topics with partners through various avenues (e.g. the ASCE report card, risk management peer exchange, Institute for Asset Management, etc.).

Examples of asset management work MnDOT does related to resilience include identifying any repeat sites for emergency relief funding, incorporating slope vulnerability research into asset management, and pursuing tools to analyze asset vulnerability to climate impacts both quantitatively and qualitatively. MnDOT staff are also available as knowledge resources through the Local Road Research Board (LRRB) Knowledge Building resources.

Opportunities and Considerations

MnDOT works with FHWA annually to identify topics for peer exchanges, which are often available to local partners to participate in. There is an opportunity to convene an exchange on the intersection of sustainability and resilience with asset management through this existing framework. As part of this discussion, MnDOT could share information from related national-level engagement with local partners, and there may be an opportunity to identify ways to continue collaboration. Other discussion options include identifying recommended resources and current gaps and needs related to sustainability and resilience.

There may be additional opportunities to support partners in advancing sustainability and resilience in asset management by compiling a summary of asset management efforts related to sustainability and resilience in an online resource. This could include information and reports such as the results of a TRS proposal (in development) to explore how other organizations measure resilience and the databases they use to do so.

Proposed Action — Support

- Host a convening or workshop on sustainability/resilience in Transportation Asset Management (TAM) with other entities within the state by mid-2022 (e.g., *what is working, what other places have done, new innovative solutions/ideas for incorporating more resilience in asset management, identifying where the need is greatest, and how MnDOT's efforts can benefit smaller entities*).
- Highlight TAM efforts related to sustainability and resilience efforts on MnDOT's website.

Second-Tier Recommendations

Workgroup Recommendation

- » Review the Design-Bid-Build method for opportunities to incorporate sustainable construction practices into the construction specifications.

MnDOT Review and Response

Related Activities

MnDOT periodically updates project specs to allow for sustainable practices where possible. For example, material reuse during paving, such as warm-in-place and cold-in-place recycling have both been used in existing projects, though their use is limited. Projects have also used recycled glass, shingles, and tires to cut down on new material use and trucking.

To increase the use of sustainable construction practices, MnDOT would need to further explore options to identify ways to minimize the potential for significant cost increases (such as through sustainable grading and base case studies).

Proposed Action — Explore Further: MnDOT will explore this by researching case studies and opportunities to test, as examples are limited.

Workgroup Recommendation

- » Review existing sustainability measuring systems, such as Greenroads Rating System, for potential applicability of transportation system performance.

MnDOT Review and Response

Related Activities

Although MnDOT does not currently use sustainability or resilience rating systems, there is an opportunity to explore these further to better understand the tradeoffs and benefits. These rating systems also offer the option to pull out key criteria, even when certain options do not apply (for example, due to MN not yet having EPDs).

Proposed Action — Support: MnDOT will review existing rating systems to better understand the tradeoffs of using a related rating system and determine their potential benefit to the agency.

MnDOT Review Teams

MnDOT staff coordinated review teams for each recommendation including internal and external stakeholders and subject area experts. Each review team met several times to inform the MnDOT responses, which were approved by agency leadership.

Transportation System Resilience Workgroup

Define and Measure Sustainability and Resilience within the Transportation System: Sustainability and Public Health Division

Design-Build Project Delivery: Peter Davich

Proactive Asset Management: Shannon McGrath, Trisha Stefanski, David Solsrud, Joseph Widing, Bradley Utecht



Memo on Climate Resilience in MN Transportation

Climate Resilience Work in Transportation in MN

Climate change impacts in Minnesota are expected to affect the transportation sector, primarily through increased rainfall and extreme rain events. This memo summarizes ongoing efforts to address climate vulnerability. General information about MnDOT resilience efforts and related research can be found on the [MnDOT Climate Resilience webpage](#) and additional state initiatives can be found [on the state climate website](#).

MnDOT Research project: [Extreme Flood Vulnerability Assessment](#)

A methodology will be developed to characterize the vulnerability of state bridges, large culverts, and pipes to flooding. This effort will build upon the Flash Flood Vulnerability and Adaptation Assessment Pilot Project. That project, completing in 2014, scored bridges, large culverts, and pipes in MnDOT Districts 1 and 6 by their vulnerability to flooding so that detailed assessments of adaptation options for each facility could be prioritized. The current study will develop and test ways to enhance the vulnerability scoring techniques used and ensure their applicability throughout the state. The current project will not actually undertake the statewide assessment, but rather develop an approach that could be used for it. This project will also explore how the outputs of the analysis can be incorporated into MnDOT's asset management systems. The results of this work will be a clear path forward for prioritizing adaptation actions - a key step towards enhancing agency resilience and maintaining good fiscal stewardship.

[University of Minnesota Climate Projections](#)

Researchers at the University of Minnesota are developing a set of climate projections built from a composite of several climate models. Initial results were released in early 2020, and additional data are being compiled and released annually.

[State Climatology Office](#)

The Minnesota State Climatology Office has numerous resources for tracking [trends in climate patterns](#) in Minnesota.

Governor’s Climate Subcabinet Resilience and Adaptation Action (R&AAT) Team

The Governor’s Climate Subcabinet is comprised of 5 action teams, one of which is focused on climate resilience and adaptation. An initial focus of all teams is to identify strategies and policies to consider for the 2021 legislative session. One of the recommendations the R&AAT advanced was the development of dynamically downscaled climate projections (at a 4km scale). A workgroup is exploring how best to advance this work (summer 2020).

Other related MnDOT research

[Slope Vulnerability research](#)

Researchers identified 14 sites representing destabilized roadway slopes in Minnesota. Following site investigations, lab testing and modeling, researchers recommended eight slope stabilization techniques that local engineers can undertake without the help of outside geotechnical engineers. The methods were packaged in a simple, accessible field guide for county engineers.

Urban Drainage Study

MnDOT staff are coordinating a research study on the effectiveness of urban drainage practices to reduce runoff and flooding. The goal is to have a better set of cost-effective urban flood resilience practices.

[Aquatic Organism Passage Culvert Update and Resilience](#)

MnDOT is leading a research project to study how designing for aquatic organism passage can also increase the resilience of the infrastructure.

National Cooperative Highway Research Program (NCHRP) Pilot Test of Climate Change Design Practices Guide for Hydrology and Hydraulics

The objective of this implementation project is to conduct pilot tests in concert with several state departments of transportation (DOTs) to determine the effectiveness and ease of implementing the Design Practices Guide produced in NCHRP Project 15-61.

NCHRP Project 15-61, [Applying Climate Change Information to Hydrologic and Hydraulic Design of Transportation Infrastructure](#), developed a proposed AASHTO Design Practices Guide of national scope that provides hydrologic and hydraulic (H&H) engineers with tools needed to amend current practice to account for future climate change. The guide addresses potential effects of climate change such as sea level rise and extreme rainfall events and will aid inland H&H and coastal engineers responsible for the planning, design, operation, and maintenance of transportation infrastructure to prepare for these effects. The guide provides a comprehensive framework for considering and, where appropriate, incorporating climate change into inland hydrology and coastal analyses. To the extent possible, the guide is independent of specific tools and data sets. Though it is applicable to the tools and data sets available today, it is not tied to them; the guide is structured so that it will remain relevant when new tools and data sets become available in the future.