



mndot.gov/research

FY2021: JULY 1, 2020 – JUNE 30, 2021

RESEARCH AT-A-GLANCE

Informing, Improving and Innovating
Transportation in Minnesota

We developed a method to measure pavement thickness using 3D ground-penetrating radar, allowing us to optimize pavement maintenance efforts. > [Report 2021-19](#)



We successfully conducted six bridge inspections using drones and acquired a fleet of 33 unmanned aircraft systems for future use. > [Report 2021-13](#)



We measured the long-term effects of deicing chemicals and devised innovative ideas for reducing salt use. > [Report 2021-07](#)



DIRECTOR'S MESSAGE



This past year presented new and unprecedented challenges—from the COVID-19 pandemic to social unrest and climate events. MnDOT staff stepped up to address these challenges head-on with passion, ingenuity and a commitment to public service. To capture the innovative solutions that were developed during this time, we surveyed staff and published the [Innovations During COVID-19 report](#).

To proactively respond and inform future decision-making related to COVID-19's impact on the transportation sector, MnDOT opened a special [COVID-19 research solicitation](#). The four funded proposals explore impacts to public engagement, speed and safety, telecommuting and contracting.

With the help of a diverse panel of representatives from across MnDOT, we've also made strides toward developing an agency-wide innovation program. Our goals, objectives and strategies are rooted in an E3 mindset of empathy, experimentation and empowerment. This next year, we look forward to launching our program!

Katie Walker, Director
MnDOT Office of Research & Innovation



MnDOT Library

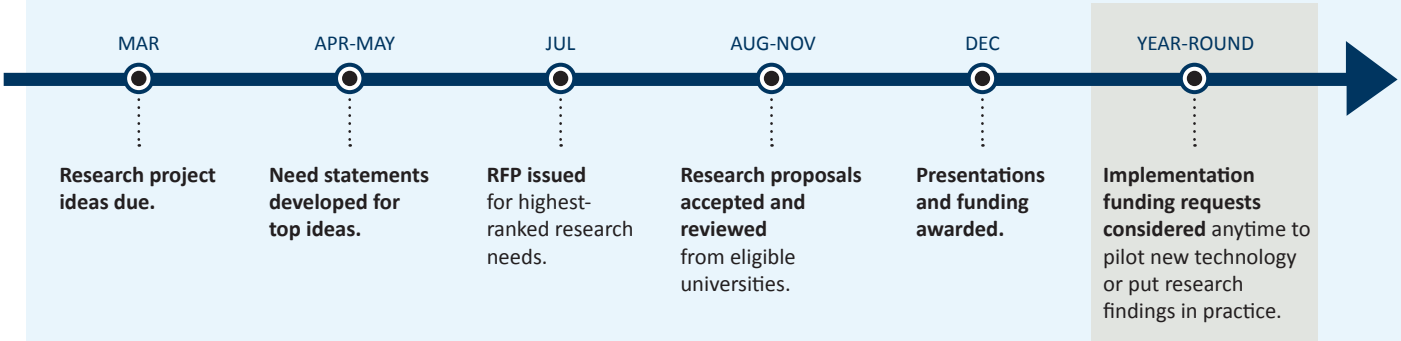
Our librarians are experts at tracking down hard-to-find information and can keep you up to date in your field. Request a literature search, interlibrary loan, periodical or special publication at 651-366-3791, library.dot@state.mn.us or mndot.gov/library. Be sure to look at our new selection of [e-books](#)!

OUR MISSION

MnDOT's Office of Research & Innovation supports Minnesota's transportation community by meeting the innovation and information needs of practitioners.

In addition to running the state transportation library, our office manages research funded by the MnDOT State Research Program (SRP) and Federal Highway Administration (FHWA) State Planning and Research (SP&R) Program (Part II). We also administer the Local Road Research Board (LRRB) program, which facilitates transportation research and information-sharing among city and county engineers.

RESEARCH FUNDING CYCLE



NOTES: Dates subject to change. Check mndot.gov/research for current schedule. Out-of-cycle funding requests are accepted in some circumstances.

OUR STRATEGIC PRIORITIES

Nearly 200 MnDOT professionals and leaders participated in the Research Strategic Direction Visioning workshops. Their input provided the framework for MnDOT's Research Strategic Priorities: safety, advancing equity, asset management, climate change and the environment, and innovation and future needs. These Research Strategic Priorities do not explicitly direct the topics of research; instead, they show ways that research at MnDOT garner progress toward [MnDOT's strategic operating goals and mission](#).



Advancing equity projects aim to recognize the role research plays in the assurance of equitable access to safe and efficient transportation systems. While research may not necessarily focus only on equity, MnDOT prioritizes research projects that advance equitable access to safe and efficient transportation systems.



Asset management research may include projects that focus on asset-related data collection processes and data management, measurement of asset life cycle and life cycle costs. Such projects inform preservation of assets and are critical measurements of return on investment.



Climate change and the environment research may manifest as projects specific to endangered and threatened species, wetland protections, salt use and incursion, congestion impacts on air quality, and the impacts of MnDOT work on the environment.



Innovation and future needs projects help MnDOT to better understand and meet the transportation needs of the future by continuing to invest in forward-looking research.



Safety research aims to ensure that all road users have access to a safe roadway system, work zones are safe for the public and workers, and MnDOT employees have the tools and skills to work in the safest way possible.

RESEARCH HIGHLIGHTS

ADVANCING EQUITY



Conveying Traffic Information to Visually Impaired Pedestrians Through Smartphones

To help pedestrians who are blind or visually impaired safely navigate an urban environment, MnDOT previously developed a smartphone app that accesses traffic signal data to provide audible crosswalk assistance in real time. A new study sought to refine and validate the reliability of the app by testing it at intersections in Stillwater, Minnesota. Investigators installed Bluetooth Low Energy (BLE) beacons at each of the test sites, creating a wireless network to relay traffic signal information to pedestrian users. The tests showed the system functions effectively to improve the mobility and independence of pedestrians with visual impairments. [Report 2020-28](#)

Bluetooth Low Energy beacons were installed on traffic signal poles at test sites in Stillwater.

Evaluating the Community Impacts of Complete Streets Redesign



A Complete Streets redesign in Richfield includes fewer vehicle lanes, a two-lane roundabout, a protected bike lane and wider pedestrian areas.

In 2013, Richfield, Minnesota, introduced a Complete Streets policy that invested in infrastructure improvements geared toward bicyclists and pedestrians. Better lighting, enhanced crosswalks, new bike lanes and bus pullouts have since been added to increase safety and reduce motor vehicle traffic. A new study assessed the effects of these changes on the city's economy and residents' quality of life. While the research did not reveal a significant impact on home sales or prices so far, residents and business owners reported feeling safer as a result of slower traffic and reduced travel times. [Report 2020-22](#)

Transportation Research Synthesis

A Transportation Research Synthesis (TRS) helps answer your research questions without the time or expense of a full research project. These reports may summarize existing research or assess the state of practice through a practitioner survey. For more information, visit mndot.gov/research/TRS.html.



TRS2005, Remote Sensing in Maintenance Work, identified and investigated remote sensing tools to use during maintenance activities in unsheltered encampments along MnDOT's rights of way.

These tools will ensure the safety of maintenance workers and the unsheltered homeless population.

ASSET MANAGEMENT

Using Unmanned Aircraft Systems for Safe, Cost-Effective Bridge Inspections

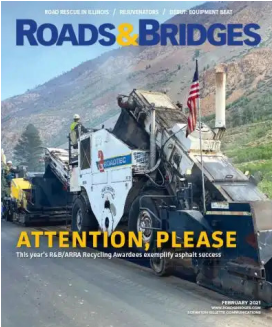


The HoloLens 2 headset enables mixed-reality virtual inspections.

Applying the findings from several completed research efforts, investigators conducted official bridge inspections across the state using unmanned aircraft systems (UAS), or drones, to gather data from hard-to-reach places. With the help of UAS technology, inspectors can accomplish their work more quickly and safely than by traditional means, which might require climbing gear or squeezing into tight spaces. The project resulted in a review of relevant technology as well as a manual that can be referenced to identify bridges that would benefit from UAS inspections. [Report 2021-13](#)

Extending Pavement Life Through Cold In-Place Recycling

Cold in-place recycling (CIR) is a maintenance technique that removes the top 2 to 4 inches of a pavement, mixes this material with asphalt and applies the mixed material to the road surface as a new asphalt layer. This practice is much less expensive than full replacement of the pavement. New research is using on-site testing and supplementary laboratory tests to provide practitioners with tools to reliably determine the effects of on-site curing (applying a hardening sealant) on asphalt layers that have undergone CIR. Results of this research will enhance construction quality and reduce the risk of premature damage to CIR. [Active Project](#)



Minnesota's cold in-place recycling project was featured in Roads & Bridges.

CLIMATE CHANGE AND THE ENVIRONMENT

Better Watering for Salt-Tolerant Roadside Turfgrasses



Drip irrigation systems were installed on turfgrass test plots on several boulevards. Water for these systems was acquired from nearby fire hydrants.

Turfgrasses planted along the 24,000 acres of Minnesota roadways are often difficult to establish due to road salting and other urban stressors. Years of investigation resulted in a more tolerant grass mix that requires an earlier watering regimen than previous mixes. In a new project, researchers designed five new watering systems and tested them along urban roadways. They developed a comprehensive online course for turfgrass installers and a website to guide homeowners living near new turfgrass installations. [Report 2020-03](#)

Harnessing Solar Energy from Noise Barriers and Snow Fences

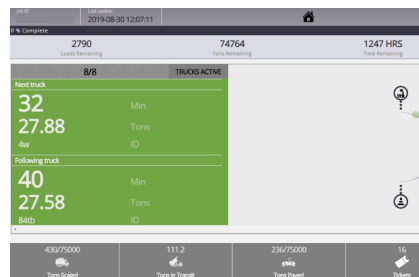
MnDOT recently installed nearly 150 miles of noise barriers and structural snow fences across the state. By adding solar panels to these installations, the agency could support renewable energy, reduce pollution and offset costs related to the structures' construction and ongoing operation. New research evaluated the costs and power-generating capabilities of the solar panels and their influence on noise reduction, visibility, traffic safety and other factors. [Report 2021-20](#)



The research team developed a prototype photovoltaic noise barrier system.

INNOVATION AND FUTURE NEEDS

Electronically Documenting Materials Used in Construction Projects



This e-ticketing software interface reports materials arrival times and is readily accessible for project managers on-site.

Inspectors at highway construction projects have traditionally collected paper receipts to track and audit the materials delivered on-site, resulting in hundreds of thousands of tickets per year and requiring significant resources to properly document, organize, mine and review the information. Based on a pilot study of approximately 40 Minnesota projects, the Material Delivery Management System (MDMS) was designed to capture and store the data electronically. A new report summarizes the lessons learned, future recommendations and the AASHTO provisional practice that was created as a result of the pilot program. [Report 2021-10](#)

Testing Winter Maintenance Innovations



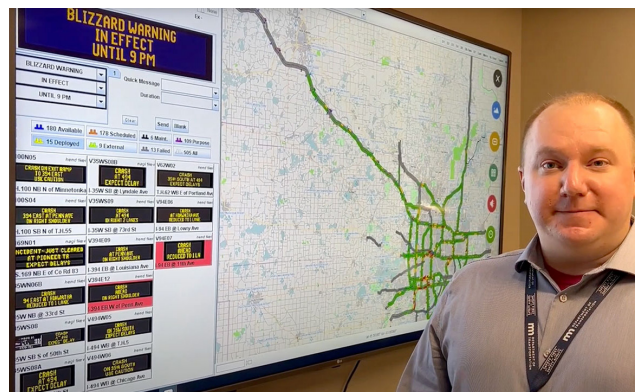
A three-year implementation project is evaluating innovative winter maintenance technologies.

New types of winter maintenance equipment often promise to control snow and ice on roads more efficiently and with less environmental impact. But this equipment must be tested under

real-world conditions before MnDOT can invest in them statewide. After two winters in a three-year research implementation project, MnDOT has evaluated five new pieces of winter maintenance equipment in the Bemidji, Minnesota, area: two slurry spreaders, each intended to offer more operator control and use less salt than traditional equipment; and three snowplows that promise better mobility and reach. For the third winter, the slurry spreaders are moving to the Metro District to assess their use in urban traffic conditions. [Active Project](#)

SAFETY

Enhancing Driver Safety with Weather Alerts on Dynamic Message Signs



Real-time weather alerts can be automatically posted to DMS through MnDOT's new system.


With nearly 400 dynamic message signs (DMS) along Minnesota's highways, MnDOT often provides real-time warnings to motorists about delays or hazards ahead. But weather-related alerts have been limited because of the time-sensitive nature of the information and the risk that motorists wouldn't take the messages seriously. To make winter road weather alerts most effective, researchers developed software that takes weather alerts from the National Weather Service, selects the appropriate DMS locations and automatically posts the alert message until it expires. This practice will enhance the timeliness and accuracy of DMS alerts for severe weather and improve safety for travelers across the state. [Report 2021-24](#)

Pavement Marking Standards Project Earns AASHTO Award

Research that developed performance standards for nighttime, rainy visibility of roadway edge lines and centerlines received an American Association of State Highway and Transportation Officials (AASHTO) High Value Research Award. [Report 2020-09](#)



LEVERAGING OUR RESEARCH DOLLARS

For every \$1  invested in a pooled fund study with other states, MnDOT leverages \$10  worth of research.

The Transportation Pooled Fund (TPF) Program allows federal, state and local agencies and other organizations to combine resources to support research into shared transportation priorities.

Minnesota leads nine pooled funds and participates in another 36. Find a summary of all pooled fund activity at mndot.gov/research/pooled.html. Some of our notable studies:



research for winter highway maintenance

Clear Roads. The Clear Roads research program brings together transportation professionals and researchers from around the country to drive innovation in winter maintenance. By evaluating materials, equipment and methods in real-world conditions, the program identifies the most effective techniques and technologies to save agencies money, improve safety and mobility, and increase efficiency. clearroads.org



National Road Research Alliance. The National Road Research Alliance (NRRA) was created by MnDOT to help fund and direct research at the MnROAD cold-weather pavement test track. NRRA finds ways to build roads faster, make them last longer, perform better, cost less to build and maintain, and have less impact on the environment. mndot.gov/mnroad/nrra



North/West Passage. Minnesota initiated this pooled fund to investigate intelligent transportation systems solutions to traffic management, traveler information and commercial vehicle operations on Interstates 90 and 94 between Washington and Minnesota. nwpassage.info

A screenshot of a webinar titled 'Clear Roads Project CR19-02'. The webinar is presented by the Minnesota Department of Transportation (MnDOT). The slide shows a 'Case Studies' section with bullet points: 'Capturing Information to Improve your Program' and 'Mentoring Program (formal and informal)'. The slide also features a 'MENTORING' graphic with icons for a person, a lightbulb, and a document. The text on the slide reads: 'created a guide and webinar presenting innovative, practical strategies for recruiting and retaining highway maintenance employees. Case studies cover recruitment programs, retention strategies, recruiting practices that focus on younger workers and those from underrepresented groups, and program improvements.'

How to Participate in National Research Projects

Pooled Funds — If your research idea addresses an issue that affects multiple states, we can help establish a TPF project to leverage resources and collaborate with other state DOTs to solve a problem. Find guidance at mndot.gov/research/pooled.html.

NCHRP Research — If you are trying to solve a problem of regional or national significance, we can help you develop a problem statement through the National Cooperative Highway Research Program (NCHRP). Contact us at research.dot@state.mn.us.

Track National Trends

Get the latest research news in your subject area from across the country by searching the national database (trid.trb.org), watching webinars (webinar.mytrb.org) and signing up for the e-newsletter (trb.org).



FY2021 RESEARCH ACTIVITIES

FINANCIAL OVERVIEW

MnDOT research is funded through the MnDOT State Research Program (SRP) and Federal Highway Administration (FHWA) State Planning and Research (SP&R) Program (Part II). MnDOT’s Office of Research & Innovation also manages research for the Minnesota Local Road Research Board (LRRB).

FY2021 Funding Sources

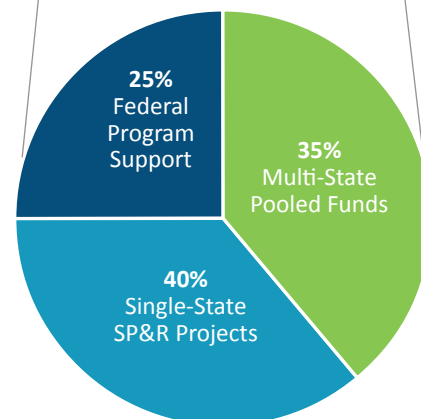
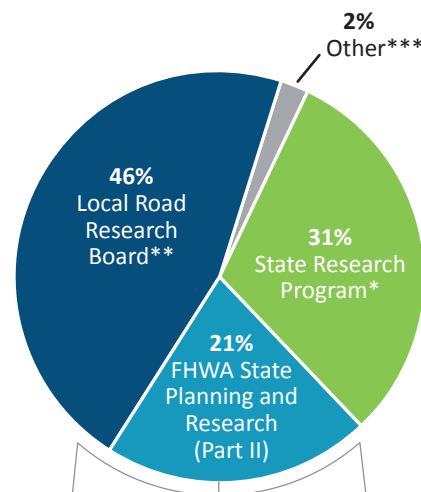
State Research Program*	\$	5,559,173
FHWA State Planning and Research (Part II)	\$	3,643,603
Local Road Research Board**	\$	8,036,152
Other***	\$	415,891
Total	\$	17,654,819

* Includes \$921,726 carried forward from FY2020. Also represents \$1,982,303 in pass-through funding for University of Minnesota Center for Transportation Studies (CTS) operations.
** Includes \$3,612,070 carried forward from FY2020.
*** Includes contributions from other MnDOT funds, partnerships with other agencies, and other federal sources.

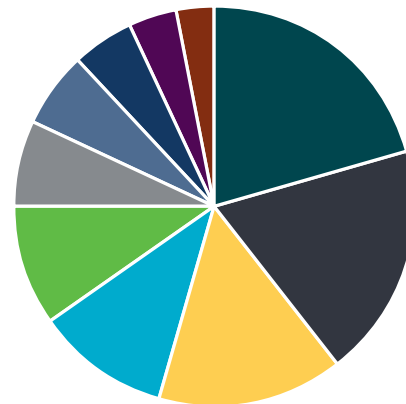
Subset: FY2021 SP&R (Part II) Funding Distribution*

FHWA SP&R (Part II) funds are allocated to MnDOT for eligible state-specific needs and to participate in multi-state initiatives as shown below:

Multi-State Pooled Funds	\$	1,259,416
a: Participation in Pooled Funds Led by Other States	\$	545,600
b: MnDOT-Led Pooled Funds	\$	713,816
Single-State SP&R Projects	\$	1,469,268
Federal Program Support	\$	914,919
a: National Cooperative Highway Research Program	\$	759,316
b: Transportation Research Board	\$	140,603
c: AASHTO	\$	15,000
Total	\$	3,643,603



FY2021 Expenditures by Research Topic/Program Area



Total: \$13,382,224*

21% Materials & Construction
19% Dedicated Programs (CTS & LTAP)
15% Traffic & Safety
11% Maintenance Operations & Security
10% Environmental
7% Federal Program Support
6% Multimodal
5% Bridges & Structures
4% Policy & Planning
3% Administrative

*This total is less than the total in Figure 1 because it includes only contracts and leaves out purchase orders, travel and most staff salaries.

FY2021 RESEARCH CONTRACTS

Each research topic area on the following pages includes two tables:

- Research reports completed in fiscal year 2021 (FY2021) followed by other research contracts active during FY2021, sorted by contract end date.
- Multi-state pooled funds and American Association of State Highway and Transportation Officials (AASHTO) projects, with MnDOT-led pooled funds listed first.

Prefixes in project titles indicate funding for projects not supported entirely by the MnDOT SRP:

- INV** – Partial or full LRRB funded
- MPR/MP** – 80% federally funded/20% state funded
- TPF** – MnDOT-administered pooled fund (100% federal funds)

For more information about projects, including two-page Technical Summaries for completed reports, search by the title on the “Projects” tab at mndot.gov/research. For more information about pooled funds, search at pooledfund.org.

BRIDGES & STRUCTURES

Report Number	Title	Investigator	Technical Liaison	End Date	Total Cost
2020-16A, 2020-16	INV 983: Development of Cost-Competitive Timber Bridge Designs for Long-Term Performance	Don Fosnacht, University of Minnesota Duluth	David Conkel	8/31/20	\$212,883
2020-24, 2020-24A	MP-18(005): Appendices for Review and Assessment of Past MnDOT Bridge Barrier Types	William Williams, Texas A&M Transportation Institute	Paul Rowekamp	7/31/20	\$145,554
2021-13	Unmanned Aircraft Systems (UAS): Metro District Bridge Inspection Implementation	Barritt Lovelace, Collins Engineers, Inc.	Jennifer Wells	5/31/21	\$99,897
2021-23	Retightening the Large Anchor Bolts of Support Structures for Signs and Luminaires—Phase II	Brent Phares, Iowa State University	Jihshya Lin	9/30/21	\$175,000
2021RIC01	Full Depth Reclamation Resource Guide for Urban and Suburban Street Application (and Appendices)	Michael Marti, SRF Consulting Group, Inc.	Guy Kohlhofer	6/12/21	\$34,676
	Steel Reinforcement Section Loss Guidance Tables	Behrouz Shafei, Iowa State University	Paul Pilarski	1/31/22	\$100,966
	MP-19(004): Implementation of Culvert Design Guide for Stream Connectivity and Aquatic Organism Passage (AOP)	Matt Hernick, University of Minnesota	Nicole Bartelt	1/31/22	\$60,001
	Bridge Pile Repair Using Underwater Fiber Reinforced Polymer (FRP) Sleeve and Steel Reinforced Grout	William Schilling, AECOM Technical Services, Inc.	Nickolas Haltvick	1/31/22	\$99,751
	Building 360 Scanning and Reality Modeling	Barritt Lovelace, Collins Engineers, Inc.	Christopher Bjork	6/30/22	\$99,709
	Load Rating Assessment of Three Slab-Span Bridges Over Shingle Creek	Ben Dymond, University of Minnesota Duluth	Yihong Gao	6/30/22	\$181,243
	INV 645: Culvert Type Evaluation: Concrete vs. Plastic vs. Corrugated Metal	Michael Marti, SRF Consulting Group, Inc.	Karin Grandia	6/30/22	\$45,999
	MP-18(008): Detecting Pile Length of Sign Structures and High Mast Poles	Bojan Guzina, University of Minnesota	Richard Lamb	7/31/22	\$198,000
	MP-18(004): Assessment of Bridge Decks With Glass Fiber Reinforced Polymer (GFRP) Reinforcement	Behrouz Shafei, Iowa State University	Paul Kettleson	3/31/23	\$100,104

FUNDED FOR FY2022: Development of Element Level Bridge Performance Measures and Targets

Bridges & Structures Pooled Fund Studies

Study Number	Title	Lead State or Agency	Number of Participating Agencies	Total Cost	2021 MnDOT Contribution	Total MN Contribution	Current MN Contribution End Date
TPF-5(372)	Building Information Modeling (BIM) for Bridges and Structures	IA	25	\$2,140,000	\$20,000	\$80,000	2022
TPF-5(387)	Development of an Integrated Unmanned Aerial Systems (UAS) Validation Center	IN	9	\$675,000	\$0	\$75,000	2020

Bridges & Structures Pooled Fund Studies [cont.]

Study Number	Title	Lead State or Agency	Number of Participating Agencies	Total Cost	2021 MnDOT Contribution	Total MN Contribution	Current MN Contribution End Date
TPF-5(392)	Construction of Low-Cracking High-Performance Bridge Decks Incorporating New Technology	KS	2	\$390,000	\$105,000	\$255,000	2021
TPF-5(432)	Bridge Element Deterioration for Midwest States	WI	12	\$500,000	\$0	\$40,000	2020
TPF-5(436)	Development of Criteria to Assess the Effects of Pack-Out Corrosion in Built-Up Steel Members	IN	6	\$800,000	\$40,000	\$120,000	2021
TPF-5(464)	Hydrologic and Hydraulic Software Enhancements (SMS, WMS, Hydraulic Toolbox and HY-8)	FHWA	8	\$450,000	\$10,000	\$50,000	2025
TPF-5(468)	Structural Behavior of Ultra-High Performance Concrete	FHWA	9	\$600,000	\$10,000	\$50,000	2024
TPF-5(474)	Bridge Deck Preservation Portal	IA	5	\$300,000	\$20,000	\$60,000	2023

ENVIRONMENTAL					
Report Number	Title	Investigator	Technical Liaison	End Date	Total Cost
2020-15	INV 1016: Permeable Pavement for Road Salt Reduction	John Gulliver, University of Minnesota	Richard McCoy	8/31/20	\$197,835
2020-23	MPR-5(006): Monitoring and Performance Analysis of the TH610 Iron-Enhanced Filtration System	Omid Mohseni, Barr Engineering Company	Beth Neuendorf	8/31/20	\$65,001
2020-26	Use of Innovative Technology to Deter Bat Bridge Use Prior to and During Construction	Basak Aldemir Bektas, Minnesota State University, Mankato	Christopher Smith	10/31/20	\$30,606
2020-26	Use of Innovative Technology to Deter Bat Bridge Use Prior to and During Construction	Katelyn Freeseaman, Iowa State University	Christopher Smith	10/31/20	\$112,684
2020-27	INV 1027: Characterization of Runoff Quality From Paved Low-Volume Roads and Optimization of Treatment Methods	John Gulliver, University of Minnesota	John Welle	11/30/20	\$192,527
2021-14	INV 1039: Design and Construction of Infiltration Facilities	John Gulliver, University of Minnesota	Dwayne Stenlund	8/31/21	\$238,572
2021-15	Continued Monitoring of Stormwater Effluents From Filter Media in Two Bioslope Sites	Meijun Cai, University of Minnesota Duluth	Dwayne Stenlund	6/30/21	\$33,250
2021-20	Harnessing Solar Energy Through Noise Barriers and Structural Snow Fencing	Mijia Yang, North Dakota State University	Daniel Gullickson	6/30/21	\$149,060
	Assessment of Field Infiltration Performance of Swales in Comparison to Minnesota Swales Calculator Estimates	Rena Weis, Wenck Associates, Inc.	Nicklas Tiedeken	7/31/21	\$94,685
	MP-20(009): Have Minnesota’s Warmer Winters Increased the Number of Freeze-Thaw Cycles?	Halil Ceylan, Iowa State University	Jeffrey Meek	8/31/21	\$59,984
	INV 1041: Assessing Culverts in Minnesota: Fish Passage and Storm Vulnerability	Jessica Kozarek, University of Minnesota	Nicole Bartelt	11/30/21	\$158,374
	TPF-5(362): Improvements to the Infrastructure Carbon Estimator (ICE)	Jeffrey Ang-Olson, ICF Incorporated, LLC	Timothy Sexton	1/31/22	\$409,992
	INV 1060: Reuse of Regional Waste in Sustainably Designed Soils	David Saftner, University of Minnesota Duluth	Dwayne Stenlund	1/31/22	\$197,406
	INV 1059: Wet Pond Maintenance for Phosphorus Retention	John Gulliver, University of Minnesota	Leslie Stovring	6/30/22	\$222,467
	Environmental Field Evaluation of Potassium Acetate (KAc)	Chris Rehmann, Iowa State University	Tara Carson	6/30/22	\$212,877
	INV 1063: Evaluation of Environmental Impacts of Potassium Acetate Used as a Road Salt Alternative	John Gulliver, University of Minnesota	Nicklas Tiedeken	7/31/22	\$214,743

ENVIRONMENTAL [cont.]

Report Number	Title	Investigator	Technical Liaison	End Date	Total Cost
	INV 1038: Regional Optimization of Roadside Turfgrass Seed Mixtures—Phase II: Regional Field Trials and Economic Analysis	Eric Watkins, University of Minnesota	Dwayne Stenlund	8/31/22	\$467,139
	INV 1084: Cost-Effective Roadside Revegetation Methods to Support Insect Pollinators	Emilie Snell-Rood, University of Minnesota	Dan MacSwain, Christopher Smith	8/31/22	\$281,412
	Turfgrass Seed Variety Evaluation Process	Eric Watkins, University of Minnesota	Warren Tuel	1/31/23	\$59,460
	MP-20(006): Climate Change Adaptation of Urban Stormwater Infrastructure	John Gulliver, University of Minnesota	Erik Brenna	6/30/23	\$224,997
	INV 1077: Stormwater Pond Maintenance and Wetland Management for Phosphorus Retention	John Gulliver, University of Minnesota	Ross Bintner	6/30/23	\$247,237
	MP-21(002): Identifying Deer-Vehicle Collision Concentrations in Minnesota	Raphael Stern, University of Minnesota	Christopher Smith	11/30/23	\$165,450
	INV 1094: Comparison of Compost and Proprietary Soil Amendments for Vegetation Establishment	Bora Cetin, Michigan State University	Warren Tuel	3/31/24	\$260,000

FUNDED FOR FY2022: Assessing a New Tool for Early Detection of Endangered Turtles on Proposed Transportation Projects; Boulevard Tree Selection—Best Practices; Reuse of Minnesota Waste Material in Sustainably Designed Soils—Phase II; Statistical and Process-Based Models of Stormwater Treatment Basin Aging to Quantify Infiltration Rate Sustainability and Maintenance Intervals; Regional Optimization of Roadside Turfgrass Seed Mixtures—Phase III; Tire-Derived Aggregate (TDA): Lightweight Fill and as Stormwater Infiltration Media; Update of 2009 Stormwater Management Best Practices Manual

Environmental Pooled Fund Studies

Study Number	Title	Lead State or Agency	Number of Participating Agencies	Total Cost	2021 MnDOT Contribution	Total MN Contribution	Current MN Commitment End Date
TPF-5(352)	Recycled Materials Resource Center—4th Generation	WI	9	\$1,380,000	\$0	\$200,000	2020
TPF-5(358)	Wildlife Collision Reduction and Habitat Connectivity	NV	13	\$1,275,000	\$20,000	\$100,000	2021
TPF-5(460)	Flood-Frequency Analysis in the Midwest: Addressing Potential Nonstationary Annual Peak-Flow Records	SD	6	\$1,223,200	\$55,600	\$222,400	2024

MAINTENANCE OPERATIONS

Report Number	Title	Investigator	Technical Liaison	End Date	Total Cost
2020-25	INV 1047: Techno-Economic Analysis of Implementing Hybrid Electric Utility Vehicles in Municipal Fleets	Will Northrop, University of Minnesota	Kevin Schlangen	7/31/20	\$100,767
2020-32, 2020-32A	MP-19(002): Appendices for Hot Shots for Cold Climates: Evaluating Treatment of the Hardest Icy Spots	Stephen Druschel, Minnesota State University, Mankato	Thomas Peters	1/31/21	\$170,315
2021-07	INV 1034: Adaptive Management to Improve Deicing Operations	Larry Baker, University of Minnesota	Ross Bintner, Jessica Wilson	3/31/21	\$204,000
2021RIC04	INV 645: Best Practices to Manage Effects of Settlement and Heave at Catch Basins and Manholes	Derek Tompkins, American Engineering Testing, Inc.	Steven Bot	7/31/21	\$59,676
2022RIC05	INV 645: Minnesota Snow and Ice Field Handbook for Snowplow Operators Update	Mindy Carlson, University of Minnesota	Kathleen Schaefer	2/28/22	\$20,000
CR19-02, CR19-02A, CR19-02C	TPF-5(353): Recruitment and Retention of Highway Maintenance Workers (Case Studies and Recommendations)	Laura Fay, Montana State University, Western Transportation Institute	Thomas Peters	7/31/21	\$70,000

MAINTENANCE OPERATIONS [cont.]					
Report Number	Title	Investigator	Technical Liaison	End Date	Total Cost
TRS2004	Preventive Maintenance and Inspection for Traffic Signals, Roadway Lighting and Overhead Sign Structures	Mark Linsenmayer, CTC & Associates, LLC	Ray Starr	11/30/20	\$16,243
TRS2005	Remote Sensing in Maintenance Work	Michael Marti, SRF Consulting Group, Inc.	Peter Morey	10/31/20	\$14,906
	TPF-5(353): Clear Roads II: Alternative Methods for Deicing	Laura Fay, Montana State University, Western Transportation Institute	Thomas Peters	7/31/20	\$77,529
	TPF-5(353): Clear Roads II: Defensive Driving for Snowplow Operators	Matthew Camden, Virginia Polytechnic Institute and State University	Thomas Peters	8/31/20	\$70,000
	TPF-5(353): Clear Roads II: Integrating Advanced Technologies Into Winter Operations Decisions	Erik Minge, SRF Consulting Group, Inc.	Thomas Peters	12/31/20	\$100,000
	TPF-5(353): Clear Roads II: Evaluation of SSI and WSI Variables	Chris Albrecht, The Narwhal Group	Thomas Peters	12/31/20	\$74,927
	Roadside Mowing and Spraying: Standardization of Recording, Reporting and Mapping Solutions: TRS	Michael Marti, SRF Consulting Group, Inc.	Clark Moe	4/30/21	\$14,839
	TPF-5(353): Clear Roads II: Aftermarket Cameras in Winter Maintenance Vehicles	Erik Minge, SRF Consulting Group, Inc.	Thomas Peters	6/30/21	\$92,977
	TPF-5(353): Clear Roads II: Review and Summary of Prewet Methods and Procedures	Xianming Shi, Washington State University	Thomas Peters	6/30/21	\$74,721
	Remote Sensing in Unsheltered Encampments	Michael Marti, SRF Consulting Group, Inc.	Brian Duffee	6/30/21	\$10,846
	MOR/Operations: Evaluation of Slurry Box, Underbody Scraper and Two-Way Reversible Plow	Brian Hirt, CTC & Associates, LLC	Thomas Peters	7/31/21	\$39,641
	TPF-5(353): FY2020 T79 Plug-and-Play Amendment 1 (MnIT Contract)	Parsons Transportation Group, Inc.	Thomas Peters	9/30/21	\$40,000
	TPF-5(353): Entry-Level Driver Training (CDL) for Maintenance Equipment Operators	Matthew Camden, Virginia Polytechnic Institute and State University	Thomas Peters	9/30/21	\$199,986
	TPF-5(353): Synthesis of Technical Requirements and Considerations for an Automated Snowplow Route Optimization RFP Template	Jonathan Dowds, University of Vermont	Thomas Peters	10/31/21	\$73,516
	TPF-5(353): Expanding Application Rate Guidance for Salt Brine Blends for Direct Liquid Application and Anti-Icing	David Noyce, University of Wisconsin–Madison	Thomas Peters	12/31/21	\$150,000
	TPF-5(353): AWSSI Enhancements—Phase II	Michael Timlin, University of Illinois	Thomas Peters	12/31/21	\$39,809
	TPF-5(353): Clear Roads II: High Performance Blade Evaluation	William Schneider, University of Akron	Thomas Peters	1/31/22	\$195,747
	MP-20(002): Promoting the Adoption of Snow Fences Through Landowner Engagement	Dean Current, University of Minnesota	Daniel Gullickson	1/31/22	\$134,967
	TPF-5(353): Measuring the Efficiencies of Tow Plows and Wing Plows	Ty Lasky, University of California, Davis	Thomas Peters	1/31/22	\$138,986
	TPF-5(353): Understanding the NaCl Phase Diagram	Laura Fay, Montana State University, Western Transportation Institute	Thomas Peters	1/31/22	\$100,000
	TPF-5(353): Continued Support for Weather Event Reconstruction and Analysis Tool	John Grant, The Narwhal Group	Thomas Peters	4/30/22	\$14,484
	TPF-5(353): Clear Roads II: Standard Test Procedure for Ice Melting Capacity of Deicers	Xianming Shi, Washington State University	Thomas Peters	5/31/22	\$74,087
	TPF-5(353): Clear Roads II: Clear Roads Administration, Research Support and Information Services	Patrick Casey, CTC & Associates, LLC	Thomas Peters	6/30/22	\$1,037,156
	INV 1078: Benefit/Cost of Applying a Higher Asphalt Film Thickness (AFT) vs. Doing a Chip Seal at One Year	Charles Jahren, Iowa State University	Bruce Hasbargen	7/31/22	\$145,001

MAINTENANCE OPERATIONS [cont.]					
Report Number	Title	Investigator	Technical Liaison	End Date	Total Cost
	TPF-5(353): Salt Shed Design Template	Wilfrid Nixon, Wilfrid A. Nixon and Associates, LLC	Thomas Peters	7/31/22	\$124,989
	TPF-5(353): Using GIS to Highlight Highway Segments Sensitive to Deicing Materials	Erik Minge, SRF Consulting Group, Inc.	Thomas Peters	7/31/22	\$98,558
	TPF-5(353): Expanded Use of AVL/GPS Technology	Ming Shiun Lee, AECOM Technical Services, Inc.	Thomas Peters	8/31/22	\$73,124
	INV 1065: Implementation of Lane Boundary Guidance System for Snowplow Operations	Max Donath, University of Minnesota	Daniel Rowe	10/31/22	\$723,034
	MP-18(010): Reducing Winter Maintenance Equipment Fuel Consumption Using Advanced Vehicle Data Analytics	Will Northrop, University of Minnesota	Joseph Huneke	1/31/23	\$212,919
	INV 645: Snowplow Optimization and GPS/AVL on Maintenance Equipment	Susan Miller, SRF Consulting Group, Inc.	Joe MacPherson	1/31/23	\$85,729
	TPF-5(353): Third-Party Laboratory Testing for the Clear Roads Qualified Products Lists	Analytical Laboratories, Inc.	Thomas Peters	12/31/25	\$60,000

FUNDED FOR FY2022: Asset Management Tools for Local Governments; Cutting Edges Performance User’s Guide; Haul Road and Detour Maintenance

Maintenance Operations Pooled Fund Studies

Study Number	Title	Lead State or Agency	Number of Participating Agencies	Total Cost	2021 MnDOT Contribution	Total MN Contribution	Current MN Commitment End Date
TPF-5(353)	Clear Roads II	MN	36	\$4,075,000	\$25,000	\$125,000	2021
TPF-5(347)	Development of Maintenance Decision Support System	SD	14	\$1,925,149	\$30,000	\$195,000	2022

MATERIALS & CONSTRUCTION

Report Number	Title	Investigator	Technical Liaison	End Date	Total Cost
2020-21	MP-19(009): MnDOT Slope Vulnerability Assessments—Phase III	Jen Holmstadt, WSB & Associates, Inc.	Raul Velasquez	8/31/20	\$94,097
2020-33	Use of J-Band to Improve the Performance of the HMA Longitudinal Joint	Christopher Williams, Iowa State University	Eddie Johnson	12/31/20	\$125,871
2020-34	INV 1028: Is Seal Coating Counterproductive or Not?	Zhanping You, Michigan Technological University	Steven Bot	12/31/20	\$140,508
2021-02	MP-18(011): Test Methods to Quantify Cracking Resistance of Asphalt Binders and Mixtures	Dave Newcomb, Texas A&M Transportation Institute	David Van Deusen	2/28/21	\$203,641
2021-04	MP-19(009): MnDOT Slope Vulnerability Assessments—Phase IV	Jen Holmstadt, WSB & Associates, Inc.	Raul Velasquez	4/30/21	\$72,793
2021-05	Modulus and Dynamic Cone Penetrometer Data Collection for Full-Depth Reclamation Projects	Derek Tompkins, American Engineering Testing, Inc.	Bruce Tanquist	2/28/21	\$99,997
2021-09	Use of Relative Surface Technology for Creation of Relative Milling Surface Models and During the Automated Machine Guidance Milling Operation	Blair Scheibel, RDO Equipment Co.	Shawn Groven	6/30/21	\$34,556
2021-10	Use of Material Delivery Management System (MDMS) for Asphalt Paving Applications	Rebecca Embacher, MnDOT Office of Materials and Road Research	Rebecca Embacher	4/30/21	\$0
2021-11	MP-17(009): Unbound Recycled Materials Database for MnPAVE-Flexible	Derek Tompkins, American Engineering Testing, Inc.	David Van Deusen	5/31/21	\$74,999

MATERIALS & CONSTRUCTION [cont.]					
Report Number	Title	Investigator	Technical Liaison	End Date	Total Cost
2021-18	INV 1046: Innovative Materials and Advanced Technologies for a Sustainable Pavement Infrastructure	Jia-Liang Le, University of Minnesota	Juan Pinero	6/30/21	\$151,514
2021-19	Pavement Thickness Evaluation Using 3D Ground Penetrating Radar	Lev Khazanovich, University of Pittsburgh	Shongtao Dai	6/30/21	\$113,852
2021-26A, 2021-26	INV 1068: Effectiveness of Geotextiles/Geogrids in Roadway Construction: Determine a Granular Equivalent (GE) Factor	Vernon Schaefer, Iowa State University	Michael McCarty	10/31/21	\$197,339
2021-28	MP-18(006): Quantifying Benefits of Improved Compaction	Christopher Williams, Iowa State University	Kyle Hoegh	12/31/21	\$125,529
2021RIC02, 2021RIC02A	Full Depth Reclamation Resource Guide for Urban and Suburban Street Application (and Appendices)	Michael Marti, SRF Consulting Group, Inc.	Steven Bot	6/12/21	\$82,214
NRRA202005, NRRA202006, NRRA202007	TPF-5(341), NRRA: Repair of Joint Associated Distress Pavements	Renae Kuehl, SRF Consulting Group, Inc.	Benjamin Worel	8/31/20	\$95,565
NRRA202101	TPF-5(341): NRRA: Cold Central Plant Recycling (CCPR)	Dave Rettner, American Engineering Testing, Inc.	Michael Vrtis	1/31/21	\$99,997
NRRA202102	TPF-5(341): Reduced Cementitious Material in Optimized Concrete Mixtures	Peter Taylor, Iowa State University	Bernard Izevbekhai	2/28/21	\$147,627
NRRA202103, NRRA202103A	TPF-5(341): Appendices for Determining Pavement Design Criteria for Recycled Aggregate Base and Large Stone Subbase	Halil Ceylan, Iowa State University	Raul Velasquez	2/28/21	\$225,000
NRRA202104	TPF-5(341): Effective Long-Lasting Partial Depth Joint Repairs for Challenging Conditions	Heidi Olson, Braun Intertec Corporation	Gerard Geib	4/30/21	\$74,978
NRRA202105	TPF-5(341): Improve Material Inputs Into Mechanistic Design Properties for Reclaimed HMA and Recycled Concrete Aggregate (RCA) Roadways	Bora Cetin, Michigan State University	Timothy Andersen	8/31/21	\$30,000
NRRA202106	TPF-5(341): Performance Benefits of Fiber-Reinforced Thin Concrete Pavement and Overlays	Manik Barman, University of Minnesota Duluth	Thomas Burnham	6/30/21	\$149,999
NRRA202107	TPF-5(341): Drainability of Base Aggregate and Sand	William J. Likos, University of Wisconsin–Madison	Terrence Beaudry	8/31/21	\$30,000
NRRA202108	TPF-5(341): Environmental Impacts on the Performance of Pavement Foundation Layers	Bora Cetin, Michigan State University	Raul Velasquez	8/31/21	\$35,000
NRRA202109	TPF-5(341): Developing Best Practices for Rehabilitation of Concrete With Hot-Mix Asphalt (HMA) Overlays Related to Density and Reflective Cracking	Eshan Dave, University of New Hampshire	Shongtao Dai	8/31/21	\$169,970
NRRA202110	TPF-5(341): Mechanistic Load Restriction Decision Platform for Pavement Systems Prone to Moisture Variations	Majid Ghayoomi, University of New Hampshire	Timothy Andersen	10/31/21	\$90,231
NRRA202111	TPF-5(341): Evaluation of Long-Term Impacts of Early Opening of Concrete Pavements	Lev Khazanovich, University of Pittsburgh	Bernard Izevbekhai	8/31/21	\$149,999
TRS2002	INV 1071: Life Cycle Cost of Local Roads	Michael Marti, SRF Consulting Group, Inc.	Brian Giese	8/31/20	\$15,356
TRS2003	Expedited Process for Developing Specifications on New Products	Patrick Casey, CTC & Associates, LLC	Joel Ulring, Clark Moe	11/30/20	\$14,960
	INV 645: RIC: Construction Inspection and Documentation Training Course	Stephanie Malinoff, University of Minnesota–CTS	Rollin Larson	12/30/20	\$137,338
	TPF-5(375): NRRA: NCAT Portion of R1.11 Cold Central Plant Recycling (CCPR)	David Rettner, American Engineering Testing, Inc.	Glenn Engstrom, Michael Vrtis	1/31/21	\$12,780
	TPF-5(341): R1.38: Repair of Joint Associated Distress Pavements	Peter Taylor, Iowa State University	Benjamin Worel	1/31/21	\$4,972
	INV 1066: Evaluation of Curing Effects on Cold In-Place Recycling (CIR)	David Rettner, American Engineering Testing, Inc.	Joel Ulring	1/31/21	\$19,800
	TPF-5(341): R1.31: Incorporation of Joint Faulting Model Into BCOA-ME	Julie Vandenbossche, University of Pittsburgh	Thomas Burnham	6/30/21	\$24,999

MATERIALS & CONSTRUCTION [cont.]					
Report Number	Title	Investigator	Technical Liaison	End Date	Total Cost
	INV 645: Contractors Missing Deadlines/Overcommitting	Ross Jentink, WSB & Associates, Inc.	Michael Flaagan	6/30/21	\$18,878
	INV 1086: Evaluation of SFDR Stabilizing Products	Michael Marti, SRF Consulting Group, Inc.	Bruce Hasbargen	7/31/21	\$66,293
	INV 645: Ride Quality of Asphalt Pavements (Overlays and New Construction), Performance of Overlays, Best Practices to Reduce Reflective Cracking	Michael Marti, SRF Consulting Group, Inc.	Joe Triplett	7/31/21	\$37,558
	INV 645: Effectiveness of Fog Seal on Chip Sealed Low-Volume Roads	Mike Rief, WSB & Associates, Inc.	Steven Bot	7/31/21	\$44,620
	Cold In-Place Recycling (CIR) for Bituminous Over Concrete (BOC)	Dave Rettner, American Engineering Testing, Inc.	Terrence Beaudry	8/31/21	\$39,995
	TPF-5(341): R1.35: Biomaterial Maintenance Treatments	Christopher Williams, Iowa State University	Gerard Geib	11/30/21	\$50,000
	Establishing Fresh Properties of Fiber-Reinforced Concrete for Performance Engineered Mixture (PEM)	Manik Barman, University of Minnesota Duluth	Robert Golish	12/31/21	\$147,070
	INV 1069: Optimizing Asphalt Mixture Designs for Low-Volume Roads of Minnesota	Manik Barman, University of Minnesota Duluth	Joel Ulring	12/31/21	\$161,333
	TPF-5(443): Continuous Asphalt Mixture Compaction Assessment Using Density Profiling System (DPS)	Fabricio Leiva, Auburn University	Kyle Hoegh	12/31/21	\$228,028
	TPF-5(341): R1.41: Novel Methods for Adding Rejuvenators in Asphalt Mixtures With High Recycled Binder Ratios	Fan Yin, Auburn University	Michael Vrtis	12/31/21	\$80,000
	TPF-5(341): R1.30: Construction Reports for 2018 Fiber-Reinforced Concrete Roundabout and Thin Whitetopping Projects	Peter Taylor, Iowa State University	Maria Masten	1/31/22	\$49,999
	TPF-5(334): Enhancement to the Intelligent Construction Data Management System (Veta) and Implementation—Phase I	George Chang, The Transtec Group, Inc.	Rebecca Embacher	2/13/22	\$1,232,189
	Remaining Service Life Asset Measure—Phase II	Mihai Marasteanu, University of Minnesota	Glenn Engstrom	2/28/22	\$118,834
	INV 1066: Evaluation of Curing Effects on Cold In-Place Recycling (CIR)	Eshan Dave, University of New Hampshire	Joel Ulring	4/30/22	\$156,052
	TPF-5(341): R1.36: An Innovative Practical Approach to Assessing Bitumen Compatibility as an End Means of Material Specification	Eshan Dave, University of New Hampshire	Michael Vrtis	4/30/22	\$204,119
	TPF-5(341): R1.42: Impact of Polymer Modification on IDEAL-CT and I-FIT for Balanced Mix Design	Fan Yin, Auburn University	Michael Vrtis	5/31/22	\$100,000
	TPF-5(375): National Partnership to Determine the Life-Extending Benefit Curves of Pavement Preservation (MnROAD/NCAT Joint Study)	Adriana Vargas-Nordcbeck, Auburn University	Gerard Geib	6/30/22	\$1,750,000
	Development of Superpave 5 Asphalt Mix Designs for Minnesota Pavements	Mihai Marasteanu, University of Minnesota	Chelsea Bennett	6/30/22	\$144,405
	TPF-5(341): R1.23: Evaluation of Levels 3-4 Intelligent Compaction Measurement Values (ICMV) for Soils Subgrade and Aggregate Subbase Compaction	George Chang, The Transtec Group, Inc.	Rebecca Embacher	6/30/22	\$162,024
	TPF-5(341): R1.32: Solutions to Mitigate Dowel/Tie-Bar Propagated Cracking—Phase I	Shreenath Rao, Applied Research Associates, Inc.	Thomas Burnham	6/30/22	\$101,083
	INV 645: BMP of Drain Tile Within the Roadway	Susan Miller, SRF Consulting Group, Inc.	John Brunkhorst	6/30/22	\$52,373
	Relative Milling Method: Relative Milling Depth Surface Model Development	Kyle Klasen, WSB & Associates, Inc.	Rebecca Embacher	6/30/22	\$99,930
	TPF-5(341): R1.25: Seismic Approach to Quality Management of HMA	Choon Park, Park Seismic, LLC	Jason Richter	7/30/22	\$299,886
	INV 645: Drainage 101 County Roadways and City Streets: Best Practices and Resources Guide	Anita Benson, Stonebrooke Engineering, Inc.	Steven Bot	7/31/22	\$85,290
	TPF-5(341): R1.44: Enhanced Entrained Air Void System Characterization for Durable Highway Concrete	Anthony Torres, Texas State University	Thomas Burnham	9/30/22	\$100,000

MATERIALS & CONSTRUCTION [cont.]

Report Number	Title	Investigator	Technical Liaison	End Date	Total Cost
	INV 1067: Construction Incentives: Are They Working?	Mohamed Diab, Minnesota State University, Mankato	Fausto Cabral Neto	11/30/22	\$88,620
	INV 645: Crack Treatments for Local Governments: Status of Saw and Seal	Michael Marti, SRF Consulting Group, Inc.	Daniel Knappek	11/30/22	\$83,352
	TPF-5(341): R1.40: Asphalt Pavement Milling Best Practices Through Enhanced Understanding of Milling Process	Eshan Dave, University of New Hampshire	John Siekmeier	12/31/22	\$100,000
	INV 1070: Base Stabilization Additives: Effect on GE	Halil Ceylan, Iowa State University	Chad Hausman	1/31/23	\$197,864
	TPF-5(341): R1.45: Continuous Moisture Measurement During Pavement Foundation Construction	Soheil Nazarian, University of Texas at El Paso	Terrence Beaudry	2/17/23	\$100,000
	TPF-5(341): R1.43: Asphalt Real Time Smoothness (ARTS) for Asphalt Paving	George Chang, The Transtec Group, Inc.	John Siekmeier	2/28/23	\$104,021
	TPF-5(341): R1.39: Pavement-Specific Structural Synthetic Fibers	Manik Barman, University of Minnesota Duluth	David Lim	3/31/23	\$99,792
	INV 1104: Cost Estimate of B vs. C Grade Asphalt Binders	Mihai Marasteanu, University of Minnesota	Jed Nordin	6/30/23	\$171,777
	INV 1103: Evaluation of Proprietary Rejuvenators	M. Emin Kutay, Michigan State University	JinYeene Neumann	6/30/23	\$199,336
	INV 986: Performance Monitoring of Olmsted CR 117/104 and Aggregate Base Material Update.	Kyle Hoegh, MnDOT Materials and Road Research	Kaye Bieniek	11/30/23	\$44,000
	TPF-5(341): R1.21: Long-Term Testing and Analysis on Asphalt Mix Rejuvenator Field Sections	Jo Sias, University of New Hampshire	Michael Vrtis	8/31/24	\$148,981

FUNDED FOR FY2022: Asphalt Pavement Cracking Performance Data Analysis; Best Practices for Dust Control (Issues With CaCl); Development of Erosion Control Product Longevity Test Methodology; Development of Process to Lower Global Warming Potential (GWP) of Construction Materials; Effective Strategies to Extend Remaining Life of Alkali-Silica Reaction (ASR) Affected Pavements; Evaluation of Gravel Stabilizer Used on Gravel Roads and Gravel Shoulders; Mitigation of Tenting of Transverse Cracks and Joints in Asphalt Pavement; Long-Term Performance of Cold In-Place Recycled and Full-Depth Reclaimed Base Layers in Minnesota State Roads—Phase II; Pavement Design Around Utilities—Best Practices; Residential Roadway Width—Best Practices; Synthesis of Usage and Performance of Daylighted Bases in Comparison to Edge Drains

Materials & Construction Pooled Fund Studies

Study Number	Title	Lead State or Agency	Number of Participating Agencies	Total Cost	2021 MnDOT Contribution	Total MN Contribution	Current MN Contribution End Date
TPF-5(341)	National Road Research Alliance (NRRRA)	MN	8	\$4,850,000	\$0	\$750,000	2020
TPF-5(375)	National Partnership to Determine the Life-Extending Benefit Curves of Pavement Preservation Techniques (MnROAD/NCAT Joint Study)	MN	23	\$4,350,000	\$50,000	\$250,000	2022
TPF-5(443)	Continuous Asphalt Mixture Compaction Assessment Using Density Profiling System (DPS)	MN	13	\$1,037,500	\$25,000	\$75,000	2021
TPF-5(466)	National Road Research Alliance (NRRRA)—Phase II	MN	10	\$4,050,000	\$150,000	\$750,000	2025
TPF-5(368)	Performance-Engineered Concrete Paving Mixtures	IA	20	\$2,230,000	\$15,000	\$75,000	2021
TPF-5(374)	Accelerated Performance Testing on the 2018 NCAT Pavement Test Track With MnROAD Research Partnership	AL	19	\$13,259,807	\$0	\$300,000	2020
TPF-5(437)	Technology Transfer Concrete Consortium	IA	34	\$1,696,000	\$12,000	\$60,000	2024
TPF-5(448)	Integrating Construction Practices and Weather Into Freeze-Thaw Specifications	OK	14	\$740,000	\$20,000	\$60,000	2022

MULTIMODAL

Report Number	Title	Investigator	Technical Liaison	End Date	Total Cost
2020-22	INV 1044: How Do Complete Streets Matter for Communities? The Case of Richfield, Minnesota	Zhirong Jerry Zhao, University of Minnesota	Jack Broz	10/31/20	\$103,834
2020-29	Pedestrian Crossings and Safety on Four Anishinaabe Reservations in Minnesota	Greg Lindsey, University of Minnesota	Michael Petesch, Hannah Pritchard	1/31/21	\$150,000
2020RIC03	INV 645: Bicycle Facility Implementation: Quick Reference Guide	Michael Marti, SRF Consulting Group, Inc.	Chad Millner	10/31/20	\$62,994
2021-03	Impact of Transitways on Travel on Parallel and Adjacent Roads and Park-and-Ride Facilities	Alireza Khani, University of Minnesota	Jim Henricksen	1/31/21	\$109,952
2021-12	INV 1049: Guidance for Separated/Buffered Bike Lanes With Delineators	John Hourdos, University of Minnesota	Paul Oehme	5/31/21	\$90,578
	TPF-5(315), Division Funds: National Accessibility Evaluation Years 4-5	Andrew Owen, University of Minnesota	Deanna Belden	4/30/21	\$881,500
	Understanding Post-COVID Safety Concerns Toward the Use of Transit, Shared Mobility, and Connected and Automated Vehicles in Greater Minnesota	Yingling Fan, University of Minnesota	Elliott McFadden	6/30/22	\$120,000
	MP-20(007): Economic Benefits of Truck Weight and Safety Enforcement Improvements	Lubinda Walubita, Texas A&M Transportation Institute	Julie Whitcher	7/31/22	Canceled
	Assessing the Economic Effects of Context-Sensitive Main Street Highways in Small Cities	Camila Fonseca-Sarmiento, University of Minnesota	Nissa Tupper	9/30/22	\$190,897
	MP-21(010): Maximizing Transportation Assets by Building Community Connection Through Innovative Development of Rights of Way and Airspace	Frank Douma, University of Minnesota	Hannah Rank	9/30/22	\$70,000
	INV 1082: Guidelines for Safer Pedestrian Crossings: Understanding the Factors That Positively Influence Vehicle Yielding to Pedestrians at Unsignalized Intersections	Raphael Stern, University of Minnesota	Jason Radde	12/31/22	\$165,278
	MP-21(003): Identify Best Types of Commodity Flow Data for Freight, Railroad, Ports and Waterways Studies	Camila Fonseca-Sarmiento, University of Minnesota	Andrew Andrusko	12/31/22	\$114,914
	MP-21(004): Designing and Implementing Maintainable Pedestrian Safety Countermeasures	David Veneziano, Iowa State University	Jacob Rueter	6/30/23	\$79,554
	INV 1090: Designing an Autonomous Service to Cover Transit Last Mile in Low-Density Areas	Alireza Khani, University of Minnesota	James Gittemeier	6/30/23	\$100,000
	Understanding Pedestrian Travel Behavior and Safety in Rural Settings	Greg Lindsey, University of Minnesota	Michael Petesch, Hannah Pritchard	6/12/24	\$311,434

Multimodal Pooled Fund Study

Study Number	Title	Lead State or Agency	Number of Participating Agencies	Total Cost	2021 MnDOT Contribution	Total MN Contribution	Current MN Commitment End Date
TPF-5(396)	Mid-America Freight Coalition (MAFC)—Phase III	WI	10	\$1,406,000	\$37,000	\$148,000	2022

POLICY & PLANNING					
Report Number	Title	Investigator	Technical Liaison	End Date	Total Cost
2020-12	INV 1043: Local Contributions to State and Regional Transportation Facilities in Minnesota	Zhirong Jerry Zhao, University of Minnesota	Russ Matthys	8/31/20	\$121,668
2021-06, 2021-06FS	INV 1037: Fact Sheet: Strategies for Recruiting and Retaining Minnesota’s Transportation Workforce	Kenneth Bartlett, University of Minnesota	Lyndon Robjent	3/31/21	\$137,281
2021-16	A Qualitative and Quantitative Assessment of Pavement Sections That Have Remained in Poor Condition for 5+ Years	Mihai Marasteanu, University of Minnesota	Shannon McGrath	6/30/21	\$85,045
2021RIC03, 2021RIC03F	System Preservation Guide and Fact Sheets	Michael Marti, SRF Consulting Group, Inc.	Andrew Witter	6/12/21	\$91,193
2021RIC05 (6 reports)	INV 645: Training Roadmap for Civil Engineering Technicians User Guide	Stephanie Malinoff, University of Minnesota	Chris Byrd	8/31/21	\$99,983
TRS2103PP, TRS2103	Public Engagement Practices During the COVID-19 Pandemic and Other Disruptive Events	Christine Kline, CTC & Associates, LLC	Jeanne Aamodt	6/30/21	\$19,925
	MP-16(002): MnDOT Research Technical Summaries	Patrick Casey, CTC & Associates, LLC	Shannon Fiecke	11/30/20	\$99,984
	Understanding How the Disparate Effects of COVID-19 are Affecting MnDOT’s Efforts at Equitable Contracting	Moira Gaidzanwa, The Improve Group	Dawn Collins, The Improve Group	8/31/21	\$49,360
	The Health and Transportation Nexus: A Conceptual Framework for Collaborative Health and Transportation Planning: TRS	Yingling Fan, University of Minnesota	Nissa Tupper	12/31/21	\$46,361
	Telecommuting During COVID-19: How Does It Shape the Future Workplace and Workforce?	Xinyi Qian, University of Minnesota	Duane Hill	3/31/22	\$33,429
	Extreme Flood Vulnerability Analysis	Chris Dorney, WSP/Parsons Brinckerhoff, Inc.	Jeffrey Meek	4/30/22	\$141,232
	INV 1073: The Impact of Deferred Maintenance in Minnesota	Camila Fonseca-Sarmiento, University of Minnesota	Paul Oehme	4/30/22	\$144,353
	MP-20(008): Qualitative and Quantitative Analysis to Advance Transportation Equity	Zachary Elgart, Texas A&M Transportation Institute	Hally Turner	10/31/22	\$130,500
	Identifying and Optimizing Electric Vehicle Corridor Charging Infrastructure for Medium and Heavy Duty Trucks	Alireza Khani, University of Minnesota	Siri Simons	10/31/22	\$149,832
	MP-21(007): Assessing the Effects of Highway Improvements on Adjacent Businesses	Yingling Fan, University of Minnesota	Jason Junge	12/31/22	\$100,000
	MP-21(008): Advancing Equity in Accessibility and Travel Experiences: The Role of Gender and Identity	Ying Song, University of Minnesota	Hally Turner	2/28/23	\$119,799
	INV 1102: MnDOT Haul/Detour Routes: Impacts on Local Roads	Bora Cetin, Michigan State University	Tim Stahl	6/30/23	\$184,389
	TPF-5(455): National Accessibility Evaluation—Phase II	Andrew Owen, University of Minnesota	Deanna Belden	12/31/25	\$1,642,000

FUNDED FOR FY2022: Complete Streets Speed Impacts; Evaluating Local Funding in Regional Projects; Role of Arts, Culture and Placemaking in Transportation Projects; Right of Way (ROW) Policies—Best Practices; State—Tribal Partnership to Support Solar Energy Feasibility Study; Understanding How Street Reconstruction Affects Property Value

Policy & Planning Pooled Fund Studies

Study Number	Title	Lead State or Agency	Number of Participating Agencies	Total Cost	2021 MnDOT Contribution	Total MN Contribution	Current MN Contribution End Date
TPF-5(455)	Access Across America: National Accessibility Evaluation—Phase II	MN	11	\$1,862,000	\$36,000	\$180,000	2025
TPF-5(335)	Biennial Asset Management Conference and Training on Implementation Strategies (2016-2020)	IA	21	\$714,000	\$0	\$36,000	2020

TRAFFIC & SAFETY					
Report Number	Title	Investigator	Technical Liaison	End Date	Total Cost
2020-17	INV 1024: Evaluation of the Effectiveness of Stop Lines in Increasing the Safety of Stop-Controlled Intersections	John Hourdos, University of Minnesota	Nick Bauler	8/31/20	\$150,528
2020-28	MP-18(009): Deploy and Test a Smartphone-Based Accessible Traffic Information System for the Visually Impaired	Chen-Fu Liao, University of Minnesota	Michael Fairbanks	12/31/20	\$165,780
2020-30	MP-20(001): Evaluation of StreetLight Data's Traffic Count Estimates From Mobile Device Data	Shawn Turner, Texas A&M Transportation Institute	Ian Vaagenes	1/31/21	\$50,000
2020-31	Integrate RTMC Vehicle Classification Into the Current Detector Volume Data	Taek Kwon, University of Minnesota Duluth	John Hackett	1/31/21	\$26,641
2021-08	Generating Traffic Information From Connected Vehicle V2V Basic Safety Messages	Michael Levin, University of Minnesota	Ray Starr	3/31/21	\$249,994
2021-17	INV 1051: Development and Demonstration of an In-Vehicle Lane Departure Warning System Using Standard GPS Technology	Imran Hayee, University of Minnesota Duluth	Victor Lund	6/30/21	\$133,656
2021-21	INV 1089: COVID-19 Impacts on Speed and Safety for Rural Roads and Work Zones	Shauna Hallmark, Iowa State University	Derek Leuer, Victor Lund	7/31/21	\$35,919
2021-24	RTMC Funds: Improving Winter Road Weather Alerts on Highway Dynamic Message Signs	Michael Marti, SRF Consulting Group, Inc.	Brian Kary	12/30/20	\$129,661
2021-25	MP-20(005): Evaluation of Road Weather Messages on DMS Based on Roadside Pavement Sensors	Skylar Knickerbocker, Iowa State University	Garrett Schreiner	11/30/21	\$75,270
2021-27	MP-20(004): Refining Inductive Loop Signature Technology for Statewide Vehicle Classification Counts	Chen-Fu Liao, University of Minnesota	Gene Hicks	1/31/22	\$67,988
TRS2101	Research on Traffic Sign Retroreflective Sheeting Performance: A Synthesis of Practice	Gene Hawkins, Texas A&M Transportation Institute	Josephine Tayse	4/30/21	\$65,482
	TPF-5(376): North/West Passage Freight Task Force—Year 4	Erika Witzke, CPCS Transcom, Inc.	Cory Johnson	1/31/21	\$49,880
	The Tipping Point: What COVID Travel Reductions Tells Us About Effective Congestion Relief	Paul Morris. SRF Consulting Group, Inc.	Bradley Utecht	6/30/21	\$65,072
	TPF-5(376): North/West Passage Freight Task Force—Year 5	Rachel Aland, CPCS Transcom, Inc.	Cory Johnson	6/30/21	\$17,245
	TPF-5(376): Program Support Services and Technical Writing for the North/West Passage Pooled Fund Research Program North/West Passage Work Plan 15	Tina Roelofs, Athey Creek Consultants, LLC	Cory Johnson	7/31/21	\$98,838
	INV 645: Autonomous Vehicles: What Should Local Agencies Expect?	Michael Marti, SRF Consulting Group, Inc.	Wayne Sandberg	7/31/21	\$30,865
	INV 645: Strategies for Effective Roundabout Approach Speed Reduction	Tim Arvidson, Stonebrooke Engineering, Inc.	Joe Gustafson	9/30/21	\$32,853
	Evaluation of Metro Freeway System for Reliability and Resilience	Eil Kwon, University of Minnesota Duluth	Brian Kary	2/28/22	\$118,000
	INV 1061: Toward Implementation of Max-Pressure Signal Timing on Minnesota Roads	Michael Levin, University of Minnesota	Ben Hao	2/28/22	\$177,000
	MP-19(008): Can Automated Vehicles “See” in Minnesota? Ambient Particle Effects on Lidar Systems	Will Northrop, University of Minnesota	Robert Chaucierre	2/28/22	\$237,840
	TPF-5(376): North/West Passage Website Maintenance	Patrick Nichols, North Dakota State University	Cory Johnson	2/28/22	\$10,243
	INV 1064: Establishing a Repeatable Method for Presenting Nontraditional Traffic Treatments to Maximize Stakeholder Support	Nichole Morris, University of Minnesota	Scott Thompson	6/30/22	\$348,994
	Pavement Marking Patterns and Widths: Human Factors Study	Adam Pike, Texas A&M Transportation Institute	Ethan Peterson	6/30/22	\$208,890
	MP-19(005): Work Zone Intrusion Mobile Application	Brian Davis, University of Minnesota	Todd Haglin	6/30/22	\$348,325

TRAFFIC & SAFETY [cont.]					
Report Number	Title	Investigator	Technical Liaison	End Date	Total Cost
	INV 1080: Assessing Pavement Markings for Automated Vehicle Readiness	Adam Pike, Texas A&M Transportation Institute	Ethan Peterson	6/30/22	\$228,183
	INV 1075: Transverse Rumble Strips at Rural Intersections	Shauna Hallmark, Iowa State University	Victor Lund	7/31/22	\$181,686
	Cost/Benefit Analysis of Fuel-Efficient Speed Control Using Signal Phasing and Timing (SPaT) Data: Evaluation for Future Connected Corridor Deployment	Michael Levin, University of Minnesota	Daniel Rowe	7/31/22	\$218,287
	INV 1048: Criteria and Guidelines for Three-Lane Road Design and Operation	Gary Davis, University of Minnesota	Jack Broz	8/31/22	\$155,559
	Evaluation and Refinement of Minnesota Queue Warning Systems	John Hourdos, University of Minnesota	Garrett Schreiner	9/30/22	\$254,187
	INV 1083: Pedestrian User Experience at Roundabouts	Ranjit Godavarthy, North Dakota State University	Joe Gustafson	9/30/22	\$120,000
	INV 645: Guidelines for Determining Speed Limits on Municipal Roadways	Tim Arvidson, Stonebrooke Engineering, Inc.	William Manchester	10/31/22	\$69,484
	INV 645: Cost-Effectiveness of Various Pavement Markings	Michael Marti, SRF Consulting Group, Inc.	Jon Pratt	10/31/22	\$51,800
	INV 645: Best Practice Guidelines for Intelligent (Active) Warning Devices	Renae Kuehl, SRF Consulting Group, Inc.	Justin Femrite	11/30/22	\$46,128
	INV 1085: Impact of Speed Limit Changes on Urban Streets	Gary Davis, University of Minnesota	Victor Lund	6/30/23	\$156,561
	INV 1079: Development of a Smartphone App to Warn the Driver of Unintentional Lane Departure Using GPS Technology	Imran Hayee, University of Minnesota Duluth	Victor Lund	6/30/23	\$147,145
	INV 1091: User-Centered Smart Traffic Sign Development Study	Nichole Morris, University of Minnesota	Wayne Sandberg	6/30/23	\$240,793
	INV 1098: Pavement Marking/Colored Pavement Friction Differential and Product Durability	Mihai Marasteanu, University of Minnesota	Ethan Peterson	6/30/23	\$136,861
	INV 1105: Multi-Method Investigation of Pedestrian Safety Impacts of Right-Turn Lanes	Curtis Craig, University of Minnesota	Bradley Estochen	6/30/23	\$156,540
	INV 1099: Performance Evaluation of Different Detection Technologies for Signalized Intersections in Minnesota	John Hourdos, University of Minnesota	Steven Misgen	11/30/23	\$179,950
	INV 1074: Taconite as a Lower Cost Alternative High Friction Surface Treatment to Calcined Bauxite for Low-Volume Roads in Minnesota	Lawrence Zanko, University of Minnesota Duluth	Tracey Von Bargaen	8/31/24	\$322,225

FUNDED FOR FY2022: Evaluation of Static and Dynamic No Right Turn on Red Signs at Traffic Signals; Development and Demonstration of a Novel Red Light Running Warning System Using Connected Vehicle-to-Infrastructure (V2I) Technology; Grand Iron Range Connected and Automated Vehicle (CAV) Initiative Data and Research Support; Mini-Roundabout FAQs; Pedestrian Safety Around Roundabouts; Identification and Assessment of Preventative Methods to Mitigate Cognitive and Physical Declines That Influence Driving Performance of Older Drivers; School Bus Stop–Arm Violations; Using Apps to Notify the Public of Local Road and Bridge Closure

Traffic & Safety Pooled Fund Studies

Study Number	Title	Lead State or Agency	Number of Participating Agencies	Total Cost	2021 MnDOT Contribution	Total MN Contribution	Current MN Contribution End Date
TPF-5(376)	North/West Passage—Phase IV	MN	6	\$725,000	\$25,000	\$125,000	2022
TPF-5(317)	Evaluation of Low-Cost Safety Improvements	FHWA	43	\$972,500	\$25,000	\$50,000	2022
TPF-5(319)	Transportation Management Center Pooled Fund Study	FHWA	22	\$3,500,569	\$0	\$125,000	2020
TPF-5(343)	Roadside Safety Research for MASH Implementation	WA	28	\$0	\$50,000	\$300,000	2022

Traffic & Safety Pooled Fund Studies [cont.]

Study Number	Title	Lead State or Agency	Number of Participating Agencies	Total Cost	2021 MnDOT Contribution	Total MN Contribution	Current MN Contribution End Date
TPF-5(359)	Evaluating New Technologies for Roads Program Initiatives in Safety and Efficiency (ENTERPRISE)—Phase II	MI	8	\$1,412,967	\$30,000	\$150,000	2021
TPF-5(377)	Enhanced Traffic Signal Performance Measures	IN	10	\$930,000	\$0	\$90,000	2020
TPF-5(380)	Autonomous Maintenance Technology (AMT)	CO	16	\$1,150,000	\$0	\$75,000	2020
TPF-5(430)	Midwest States Pooled Fund Crash Test Program	NE	22	\$4,573,996	\$66,000	\$198,000	2022
TPF-5(435)	Aurora Program (FY2020-FY2024)	IA	18	\$1,675,000	\$25,000	\$125,000	2024
TPF-5(444)	Traffic Safety Culture—Phase II	MT	20	\$1,440,000	\$10,000	\$50,000	2024
TPF-5(453)	Automated Vehicle Pooled Fund Study	OH	8	\$1,750,000	\$50,000	\$250,000	2025

ADMINISTRATIVE				
Title	Investigator	Technical Liaison	End Date	Total Cost
MP-16(001): ARTS Technical Support and Maintenance Services (FY2019)	Ryan Anderson, ArchWing Innovations, LLC	Katie Fleming	7/31/20	\$152,190
INV 645B: LRRB Outreach and Marketing Support (2019-2020)	Renae Kuehl, SRF Consulting Group, Inc.	Kristine Elwood	7/31/20	\$99,965
TPF-5(376): Program Support Services and Technical Writing for the North/West Passage Pooled Fund Research Program	Dean Deeter, Athey Creek Consultants, LLC	Cory Johnson	8/31/20	\$97,290
MnDOT Library Strategic Plan	Patty Henderson, Radford Henderson, LLC	Catherine Walker	8/31/20	\$4,950
INV 916: LRRB Technical Summaries and Project Evaluation Forms (LRRB Technical Transfer Materials Development) (FY2019)	Patrick Casey, CTC & Associates, LLC	Shannon Fiecke	12/31/20	\$99,913
MP-18(013): Facilitation and Reporting for MnDOT State Planning & Research Peer Exchange	Patrick Casey, CTC & Associates, LLC	Catherine Walker	3/31/21	\$1,894
INV 645: Research Implementation Committee (RIC): Implementation of Research Findings (FY2017-2019)	Michael Marti, SRF Consulting Group, Inc.	Michael Flaagan	6/12/21	\$792,295
MP-16(002): MnDOT R&I Technology Transfer (T2) Material Development: R&I At-A-Glance, Accelerator Newsletter, Other T2 Materials (FY2020)	Patrick Casey, CTC & Associates, LLC	Shannon Fiecke	6/30/21	\$99,953
INV 999: Office of Research & Innovation Report Publication Services (FY2020-2021)	Arlene Mathison, University of Minnesota	Shannon Fiecke	6/30/21	\$109,169
INV 916: LRRB Technical Transfer Materials Development (FY2020)	Patrick Casey, CTC & Associates, LLC	Shannon Fiecke	6/30/21	\$48,961
MP-19(007): MnDOT Research Technical Summaries	Patrick Casey, CTC & Associates, LLC	Shannon Fiecke	6/30/21	\$99,615
INV 936: Developing LRRB Need Statements	Michael Marti, SRF Consulting Group, Inc.	Kristine Elwood	6/30/21	\$36,956
Development of MnDOT Research Roadmaps	Patrick Casey, CTC & Associates, LLC	Catherine Walker	6/30/21	\$17,876
INV 645B: LRRB Outreach and Marketing Support (2020-2021)	Renae Kuehl, SRF Consulting Group, Inc.	Shannon Fiecke	7/31/21	\$99,985

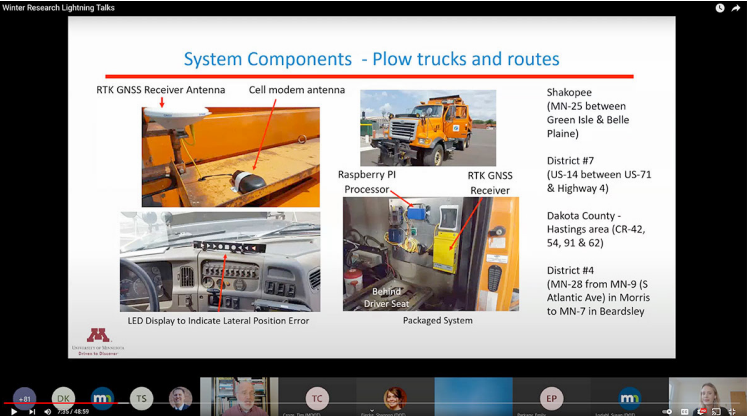
ADMINISTRATIVE [cont.]				
Title	Investigator	Technical Liaison	End Date	Total Cost
INV 916: LRRB Technical Summaries (FY2021)	Patrick Casey, CTC & Associates, LLC	Shannon Fiecke	7/31/21	\$40,344
INV 1087: LRRB Marketing Assessment and Plan	Arlene Mathison, University of Minnesota	Shannon Fiecke	10/31/21	\$32,508
MP-20(010): Innovation Implementation Plan	Andy Zimney, Employee Strategies, Inc.	Catherine Walker	12/31/21	\$90,036
INV 645: Implementation of Research Findings (FY2021-2024)	Stonebrooke Engineering, Inc.	Michael Flaagan	6/30/24	
INV 645: Research Implementation Committee (RIC): Implementation of Research Findings (FY2022-2026)	Michael Marti, SRF Consulting Group, Inc.	Michael Flaagan	6/30/24	\$600,000

Federal Program Support

Study Number	Title	2021 MnDOT Contribution	Total MN Contribution
TPF-5(421)	National Cooperative Highway Research Program (NCHRP)	\$759,316	\$759,316
TPF-5(473)	Transportation Research Board (TRB)	\$140,603	\$140,603
	American Association of State Highway and Transportation Officials (AASHTO)	\$15,000	

DEDICATED PROGRAMS				
Title	Investigator	Technical Liaison	End Date	Total Cost
INV 998: Operational Research Program for Local Transportation Groups (OPERA) (FY2019-2020)	Mindy Carlson, University of Minnesota-CTS	Kristine Elwood	10/31/21	\$140,900
CTS Operations (FY2020-2021)	Dawn Hood, University of Minnesota	Catherine Walker	6/30/21	\$3,964,606
INV 668: Local Technical Assistance Program (LTAP) (FY2020)	Stephanie Malinoff, University of Minnesota-CTS	Kristine Elwood	9/30/20	\$450,500
INV 686: LTAP Expanded Activities (FY2021-2022)	Stephanie Malinoff, University of Minnesota-CTS	Kristine Elwood	6/30/22	\$438,000
MnDOT Research Librarian Services (2021-2022)	Arlene Mathison, University of Minnesota-CTS	Sheila Hatchell	6/30/22	\$80,604
INV 998: Operational Research Program for Local Transportation Groups (OPERA) (FY2021-2023)	Mindy Carlson, University of Minnesota	Kristine Elwood	8/31/22	\$160,000
INV 668: Local Technical Assistance Program (LTAP) (FY2021)	Stephanie Malinoff, University of Minnesota	Kristine Elwood	9/30/21	\$300,000

RESEARCH ACROSS MnDOT



MnDOT’s Office of Maintenance teamed up with the Office of Research & Innovation to host a webinar, “Winter Research Lightning Talks,” that included five presentations by winter maintenance researchers.

In addition to the more than 170 local, state and federal transportation research projects administered annually through the MnDOT Office of Research & Innovation, the following MnDOT programs have in-house teams that conduct or sponsor specialized research:

- Maintenance Operations Research
- MnROAD (Office of Materials & Road Research)
- Connected and Automated Vehicles
- Traffic Engineering

Learn more at mndot.gov/research.html.



LOCAL ROAD RESEARCH BOARD

Administered by the MnDOT Office of Research & Innovation, the LRRB has been bringing innovations to local Minnesota engineers since 1959. LRRB research ideas come from local Minnesota transportation professionals, either through the IdeaScale button at lrrb.org or at LRRB sessions during October State Aid prescreening meetings held around the state. MnDOT Office of Research & Innovation helps to identify existing solutions and formulate need statements to elicit project proposals. In December, the LRRB evaluates all proposals and makes funding selections.



JOIN A TECHNICAL ADVISORY PANEL

You can help shape research and innovation projects in your subject area by serving on a Technical Advisory Panel (TAP). Involvement may include a few meetings and assistance developing work plans and reviewing final deliverables.

KEEP UP WITH MnDOT RESEARCH



Email Updates: Subscribe at mndot.gov/research/subscribe.html.



Crossroads Blog: Check out our recent stories on Minnesota transportation research at mntransportationresearch.org.



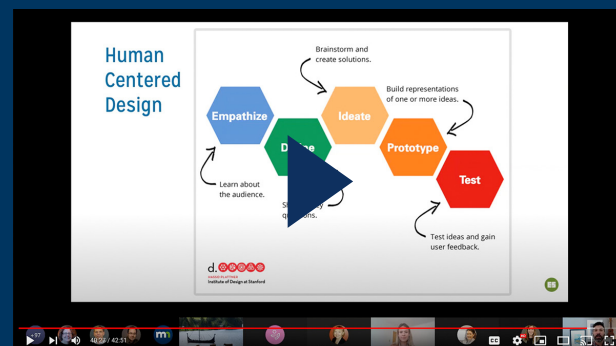
Presentations: Schedule a visit to learn how the research program or library can help your office or district.



Social Media: Connect with us at @MnDOTResearch using your favorite social media channels.

Videos: We highlight research projects and educational resources for the public.

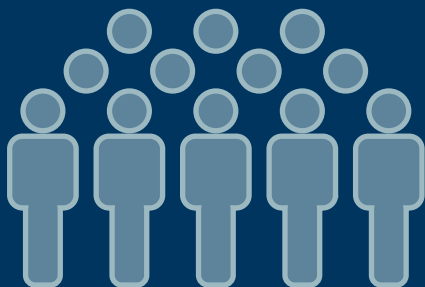
See mndot.gov/research/videos.html or the [MnDOT Research YouTube Channel](#).



A Human-Centered Design Learn and Lunch presented by Andy Zimney from Employee Strategies offered a creative approach to problem-solving that focuses on diverse perspectives and disciplines.

BY THE NUMBERS

3,523 MnDOT Research Twitter followers



7,955 e-newsletter subscribers

4,490
library information transactions

599

library items loaned



109
active and completed research projects during 2021



16
qualified universities participated in our academic RFP



DEPARTMENT OF
TRANSPORTATION
OFFICE OF RESEARCH & INNOVATION

Produced by CTC & Associates LLC for:

Minnesota Department of Transportation
Office of Research and Innovation
MS 330, First Floor
395 John Ireland Blvd., St. Paul, MN 55155-1800

651-366-3780

Website: mndot.gov/research

Minnesota Department of Transportation: mndot.gov

MnDOT Library: mndot.gov/library

Minnesota Local Road Research Board: lrrb.org