

**mn**  
DEPARTMENT OF  
TRANSPORTATION

Office of Maintenance  
Statewide Biennial

# Maintenance Operations Research Report

2015–2017

## DISCLAIMER

*Trade names are used on occasions in this report to better identify the type or use of a product or material involved in field research. However, use of these names in no way implies Minnesota Department of Transportation's (MnDOT) endorsement of the product or material discussed unless there is a specific MnDOT recommendation to that effect. No attempt was made to identify which product or material had registered trade mark associated with it.*

## ACKNOWLEDGMENTS

The Maintenance Operations Research program is able to make a significant impact on the efficiency, safety, and cost of state maintenance operations. Many thanks to the Area Maintenance Engineers and District champions for their enthusiastic involvement. We sincerely appreciate these contributions, as well as the strong support of MnDOT's Office of Maintenance in advancing technology implementation.

Thanks very much to all who contributed content to this biennial report, including writing summaries, submitting photographs and compiling data.

*For more information, please visit:*

Minnesota Department of Transportation:

<http://www.dot.state.mn.us/>

MnDOT Office of Maintenance Research Unit:

<http://www.dot.state.mn.us/maintenance/research.html>

MnDOT Research Services Section:

<http://www.dot.state.mn.us/research/index.html>

MnDOT Library:

<http://www.dot.state.mn.us/library/>

Office of Maintenance  
Statewide Biennial

# Maintenance Operations Research Report

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2015–2017



DEPARTMENT OF  
TRANSPORTATION  
RESEARCH SERVICES & LIBRARY

Prepared by CTC & Associates LLC  
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## Introduction

The Maintenance Operations Research (MOR) program is a unique statewide collaboration focused on identifying and applying real-world solutions to highway maintenance operations. Managed by the MnDOT Office of Maintenance, the program funds the testing and evaluation of innovative products and practices intended to preserve the existing transportation system and improve the efficiency and safety of MnDOT maintenance operations. This report presents the program and project highlights of the 2015–2017 funding biennium.

The report includes four sections:

- **About the Program** looks at the history of the MOR Program, its goals and objectives, and the MnDOT staff throughout the state who make it a success.
- **Project Funding and Selection** describes the funding breakdown for 2015-2017 and the criteria used to evaluate proposed research and implementation projects.
- **2015–2017 Projects** reports on every completed and in-progress research project for FY 2016 and FY 2017. Each project summary includes an overview of the product tested, the expected benefits and any results documented to date.
- **Previous Statewide MOR/NTREC Project Reports** lists all completed research projects since the program began.

## About the Program

### History

The Minnesota Maintenance Operations Research program began in 1988 with a legislative appropriation for salt research. The department received \$1.5 million for a two-year field study to investigate alternatives to salt for winter maintenance and the effectiveness of additives for reducing salt corrosion.

After this initial investment, MnDOT's interest in maintenance innovations remained strong, and the agency sought an ongoing funding source for maintenance research activities. In 1991, MnDOT's area maintenance engineers set aside 18% of the Road Equipment Budget contingency fund to support the multidisciplinary New Technology, Research and Equipment Committee (NTREC), a subcommittee of the MnDOT Operations Management Group (OMG) focused on identifying practices and technologies to improve MnDOT business. NTREC evolved and grew to encompass four key programs at MnDOT: the MOR program, the Maintenance Operations Implementation Fund, the Maintenance Operations New Equipment Technology Fund, and the Maintenance Operations Strategic Activities Fund. By the mid-1990s, funding across these four programs totaled \$1,346,000, with \$712,500 of this amount dedicated solely to the MOR program. This ongoing investment supported numerous investigations across a range of winter and summer maintenance methods, products, procedures and technologies.

In 2004, department-wide budget cuts and layoffs resulted in a reduction in the MOR program to \$470,000. However, MnDOT staff maintained their commitment to bringing innovation to the department, evaluating over 175 tools and techniques for enhancing maintenance operations since 2005. In 2013, the Office of Maintenance leveraged additional agency funds to add a technology transfer position to the MOR program. This new position helped the MOR program further encourage and communicate maintenance innovations throughout the state by collecting and distributing information on devices built in house by MnDOT employees in the field.

### Goals and objectives

The MOR program encourages and funds real-world research in maintenance operations to help MnDOT staff improve safety, preserve infrastructure, increase efficiency and ensure fiscal responsibility. The goal is to identify, develop and implement the most effective maintenance procedures, materials and equipment throughout the state.

The MOR program addresses all MnDOT maintenance operations, including winter maintenance, summer maintenance, preservation, road and bridge maintenance, roadside maintenance, work zone safety and traffic control. The program relies on the leadership of the 25 NTREC members who represent a range of specialties and offices within MnDOT, along with involvement of staff in all districts who propose research ideas and evaluate new products and technologies.





## Research Unit Staff



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(651) 216-9885

## NTREC Committee Members, 2015–2017

NTREC Committee members are comprised of staff from the following areas:

- Central Office
- Maintenance
- Construction
- Safety
- Training
- Fleet
- Bridge
- Materials
- ITS
- Environmental Services
- Maintenance Districts

## Project Funding and Selection

### Funding distribution

The average annual budget for the Maintenance Operations Research program is \$529,441. The funds are distributed among maintenance research projects, product implementation and staff salaries.

#### FY 2016 program funding breakdown

Research projects:	\$241,486
Staff salaries:	\$216,720
<b>Total:</b>	<b>\$458,206</b>

#### FY 2017 program funding breakdown

Research projects:	\$198,253
Implementation:	\$216,000
Staff salaries:	\$186,422
<b>Total:</b>	<b>\$600,675</b>

The MOR program funds research projects across the state in the categories of Winter Maintenance; Winter Material/Chemicals; Road and Bridge Maintenance; Roadside Maintenance; Equipment and Tools; and Work Zone Safety. See the chart at right for the FY 2016/2017 distribution of funds by research category.

To optimize the return on the research investment, the program typically contributes 25% of the available budget for projects in implementation. Implementation activities that are eligible for partial or full funding include demonstrations, training, technical assistance and distribution of products statewide.

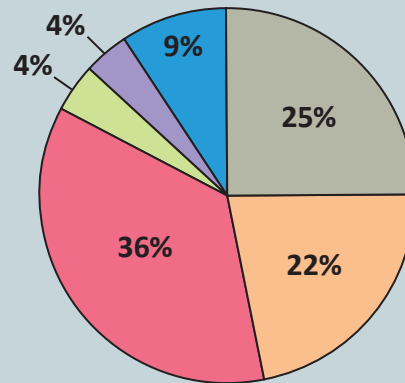
Budgets for FY 2016 and FY 2017 are summarized in Table 1 (by category) and Table 2 (by district). See the location of districts throughout the state in Figure 1.

### Selection criteria

To ensure that all research projects selected for funding meet the goals and purpose of the Maintenance Operations Research program, the following criteria are used to evaluate each proposed project:

- Availability of funding and matching resources
- Expected benefits or return on investment
- Potential for improving safety in the field
- Opportunity for statewide implementation
- Innovation
- Supports transportation preservation

### FY 2016–FY 2017 Funding Distribution by Research Category

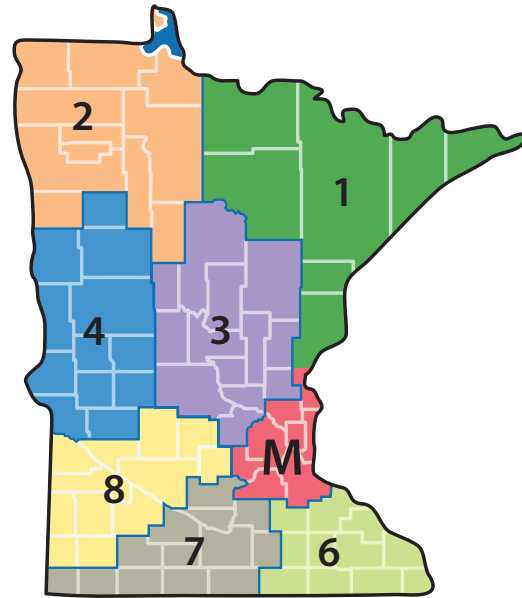


Equipment and Tools	\$110,336
Road and Bridge Maintenance	\$98,400
Roadside Maintenance	\$156,890
Winter Maintenance	\$19,299
Winter Materials	\$16,635
Work Zone Safety	\$38,179
<b>Total</b>	<b>\$439,739</b>

Research proposals with funding requests of more than \$15,000 require approval from NTREC, which meets twice a year, once to consider proposals and once to act as an update meeting to review previous NTREC projects. Funding requests of less than \$15,000 require approval from the maintenance operations research committee. See pages 7 to 64 for details

about each research in-progress and completed research project for 2015-2017.

Although MnDOT tests numerous products and procedures each year, funding is available to implement only a portion of them. The Maintenance Research Unit, in collaboration with the Research Services & Library, NTREC representatives and a district representative, identifies promising products to implement based on field reports of the research conducted. NTREC then develops a final list of implementation products that are available to the districts. When available, implementation funding is divided up equally among the districts and can be used for implementing any of the approved products from the current year or previous years.



**Figure 1.** Minnesota Department of Transportation Districts

- 1 Duluth
- 6 Rochester
- 2 Bemidji
- 7 Mankato
- 3 Brainerd
- 8 Wilmar
- 4 Detroit Lakes
- Metro

**TABLE 1** FY 2016 and 2017 MOR/NTREC Budget by Category

Category	No. of Projects	Funds Assigned	% of Total Funds
Equipment and Tools	21	\$110,336	25%
Road and Bridge Maintenance	5	\$98,400	22%
Roadside Maintenance	7	\$156,890	36%
Winter Maintenance	6	\$19,299	4%
Winter Materials	1	\$16,635	4%
Work Zone Safety	5	\$38,179	9%
<b>Total</b>	<b>45</b>	<b>\$439,739</b>	<b>100%</b>

**TABLE 2** FY 2016 and 2017 MOR/NTREC Budget by District\*

District	No. of Projects	Funds Received	% of Total Funds
2	1	\$15,000	3%
3	6	\$19,282	4%
4	4	\$28,624	7%
6	14	\$219,030	50%
7	3	\$19,300	5%
8	3	\$17,080	4%
Central Office	2	\$5,500	1%
Metro	12	\$115,923	26%
<b>Total</b>	<b>45</b>	<b>\$439,739</b>	<b>100%</b>

\*NOTE: Projects are initiated by MnDOT Central Office and are distributed to the districts.



## Maintenance Research

### Equipment and Tools

**District/Office:**  
6W

**Contact:**  
Brad Peterson  
507-379-3414

**Project Cost:**  
\$2,468

**Start Date:**  
November 2016

**Completion Date:**  
March 2017

**Vendor:**  
[towmaster.com](http://towmaster.com)

## Fast Flap Mud Flap *Completed Research*



**Project Description:** The Fast Flap is a quick-change mud flap that can be changed in the field with just a screwdriver. The operator opens the fast flap bracket and slides in a new mud flap. Since there are no holes, Fast Flaps don't tear when being pulled out, so reuse is possible.

**Purpose:** Currently, if a mud flap gets torn off a truck, the operator has to go back to the shop to find a new one, remove the entire angle bracket from the truck, line everything up and drill holes in the new mud flap before mounting. The Fast Flap is expected to save time and money through quick installation and by eliminating the need for replacement mud flaps.

**Test Procedure:** The district evaluated the Fast Flap for five months on its performance in the field for time and cost savings, as well as possible injury reduction, as operators no longer have to drill holes.

**Conclusions:** The Fast Flap performed well and saved installation time. The product also saved money because only the flap is replaced, saving the cost and time to purchase and fit new brackets. Fast Flap brackets mount easily on 2012 and newer trucks but may have issues on older trucks due to bracket configuration.

**Recommendation:** The district recommends this product for statewide implementation on 2012 and newer trucks.



## Maintenance Research

### Equipment and Tools

**District/Office:**  
6W/Red Wing

**Contact:**  
Greg Peters  
507-263-2323

**Project Cost:**  
\$16,283

**Start Date:**  
September 2016

**Completion Date:**  
July 2017

**Vendor:**  
[rdoequipment.com](http://rdoequipment.com)

## Grapple for John Deere Backhoe *Completed Research*



**Project Description:** In steep ditches, maintenance crews can have difficulty getting in equipment to collect brush. This means they usually have to either haul it manually or use a skid steer or backhoe, sliding around the ditch bottom.

**Purpose:** The grapple is a tool that helps haul trees and brush from hard-to-reach areas. It can also be used for culvert clearing and for collecting debris such as tires or trash.

**Test Procedure:** The district evaluated brushing operations with the grapple for 11 months, comparing it to current hand operation hours, lane miles cleared and lane regain times. The district expected to save time and manpower and to reduce the possibility of injury.

**Conclusions:** The grapple took a little longer to install than a bucket, but it worked well and provided manpower savings in a culvert cleanout. Instead of several people entering a creek to attach chains to tree branches, an operator could drop the grapple onto a debris pile and pick it up easily. The risks of injury and hypothermia were reduced because no one was required to enter cold water.

**Recommendations:** The district found the grapple to be very useful and recommends it for statewide implementation.



## Maintenance Research

### Equipment and Tools

**District/Office:**  
2W

**Contact:**  
Steve Scholand  
218-277-7966

**Project Cost:**  
\$1,342

**Start Date:**  
August 2013

**Completion Date:**  
October 2016

**Vendor:**  
[gates.com](http://gates.com)

## Hydraulic Hose Cleaning System

### *Completed Research*



**Project Description:** The Gates MegaClean hose and tube cleaning system is used to remove dirt from the inside of hoses with the help of pressurized launchers and compatible nozzles. Foam projectiles flow through the inside of the hose, removing with them fine particles of loose dirt and other contaminants.

**Purpose:** Debris can be left in a hydraulic hose after it has been cut, and hydraulic pumps or motors that fail can leave contamination behind. A hose cleaning system can reduce or eliminate contamination from being introduced into a vehicle's hydraulic system when a new or refurbished hose is installed.

**Test Procedure:** The district tested two hose cleaning systems to assess the system's ability to reduce downtime and save time, money and materials associated with equipment repairs.

**Conclusions:** The Gates MegaClean system performed as expected in cleaning the hydraulic systems. No issues were reported and the mechanics were satisfied with the results. The cleanliness of the hydraulic system saved time, money and manpower to clean an otherwise contaminated hydraulic system.

**Recommendations:** Because keeping a hydraulic system free of debris is a necessity, the district recommends the statewide implementation of the Gates MegaClean system.





## Maintenance Research Equipment and Tools

**District/Office:**  
6

**Contact:**  
Ruth Betcher  
507-286-7692

**Project Cost:**  
\$6,000

**Start Date:**  
May 2014

**Completion Date:**  
May 2016

**Vendor:**  
[frontierprecision.com](http://frontierprecision.com)

## Laser Range Finder *Completed Research*



**Project Description:** In recent years, District 6 has experienced flood damage by water overtopping the roadways and washing out embankments. For the district to receive federal emergency relief funding, documentation that includes pictures, diagrams, written descriptions and measurements of damaged areas must be submitted to the Federal Highway Administration. Accurate data that describes the flood damage and the cost of repair is essential to receive funds. This project evaluated equipment that could minimize the time spent by MnDOT staff in documenting flood damage.

**Purpose:** The TruPulse 360° laser range finder calculates the geolocation of flooded areas that are either inaccessible or dangerous to access. Field staff can use the range finder to determine the latitude and longitude of damage area points while standing on the roadway shoulder. The area measurements gathered by the unit can be used to estimate material repair quantities. Range finder data is sent automatically to a nearby GPS data collector unit for database storage and linkage with appropriate geolocated photos.

**Test Procedure:** The district tested three range finder units, assessing the range finder's ability to save time, money and manpower by considering factors such as speed and accuracy of data collection; adaptability of various collection types; usability of collected data; and ease of GIS mapping and usefulness of the maps.

**Conclusions:** The TruPulse 360° laser range finder did not help save time, money or manpower. There is a steep learning curve for the device. Because there was no flooding during the testing period, the device was not used as it was originally intended. It was used to measure other applications such as estimating salt pile volume and estimating tree heights to determine the distance from the fallen tree to the road in order to plan for road closures. Due to newer and better models, the district purchased alternative GPS data collector units with a built-in range finder.

**Recommendations:** The TruPulse 360° laser range finder is not recommended due to its limited application and difficulty of use.



## Maintenance Research

### Equipment and Tools

**District/Office:**  
2

**Contact:**  
Bryan Bolstad  
218-683-8022

**Project Cost:**  
\$1,995

**Start Date:**  
June 2014

**Completion Date:**  
November 2016

**Vendor:**  
[multiplaz.com](http://multiplaz.com)

## Multiplaz 3500 *Completed Research*



**Project Description:** The Multiplaz 3500 is a compact, portable welding tool that uses tap water for heating materials by turning water into plasma. The tool can weld, solder, braze, harden and cleanse metals including steel, aluminum, copper, cast iron and bronze. Multiplaz 3500 can cut any metal, replicating the functionality of a welding machine, gas torch, plasma cutter and other tools. The unit is efficient and cost-effective to operate, and eliminates the need for gas bottles and additional equipment such as compressors.

**Purpose:** With the use of a single, portable tool to complete welding-related projects, staff throughout the district can have the right tool available at the right time, eliminating the need to transport a welding project to the district's main shop.

**Test Procedure:** The district tested the Multiplaz 3500 for one year, evaluating its functionality and ease of use, and its ability to save time and reduce equipment needs.

**Conclusions:** The cutting and welding function of the Multiplaz 3500 was subpar. Cuts made on steel, stainless steel or aluminum were not clean and straight. The tool had the power to weld steel but failed to weld stainless steel and aluminum metals properly. The district contacted the vendor twice for support but was still unable to get the Multiplaz 3500 to function as claimed.

**Recommendations:** The Multiplaz 3500 is not recommended for statewide implementation.



## Maintenance Research Equipment and Tools

**District/Office:**  
Metro

**Contact:**  
David Hagle  
651-775-0366

**Project Cost:**  
\$4,200

**Start Date:**  
July 2016

**Completion Date:**  
August 2016

**Vendor:**  
[csunitec.com](http://csunitec.com)

## Pneumatic Concrete Chainsaw *Completed Research*



**Project Description:** The gas-powered chop saw currently in use by the district is inadequate for certain tasks. It is limited to certain kinds of cuts and cannot be submerged in water. It also emits fumes that are hazardous in confined spaces. The concrete chainsaw does not have these limitations.

**Purpose:** The concrete chainsaw will improve cutting activities by making plunge cuts and by cutting through pipes in a single motion. It is also submersible, which gives it a versatility the chop saw does not have. The district expects to save time and money through the use of this saw, in addition to reducing worker injuries.

**Test Procedure:** The district evaluated the chainsaw in the field for one year on its overall performance, safety, durability and efficiency. In particular, they tested the chainsaw's ability to cut through walls and other structures.

**Conclusions:** The pneumatic concrete chainsaw performed well cutting through various structures. It's 20" cutting depth allowed for easy cutting through walls. Easier and faster cutting saved time and allowed for more projects to be completed. Additionally, because the chainsaw uses an air motor, no gas or engine fumes were reported.

**Recommendations:** The district recommends the pneumatic concrete chainsaw for cutting through concrete structures and walls.



## Maintenance Research

### Equipment and Tools

**District/Office:**  
3B

**Contact:**  
Kelvin Smith  
320-223-6560

**Project Cost:**  
\$3,600

**Start Date:**  
September 2013

**Completion Date:**  
January 2017

**Vendor:**  
[us.chemsearch.com](http://us.chemsearch.com)

## Torrent 400 Parts Washer

### *Completed Research*



**Project Description:** Currently, the district uses large, hot-water “dishwasher”-type parts cleaners to clean small parts. Waiting for the cleaning cycle can sometimes delay returning units to service. The Torrent 400 parts washer provides an alternative for cleaning small parts.

**Purpose:** The Torrent 400 parts washer uses a water-based solution that is nonflammable and nonhazardous, and eliminates the need for secondary use of aerosols or other solvents for cleaning. The combination of the special water-based solution, high pressure and heat cleans parts safely and quickly. A special compressed air gun can be used to dry the cleaned parts to allow for immediate use.

**Test Procedure:** The district compared the cleaning performance, dependability and efficiency of the new parts washer with the current dishwasher-type parts cleaner.

**Conclusions:** The Torrent 400 parts washer’s feature to quickly dry parts for immediate installation was very useful. In addition, the vendor provided prompt customer service and thorough servicing of the unit. Despite the positive evaluation, the price of the equipment did not justify the benefits. Solvent based units would be a more cost-efficient investment.

**Recommendations:** The Torrent 400 parts washer is not recommended due to high maintenance costs.



## Maintenance Research

### Equipment and Tools

**District/Office:**

6E,6W/Albert Lea, Austin,  
Rochester, Owatonna, Red  
Wing

**Contact:**

Brad Peterson  
507-379-3414

**Project Cost:**

\$5,546

**Start Date:**

November 2016

**Completion Date:**

February 2017

**Vendor:**

[metal-services.com](http://metal-services.com)

## Universal Sander Stand *Completed Research*



**Project Description:** The sanding stands currently in use are old and have been retrofitted many times. Their jacks are loose, the stands are narrow, they hit the sensors on the sander, and they have pinch points that can cause hand injuries. The district would like to test new sander stands to alleviate these concerns.

**Purpose:** New sander stands will replace the old stands that are not safe. Making the stands wider and improving their function will make it easier to install and remove sanders on trucks. This will also make sanders more user-friendly and safer by removing the pinch point problem. The district expects to save time, manpower and money in addition to reducing accidents and injuries through the use of the sander stand.

**Test Procedure:** The sander stands were evaluated by the operators who used them in the shop. They were also used on the tailgate sander, which is a new application for this type of equipment.

**Results:** Because each truck is different, fitting the sander stands to the trucks required some modifications to the truck. The district found the stands to be a better and safer way to mount sanders on trucks.

**Recommendations:** The district recommends statewide implementation of the universal sander stand and plans to produce a video of how to remove the tailgate sander from a truck using the sander stand.



## Maintenance Research

### Road and Bridge Maintenance

**District/Office:**  
1/Range

**Contact:**  
Daniel Perkins  
218-742-1110

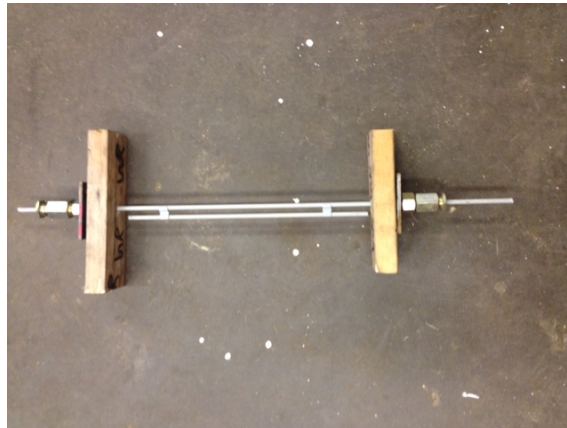
**Project Cost:**  
\$6,870

**Start Date:**  
December 2012

**Completion Date:**  
June 2013

**Vendor**  
[rjdindustries.com](http://rjdindustries.com)

## Fiber Rods for Bridge Rail Replacement *Completed Research*



**Project Description:** The district uses snap ties to hold forms together when placing concrete for bridge rail replacement. Seeking to reduce or eliminate the additional effort needed to prepare the ties for installation and avoid future rusting when they are placed, the district will test fiber rods as a replacement for the snap ties used when replacing bridge rails. If successful in this application, the use of fiber rods may be expanded to any formed concrete project.

**Purpose:** Fiber rods provide multiple benefits that speed up the work process, including eliminating the need to backfill the holes left by the cones on the snap ties to eliminate future rusting. Unlike snap ties, which are available in one length and must be cut and welded for custom lengths, fiber rods may be cut to any length needed. The fiber rods are also more adaptable when angled forms are used.

**Test Procedure:** The district assessed the impact of fiber rods in saving time and money in setting and removing forms for bridge rail replacement.

**Conclusions:** The fiber rods are inexpensive and can be cut to length onsite. This makes them faster and less costly to use than metal snap ties that must be special ordered or welded onsite. Once an installer gets past the initial learning curve, the fiber rods are easy to use, adjust and remove. The rods are corrosion resistant and may be painted.

**Recommendations:** The district recommends this product for statewide implementation. It is easy to work with and has the potential to save time and money.





## Maintenance Research

### Road and Bridge Maintenance

**District/Office:**  
4A/Fergus Falls

**Contact:**  
Joe Stegmaier  
218-846-7943

Brent Holland  
218-332-5640

**Project Cost:**  
\$86,000

**Start Date:**  
August 2014

**Completion Date:**  
October 2014

**Vendor:**  
rcmspecialties.com

## Portable Emulsion Storage Tank *Completed Research*



**Project Description:** Stored outside and without insulation, the district's two stationary emulsion tanks can store emulsion only during the summer months. Emulsion needed during the winter months must be obtained in small quantities from other MnDOT truck stations. Crews are not able to efficiently fill newer trucks and trailers with emulsion because of the emulsion tanks' gravity feed dispensing systems, and cleaning the stationary gravity tanks is costly.

**Purpose:** The portable storage tank the district will test is self-contained. An insulated housing permits year-round outdoor storage, and a heated pump allows for efficient year-round transfer of material. The portable roll-off design allows easy access to crews throughout the district. The cone bottom tank design eliminates sludge buildup and costly cleaning, and the unit's forward and reverse pump eliminates the possibility of sloppy transfers by allowing an operator to draw back material through the hose.

**Test Procedure:** The district evaluated the functionality, mobility and efficiency of the portable storage tank for one year, assessing its ability to save time and money and reduce material loss.

**Conclusions:** The district replaced two smaller tanks with the portable storage tank. A lower cost was associated with maintaining only one tank. Due to the tank's ability to hold emulsion without any separation issues, it reduced cleaning time and allowed for easy transfer of materials to and from the storage tank without a reduction in material loss.

**Recommendations:** The district recommends the installation of portable storage tanks to house asphalt emulsion year-round without separation issues.



## Maintenance Research

### Road and Bridge Maintenance

**District/Office:**

Metro/Camden, Cedar

**Contact:**

Mindy Heinkel  
651-366-3585

Dan Sullivan  
651-234-7943

**Project Cost:**

\$1,100

**Start Date:**

July 2016

**Completion Date:**

April 2017

**Vendor:**

[lonestarsafety.com](http://lonestarsafety.com)

## Ultra-Ever Dry *Completed Research*



**Project Description:** The Lowry Tunnel is difficult to keep clean due to the large volume of traffic that deposits hydrocarbon pollutants as well as mud and dirt onto the ceramic tiles. Cleaning the tunnel requires complete closure in each direction of traffic for six to seven hours.

**Purpose:** Ultra-Ever Dry is a super-hydrophobic coating that, when applied to a surface, prevents water and water-carried contaminants from adhering to the tiles. If the tiles can be kept cleaner longer, the need for tunnel closure and cleaning can be reduced. The district expects to save time, manpower and money through the use of this coating.

**Test Procedure:** A test section of the tunnel was prepared and the coating applied. The section was observed and photographed monthly to monitor the difference in cleanliness between the test section and the adjacent untreated areas.

**Results:** The coating is more expensive than regular paint and must be applied in two coats, and the surface must be clean before application. It was not difficult to apply and the sprayer worked well. Once applied, the coating proved to have excellent moisture-repelling properties and held up well in sunlight even for prolonged periods.

**Recommendations:** This product is recommended for statewide implementation, and further testing on a variety of surfaces is warranted. Metro Maintenance would like to hear from others statewide as to where there may be opportunities to implement this coating.



## Maintenance Research

### Road and Bridge Maintenance

**District/Office:**  
Metro/5B

**Contact:**  
Patrick J. O'Brien  
651-366-5820

**Project Cost:**  
\$64,000

**Start Date:**  
August 2015

**Completion Date:**  
March 2017

**Vendor:**  
[cispray.com](http://cispray.com)

## Vapor Abrasive Blast Equipment *Completed Research*



**Project Description:** When media blasting bridge infrastructure, there is a high amount of dust and other airborne particles generated. This creates health and safety concerns for the employee and others in the vicinity. In addition, prepping, cleanup and disposal with media or sand blasting is time consuming and expensive.

**Purpose:** The vapor blaster does not use media to remove dirt, graffiti, or other contamination from infrastructure surfaces. Because of this, the district expects to save time, manpower, money and material. No containment is needed, and one person can operate the equipment.

**Test Procedure:** The blaster was used on beam ends, bearings, abutments and joints for one year to verify the improvements and to determine whether the savings and improvements due to the use of the vapor blaster were real.

**Results:** The vapor blaster machine was a safer alternative to sand blasting, and required no tarping of the work area. There was a 90 percent reduction in airborne media as a result of using the vapor blaster.

**Recommendations:** The district recommends the implementation of the vapor blaster on a statewide basis. Other units that would find the machine useful include graffiti removal crews, striping crews and building maintenance.



## Maintenance Research

### Roadside Maintenance

**District/Office:**  
6W/Albert Lea

**Contact:**  
Brad Peterson  
507-379-3414

**Project Cost:**  
\$15,000

**Start Date:**  
December 2016

**Completion Date:**  
August 2017

**Vendor:**  
[altoz.com](http://altoz.com)

## ALTOZ TRX Mower

### Completed Research



**Project Description:** Mowing in wet grassy areas can cause mowers to get stuck and leave ruts behind. Filling ruts and extracting stuck mowers can be time-consuming, costly, and be a safety hazard. With the need for precision cutting around structures, and the feature to safely mow steep hills, the ALTOZ TRX zero turn mower is designed to easily mow in tough terrains and harsh conditions as well as cut hard corners.

**Purpose:** Known for its rugged design, the ALTOZ TRX mower minimizes tipping hazards for mowers when used on steep hills. Other safety benefits include reducing accidents and injuries from not having to extract mowers that get stuck in wet grass. The ALTOZ TRX mower is less expensive than the current mower, which will save money when it's time to purchase a new mower.

**Test Procedure:** The district evaluated the mower for one year, especially around monument structures and areas that are steep or wet.

**Conclusions:** The ALTOX TRX mower saved a lot of time by allowing operators to mow in various conditions, especially on wet grass. With other mowers, operators had to wait until the grass dried. Because of the efficiency, the district provided better service to their customers and completed more projects on time. Operators liked the easy steering and zero turn feature but noted the excessive vibration when driving the mower tracks over hard surfaces.

**Recommendations:** The district recommends the ALTOX mower for use statewide because it saves time and money by allowing operators to mow more efficiently.



## Maintenance Research

### Roadside Maintenance

**District/Office:**  
6E, 6W

**Contact:**  
Kristoffer Langlie  
507-286-7718

Rob Coughlin  
507-286-7564

**Project Cost:**  
\$13,000

**Start Date:**  
August 2015

**Completion Date:**  
April 2017

**Vendor:**  
[infrastructure.milliken.com](http://infrastructure.milliken.com)

## Concrete Cloth for Culvert Invert Lining *Completed Research*



**Project Description:** Metal culverts typically fail due to the invert (bottom of the pipe) rusting, causing holes. Lining a metal culvert can extend the service life up to 25 years. Traditional lining methods including concrete paving, cast in place pipe and sliplining, are labor intensive, expensive or greatly reduce a culvert's capacity. Concrete cloth liner comes in a roll, with concrete mix and fibers sandwiched between a bottom layer of PVC and a top layer of woven canvas. To install, the cloth is rolled out, secured and wet down. The district will test concrete cloth to determine its effectiveness and ease of installation.

**Purpose:** Concrete cloth is expected to save time, money and manpower over other methods of culvert lining. It can be installed without a contractor, is faster and easier to install and does not reduce culvert capacity.

**Test Procedure:** The district evaluated the performance of concrete cloth lining on two culverts with varying deteriorated conditions. One culvert was severely rusted with a few holes, and the other was rusted throughout with a completely deteriorated invert.

**Conclusions:** Installation of concrete cloths costs substantially less than Cured-In-Place-Pipe (CIPP) lining or full pipe replacements, and requires much less manpower and time. However, the service life of concrete cloths is 10 to 25 years versus 70 to 100 years of CIPP lining or full pipe replacement. Because concrete cloth lining is easy and quick to install, and is cost-effective, it is an ideal short-term solution for extending service life of culverts for another 25 years.

**Recommendations:** The district recommends concrete cloth lining for temporary or emergency repairs of deteriorated culverts with minimal to no holes.





## Maintenance Research

### Roadside Maintenance

**District/Office:**  
6W/Owatonna

**Contact:**  
Tony McCracken  
507-334-4495

**Project Cost:**  
\$96,065

**Start Date:**  
April 2014

**Completion Date:**  
December 2015

**Vendor:**  
[groundworkexperts.com](http://groundworkexperts.com)

## Guardrail Post Driver *Completed Research*



**Project Description:** This self-propelled guardrail post driver will make guardrail repair fast, easy and accurate, enabling crews to install posts in harsh conditions and on uneven terrain. The unit, which can install posts up to 13 feet tall, is designed with a compact footprint to help minimize traffic disruption and lane closures.

**Purpose:** Currently, maintenance crews use chains and booms to install guardrail posts. The guardrail post driver will save time by automating the post installation and removal processes, and provide a safer environment for both maintenance crews and the traveling public.

**Test Procedure:** The district evaluated the post driver's ability to increase productivity and improve workplace safety for maintenance crews and the traveling public, as well as its overall effectiveness in a variety of guardrail post applications.

**Conclusions:** The guardrail post driver's performance exceeded expectations of the district. The machine's capability to install posts at the correct height while keeping the post aligned eliminated the time needed to adjust the post. This saved money by reducing the manpower required and the potential for injuries. Because the guardrail post driver is a specialized piece of equipment, it requires an operator to be certified. However, the machine is not difficult to operate after training.

**Recommendations:** The district recommends the guardrail post driver for efficient installation of guardrails.





## Maintenance Research

### Safety, Traffic Control and Work Zone Safety

**District/Office:**  
7/Window

**Contact:**  
Mark Larson  
507-831-8041

**Project Cost:**  
\$8,000

**Start Date:**  
September 2013

**Completion Date:**  
December 2013

**Vendor:**  
[minnesotaequipment.com](http://minnesotaequipment.com)

## Barricade Trailer

### Completed Research



**Project Description:** Handling and transporting the cumbersome barricades used for road and lane closures can be challenging and result in injuries and equipment damage. The district will test a small trailer designed to hold barricades and the other materials needed for barricade placement (legs, sandbags and night flashers) in an effort to improve efficiency and safety.

**Purpose:** The barricade trailer is expected to save time when barricades must be set quickly in emergency conditions, require fewer employees to transport and set barricades, and eliminate lift hazards when barricades are loaded and unloaded from larger trailers.

**Test Procedure:** District maintenance crews will assess the effectiveness of the barricade trailer in saving time, reducing the staff needed for barricade placement, and reducing injuries.

**Conclusions:** Due to the trailer's design that allows barricades to be set at a lower ground level, fewer reports of lift injuries have been reported. The trailer's ample storage feature that holds barricades and related supplies, in combination with its streamlined design, requires fewer employees to transport and set barricades. A reduction in injuries and manpower has helped in reducing costs of barricade deployment.

**Recommendations:** The district recommends the barricade trailer, especially for outlying truck stations that may not need a large supply of barricades and signs.



## Maintenance Research

### Safety, Traffic Control and Work Zone Safety

**District/Office:**  
4A

**Contact:**  
Joe Stegmaier  
218-846-7943

**Project Cost:**  
\$11,000

**Start Date:**  
September 2014

**Completion Date:**  
November 2016

**Vendor:**  
[actionfabricating.com](http://actionfabricating.com)

## Cone Setting Basket

### *Completed Research*



**Project Description:** Placing cones for temporary traffic control is one of the more dangerous activities associated with setting up work zones. Currently, crew members stand or sit on the lift gate of a truck when setting cones on roadways to identify lane closures. Another method is needed that better protects crew members and allows crews to set cones for traffic control safely and quickly.

**Purpose:** District 4 has developed a front-mounted attachment to a truck from which workers can place cones. The truck can also be fitted with a truck-mounted attenuator, improving the safety of both MnDOT crew members and the traveling public.

**Test Procedure:** The district evaluated the functionality of the cone setting basket and its ability to save time and money, reduce injuries, and increase efficiency when setting cones for traffic control.

**Conclusions:** Because the cone setting basket held all the tools and was within easy reach, workers took only half the normal time required for cone setting tasks. The workers also reported that placing the cone setter at the front of the truck, in addition to being strapped to the basket, made them feel protected from any potential accidents.

**Recommendations:** The district recommends statewide implementation of cone setting baskets to increase safety of workers. They will also save money because less field time is needed to set cones.



## Maintenance Research

### Safety, Traffic Control and Work Zone Safety

**District/Office:**  
Metro

**Contact:**  
Sheila Johnson  
651-234-7935

**Project Cost:**  
\$5,200

**Start Date:**  
June 2014

**Completion Date:**  
June 2014

**Vendor:**  
[pivvariables.com](http://pivvariables.com)

## Sequential Traffic Safety Lights

### Completed Research



**Project Description:** When MnDOT supervisors are the first responders on the scene of a disabled vehicle or crash, the supervisor's truck and traffic cones may be the only protection or guidance marking the scene. The district will test a battery-powered beacon-style lamp that can be easily attached to a traffic cone to enhance the conspicuity of the incident scene. The lamps offer five "march" patterns and are remotely operated from the safety of the supervisor's vehicle. A similar barricade-style lamp that can be installed on drums offers five flash patterns and can be used for night-only or 24-hour operation.

**Purpose:** The sequential traffic safety lights are expected to enhance the positive guidance provided by the traffic cones and drums used in temporary traffic control, reinforcing the message to drivers that they must move over.

**Test Procedure:** The district tested four units—three sets of 10 beacon-style lamps that were added to traffic cones, and one set of 10 barricade-style lamps that were installed on drums used to mark the taper of lane closures. The district used field observations to assess the effectiveness of the sequential traffic safety lights in reducing injuries and accidents.

**Conclusions:** Even though the lamps were not as visible during daytime, the lights improved nighttime conspicuity. The sequential lights improved safety and traffic guidance at construction work zones at night. Because the lights required a lot of effort to set up, they would be more suited for long-term versus short-term maintenance projects. Additionally, the sequential traffic safety lights helped save money because they cost much less than the alternative barricade lights.

**Recommendations:** The district recommends the sequential lamp lights to be used at construction work zones to increase safety for workers. Because of the amount of effort needed to deploy the lights, they are more suited for longer-term road construction projects.



## Maintenance Research

### Safety, Traffic Control and Work Zone Safety

**District/Office:**  
Metro/Arden Hills

**Contact:**  
Michael Hartel  
651-639-4053

**Project Cost:**  
\$8,865

**Start Date:**  
November 2016

**Completion Date:**  
April 2017

**Vendor:**  
[airstarsafety.com](http://airstarsafety.com)

## Sirocco LED Balloon Lights

### Completed Research



**Project Description:** Balloon lighting is commonly used at construction zone work sites to illuminate night work. The current balloon light setup, which uses halogen bulbs, has several problems: the bulb housing requires frequent rewiring and repair, and the bulbs get very hot, sometimes melting the balloon itself. Despite the heat they generate, these bulbs are not bright enough to adequately illuminate the job site. The district will test Sirocco LED balloon lights, which are cooler and also cast a 360-degree light without glare.

**Purpose:** The Sirocco LED balloon lights will illuminate a larger area than the current halogen bulbs, making the work site safer. These bulbs also operate at cooler temperatures, so they have a short cooling time and will not melt the balloon.

**Test Procedure:** The district will evaluate the Sirocco LED balloon light for one year to compare it to the current halogen lights. The district expects to save time and material on repairs and replacement. In addition, the district expects a savings in manpower, since better illumination will result in fewer errors on projects.

**Conclusions:** The smaller Sirocco LED balloon lights provided better illumination than halogen lights. Even though both the halogen and LED large balloon lights provided the same amount of brightness, the LED bulbs are more durable and cools faster than the halogen lights, which also saves labor costs in waiting for the bulbs to cool.

**Recommendations:** The district recommends statewide use of the Sirocco LED balloon lights to provide safer work sites and cost savings.



## Maintenance Research

### Safety, Traffic Control and Work Zone Safety

**District/Office:**  
Metro/Golden Valley

**Contact:**  
Jeff Streeter  
651-366-5191

Pat Nagel  
651-366-5206

**Project Cost:**  
\$14,600

**Start Date:**  
October 2015

**Completion Date:**  
March 2017

**Vendor:**  
[actionradio.com](http://actionradio.com)

## Sonetics Wireless Headsets

### *Completed Research*



**Project Description:** When setting traffic cones, flagging traffic, and working on overhead signs, employees are in an especially vulnerable position. Workers often cannot see and hear other crew members, making communication difficult.

**Purpose:** The use of wireless headsets improves communications during traffic control operations, creating a safer work environment. The district expects to save time, money, manpower and material through improved communications. In addition, the district anticipates reduced accidents and injuries due to hands-free operation and duplex mode (simultaneous speak and listen) operation.

**Test Procedure:** The district evaluated the wireless headsets for one year to determine whether communication improvements actually led to safer work zone operations.

**Results:** Workers and crews found the headsets very comfortable and easy to use. They muffle external noise, making hearing easier, and the hands-free communication made flagging a safer operation. The headsets were used for flagging, lane closures and aerial work. Other crews heard about them, tried them and would like to order sets.

**Recommendations:** The district recommends statewide implementation because improved communications can lead to improved safety and there are numerous potential applications around the state.





## Maintenance Research

### Winter Maintenance

**District/Office:**  
6W/Albert Lea

**Contact:**  
Brad Peterson  
507-379-3414

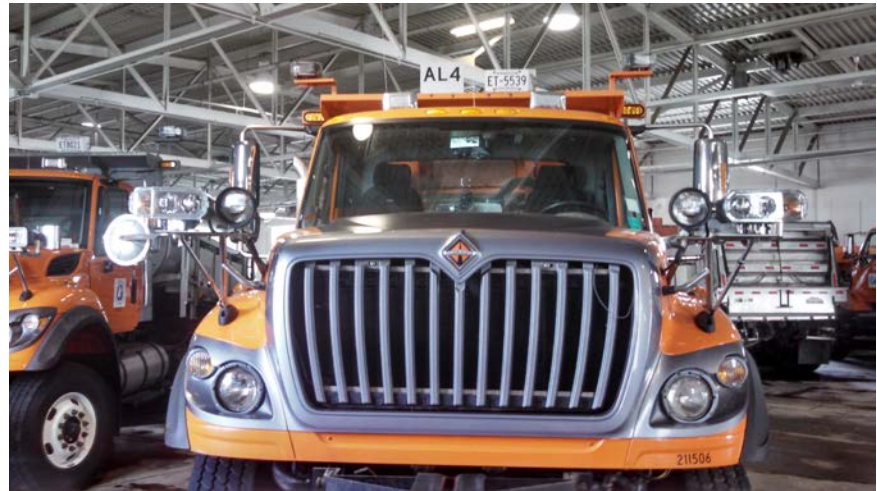
**Project Cost:**  
\$1,280

**Start Date:**  
August 2014

**Completion Date:**  
January 2016

**Vendor:**  
[towmaster.com](http://towmaster.com)

## Combination Snowplow Headlight System *Completed Research*



**Project Description:** Standard plow lights may not provide sufficient illumination for snowplow operators during nighttime plowing operations, particularly during snow events. Standard plow lights also lack a turn signal. To improve nighttime visibility, MnDOT is testing the use of an auxiliary combination snowplow headlight system.

**Purpose:** The combination headlight system, which combines a heavy-duty headlight with integrated park and signal lights, includes the wiring harness and the necessary mounting hardware. The new system is expected to increase road illumination for the plow operator and make the snowplow more visible to the traveling public.

**Test Procedure:** Four sets of combination headlights were tested—one set for use by District 6W and three sets that were shared across the state. Snowplow operators compared the new combination headlight system with plows using only standard plow lights to assess the combination headlight system's ability to improve nighttime visibility and safety.

**Conclusions:** The combination headlights were easy to install and adjust. In snow and fog, the heavy-duty headlights increased road illumination providing better visibility.

**Recommendations:** The district recommends adding the heavy-duty headlights in addition to existing standard plow lights on vehicles.





## Maintenance Research

### Winter Maintenance

**District/Office:**  
4/Detroit Lakes

**Contact:**  
Joe Stegmaier  
218-846-7943

**Project Cost:**  
\$10,000

**Start Date:**  
May 2014

**Completion Date:**  
August 2015

**Vendor:**  
[fallsplows.com](http://fallsplows.com)

## Falls Poly Trip Moldboard Plow *Completed Research*



**Project Description:** The Falls poly trip moldboard plow offers an alternative to steel plows. Mounted closer to the truck than a steel plow, the poly plow is expected to push snow further away from the plow, requiring less power to push the plow and reducing the amount of debris that flies onto the plow truck's windshield. Less debris on the windshield means better visibility for the plow operator and less wear on the windshield and wipers.

**Purpose:** Reducing the amount of snow and debris that comes up over the plow and onto the windshield during snow and ice events will improve the safety and efficiency of plowing operations. Operators will no longer be required to manually clear snow from the truck's hood and wipers, and a poly plow is less likely than a steel plow to frost up between plow shifts.

**Test Procedure:** The district evaluated the poly plow's effectiveness in saving fuel, reducing injuries and accidents by improving visibility, reducing wear on a plow truck's windshield and wipers, and increasing cutting edge life as compared to other types of plows on similar surfaces.

**Conclusions:** The poly plow was serviceable and did not crack during the test period. However, it did not appreciably reduce the amount of snow flying up onto the truck's windshield, the main benefit claimed. There was also no observable fuel savings during the test period.

**Recommendations:** The district does not recommend the poly plow for statewide implementation. The \$1,800 cost increase over a conventional plow is not justified by its performance.



## Maintenance Research

### Winter Maintenance

**District/Office:**  
3A/Baxter

**Contact:**  
Brandon Benning  
218-828-5818

Brian Steidl  
218-631-7688

**Project Cost:**  
\$4,900

**Start Date:**  
September 2016

**Completion Date:**  
February 2017

**Vendor:**  
[ironhawkindustrial.com](http://ironhawkindustrial.com)

## Lake Effect Blade System *Completed Research*



**Project Description:** Cutting edges for plow blades are a wear item. The district will evaluate the Lake Effect brand against the Joma brand, currently in use, as its cost has increased.

**Purpose:** The district expects the Lake Effect cutting edge to provide better wear than the current blade, therefore saving time and manpower in changing blades, and money to purchase them. The district also expects the new blade to reduce accidents by removing more compacted snow from the roadway, and result in fewer injuries as there will be less frequent blade changes.

**Test Procedure:** The district evaluated the Lake Effect cutting edge from November 2016 through January 2017, over thirteen snow events and two wind events. Approximately 6,200 total miles of plowing was done with the Lake Effect cutting edge on the plow. The blade was evaluated for frequency of change, replacement cost, time to change and performance on the road.

**Conclusions:** Operators found the blade easy to install, and it gave a comparable result on the road to the current blade cutting edge. The blade was also relatively quiet in operation, similar to the Joma blade. However, the blades experienced wear failure, particularly on the left side, which operators believe may be due to the presence of center line rumble strips on the roadway.

**Recommendations:** The district does not recommend this product for statewide implementation, as it did not perform well on roadways with rumble strips. It may be better suited to roadways that do not have rumble strips, but was not tested on that type of roadway.



## Maintenance Research

### Winter Maintenance

**District/Office:**  
6W

**Contact:**  
Albert Lea Truck Station  
507-379-3414

**Project Cost:**  
\$1,424

**Start Date:**  
August 2015

**Completion Date:**  
March 2017

**Vendor:**  
[kibbleeq.com](http://kibbleeq.com)

## LED Fog Lights *Completed Research*



**Project Description:** The lack of visibility on roads during heavy snow conditions presents a safety hazard for snowplow truck operators. The district currently uses halogen fog lights which are adequate for normal use but ineffective in illuminating through heavy snowfall.

**Purpose:** The LED fog lights will replace existing halogen lights. LED lights use less energy than fog lights but illuminate much brighter, which can also reduce accidents. Replacing fog lights less frequently helps reduce costs for the district.

**Test Procedure:** Truck operators evaluated the ease of installation of the lights, and tested the effectiveness of LED fog lights in heavy snowfall.

**Conclusions:** The LED fog lights performed better than the halogen fog lights in heavy snow conditions. The brighter light illuminated a wider area of the road making it safer for truck operators. Additionally, they were easy and quick to install.

**Recommendations:** Even though LED fog lights provide a better alternative to halogen lights, the cost may not justify their benefits. LED fog lights should only be used if they cost equal to or less than the currently stocked strike force lights at the district.



## Maintenance Research

### Winter Maintenance

**District/Office:**  
6W/Red Wing

**Contact:**  
Trevor Huneke  
507-732-7112

**Project Cost:**  
\$2,000

**Start Date:**  
September 2013

**Completion Date:** January  
2016

**Vendor:**  
[Midwest Custom Concepts](#)

## LED Plow Lights *Completed Research*



**Project Description:** This project will test an LED lighting combination that includes spot and flood lights to provide effective illumination of both distance and area. The spot-style LED light projects light over great distances in a concentrated beam. This type of light is designed for use at high speeds or when visibility is needed at great distances. While the flood-type LED light projects light at just over half the distance of the spot light, it provides twice the area coverage.

**Purpose:** The district will test these lights to determine if they will penetrate adverse weather conditions such as heavy or blowing snow and fog to provide greater visibility than standard fog or white headlights.

**Test Procedure:** The district installed the lights on four plow trucks and evaluated their effectiveness in providing better visibility and increasing safety when plowing during heavy snowstorms, fog and other adverse weather conditions.

**Conclusions:** The spot and flood LED lights failed to provide better visibility in heavy snow or other adverse weather conditions. At times, the orange shaded lighting made visibility worse. Because the lights were ineffective in providing better visibility, they were hardly used by the truck operators.

**Recommendations:** The district does not recommend the use of spot and flood LED lights.



## Maintenance Research

### Winter Maintenance

**District/Office:**  
4/Moorhead

**Contact:**  
Joe Stegmaier  
218-846-7943

**Project Cost:**  
\$9,500

**Start Date:**  
October 2015

**Completion Date:**  
April 2016

**Vendor:**  
[monroetruck.com](http://monroetruck.com)

## Monroe Tailgate Spreader

### Completed Research



**Project Description:** The district is seeking an alternative to custom-made tailgate sanders. Premanufactured Monroe replacement tailgate sand spreaders have a shorter delivery time than custom-made sanders which can take several months. Additionally, existing truck tailgates have to be modified for the customized sanders to fit properly.

**Purpose:** The Monroe stainless steel tailgate comes with a sander installed, so the tailgate can be used in the winter months and switched out with the regular tailgate for the summer months. Additional benefits include a quick delivery time and it costs less than a customized tailgate sander.

**Test Procedure:** The district tow plow operators evaluated the ease of use and performance of the Monroe replacement tailgate sanders during the 2015 snow and ice season.

**Conclusions:** A fast delivery time allowed the Monroe replacement tailgate to be delivered before the winter season. When the cover plates were not shipped with the unit, the vendor was responsive and promptly sent the parts. The tailgate worked well for sanding due to an auger that kept materials from bridging. Because the sanders did not have to be removed from the trucks when used for towing trailers and crash attenuators, they saved time and manpower.

**Recommendations:** The district recommends statewide implementation of the Monroe replacement tailgate sanders because it costs less than the customized ones, saves time on delivery and performs well.





DEPARTMENT OF  
TRANSPORTATION

## Maintenance Research

### Winter Maintenance

**District/Office:**  
6W/Albert Lea

**Contact:**  
Wayne Golberg  
507-434-2776

Ken Graeve  
651-366-3613

Daniel Gullickson  
651-366-3610

**Project Cost:**  
\$6,440

**Start Date:**  
September 2010

**Completion Date:**  
November 2015

**Vendor:**  
[prairiemoonnursery.com](http://prairiemoonnursery.com)

## Native Planting Snow Drift Control

### *Completed Research*



**Project Description:** Keeping snow and ice off of windswept areas of the roadway can be aided by the installation of a traditional snow fence, tree and shrub planting, and by leaving standing corn rows in farm fields. In roadway ditch rights of way where these methods are not an option or have proved to be too expensive to implement, the district will plant a 10-foot-wide swath of tall native grasses and a 5-foot-wide strip of a perennial cone wildflower mix to serve as a windbreak.

**Purpose:** An effective windbreak can save time and money by requiring fewer passes and less material to clear snow and ice from the roadway. The project plantings have the additional benefit of providing wildlife habitat and an aesthetically pleasing backdrop for the traveling public.

**Test Procedure:** The district assessed the impact of the planting areas in reducing the time and material required to keep the adjacent roadway free of snow and ice.

**Conclusions:** Due to constant mowing to remove weeds during the planting establishment period from 2011 through 2013, the native prairie growth was not tall enough to trap snow until 2014. Snow plow operators reported minimal difference in the amount of snow on the roads from previous years. Based on cost analysis of materials spent and manpower to clear the snow, there were no cost savings during this period. If, however, periodic controlled burns, weed control methods and better tracking of benefit costs are implemented, native plantings can result in potential long-term savings.

**Recommendations:** The district recommends planting of native prairie or wildflowers only if a vegetation management plan and prescribed periodic fire treatments are also implemented.





DEPARTMENT OF  
TRANSPORTATION

## Maintenance Research

### Winter Maintenance

**District/Office:**  
6E/Winona

**Contact:**  
Reggie Shones  
507-286-7577

**Project Cost:**  
\$11,919

**Start Date:**  
July 2013

**Completion Date:**  
August 2015

**Vendor:**  
[wikco.com](http://wikco.com)

## Wikco Truck-Mounted Sweeper *Completed Research*



**Project Description:** A truck-mounted, hydraulically driven sweeper that mounts on a truck's snowplow hitch frame offers an effective solution for cleaning up salt stockpiles and yards after a snow event, controlling the salt residue that presents environmental concerns.

**Purpose:** A sweeper truck attachment that can be used by remote locations lacking a sweeper eliminates the need for staff to load skid steers onto trailers to transport to outlying truck stations.

**Test Procedure:** The district evaluated the sweeper attachment for its ability to contain environmental threats related to salt use. They also evaluated the easy installation of the sweeper which saves time, money and manpower, and reduces the potential for injuries and accidents.

**Conclusions:** Even though the sweeper was easy to install and was well-made, the existing truck fleet did not meet the hydraulic system requirements to properly operate the sweeper. Due to low hydraulic flow, overheating issues of the existing trucks and low productivity were observed.

**Recommendations:** The district does not recommend the truck-mounted sweeper due to the inadequate hydraulic system design of their truck fleet.



## Maintenance Research

### Equipment and Tools

**District/Office:**  
Metro/Maple Grove,  
Plymouth

**Contact:**  
Bill Augello  
651-234-7906

**Project Cost:**  
\$1,600

**Start Date:**  
June 2017

**Vendor:**  
[stihlusa.com](http://stihlusa.com)

## Battery Chainsaw

### *Research in Progress*



**Project Description:** Due to the long bar length of large chainsaws, kickbacks can occur when the tip of the guide bar hits another object or gets pinched on either side. Kickbacks, or the reversal of the chainsaw motion, poses greater risks for injuries. The district will test smaller, battery operated chainsaws that are lightweight and provide better control.

**Purpose:** Battery-powered chainsaws save time and money by eliminating the need for fuel and refueling during jobs. Smaller chainsaws are ideal for light cutting and are safer to use than large chainsaws.

**Test Procedure:** The district will test four battery-powered chainsaws for one year. The smaller chainsaws will be used to do light cutting of bushes and overgrowth around guardrails and cables. The district will evaluate the occurrences of kickbacks from using a smaller chainsaw, and will assess the difference in costs on maintenance expenses between the larger chainsaws versus the smaller chainsaws.



## Maintenance Research

### Equipment and Tools

**District/Office:**  
Metro/Maple Grove

**Contact:**  
Bill Augello  
651-234-7906

**Project Cost:**  
\$1,000

**Start Date:**  
August 2015

**Vendor:**  
[powerhouse.cc](http://powerhouse.cc)

## Battery Powered Chop Saw *Research in Progress*



**Project Description:** To be ecofriendly, the district would like to replace existing gas chop saws with battery powered chop saws. There may be a difference in performance between the two models. Gas powered tools are known to provide stronger cutting power over electric powered tools.

**Purpose:** Battery powered chop saws save time and money by eliminating the need for fuel and refueling during jobs. Since battery-based models are usually lighter, they can also reduce lifting injuries. A battery powered chop saw is also half the price of a gas chop saw. Differences in performance of the two models will be evaluated against the pros and cons of each.

**Test Procedure:** The night guardrail crew will use the battery powered chop saw for one year. The district will conduct a comparative evaluation between a gas powered chop saw and a battery powered chop saw focusing on the performance of each.



## Maintenance Research

### Equipment and Tools

**District/Office:**  
Metro/Maple Grove

**Contact:**  
Bill Augello  
651-234-7906

**Project Cost:**  
\$2,500

**Start Date:**  
June 2017

**Vendor:**  
[mscdirect.com](http://mscdirect.com)

## Battery Powered Stand Light

### *Research in Progress*



**Project Description:** The district is seeking a more cost-efficient lighting alternative to handheld spot lights. A more flexible design with a stand and multidirectional light heads can provide a wider area of illumination.

**Purpose:** The Rocket LED tower cordless work light sits on a stand that can extend to seven feet. An additional feature of three independent pivoting light heads delivering 3000 lumens means large areas can be brightly illuminated. Better lighting provides a safer work environment. The Rocket LED tower light is also easy to set up, saving time

**Test Procedure:** The district's guardrail crews, night drain crews and smooth pavement crews will evaluate the effectiveness of the battery powered stand light.



## Maintenance Research

### Equipment and Tools

**District/Office:**  
6W/Austin

**Contact:**  
Mike Mehling  
507-434-2776

**Project Cost:**  
\$5,500

**Start Date:**  
March 2017

**Vendor:**  
[buffaloturbine.com](http://buffaloturbine.com)

## Buffalo Turbine Blower

### *Research in Progress*



**Project Description:** Blowers are useful for clearing snow under guardrails, clearing cracks for asphalt repairs and cleaning debris from vehicle accidents on roads. Currently, the district is using backpack blowers for these tasks. However, any task that requires an operator to be on the roads can be dangerous due to passing cars. The Buffalo Cyclone PTO is a powerful turbine debris blower that can be attached to a tractor allowing an operator to sit safely in a vehicle versus walking on the roads.

**Purpose:** The more powerful Buffalo turbine blower can easily and efficiently clear glass and other debris from road accidents as well as thoroughly clean cracks before a crack filling machine is used to repair asphalt. In addition, using the Buffalo turbine blower to remove snow under guardrails helps reduce drifting which results in safer roads. The wirelessly controlled 360-degree nozzle makes it easy to use and the fuel-efficient engine design helps reduce operating costs.

**Test Procedure:** The district will evaluate the effectiveness of the blower on clearing snow drift under guardrails and road debris. The district will also assess the cost savings of the Buffalo turbine blower after one year of testing.



## Maintenance Research

### Equipment and Tools

**District/Office:**  
Metro

**Contact:**  
Rob Lehrke  
952-476-3261

**Project Cost:**  
\$9,960

**Start Date:**  
July 2013

**Vendor:**  
[dakecorp.com](http://dakecorp.com)

## Dake Manual Cold Saw

*Research in Progress*



**Project Description:** Cold saws are an alternative to abrasive saws. They stay cool because heat from cutting is transferred to the chips rather than the blade or the main material being cut. The district will test the cold saw to determine whether it can outperform and replace other saws in district mechanic, sign and welding shops.

**Purpose:** The cold saw is expected to provide accurate and more efficient metal cutting. It could replace horizontal band saws, handheld band saws, and stationary cut off saws. Cold saws make cleaner and more accurate cuts and cause less wear on blades and belts. They may also offer safety advantages such as quieter operation, slower speeds, elimination of particulate materials, and no sparking.

**Test Procedure:** The district will do a one-year test to evaluate the effectiveness of the cold saw against five criteria: (1) increased cutting accuracy; (2) increased ability to use smaller pieces of material; (3) reduction in the use of belts and blades; (4) reduced setup times; and (5) reduction in the amount of airborne abrasive particulate. The slower speed of the saw may also reduce employee injuries.





## Maintenance Research Equipment and Tools

**District/Office:**  
Metro

**Contact:**  
Rich Ellinghuysen  
651-366-5993

**Project Cost:**  
\$1,011

**Start Date:**  
December 2016

**Vendor:**  
[soundingtech.com](http://soundingtech.com)

## Electronic Delamination Sounding Tool *Research in Progress*



**Project Description:** Delaminations in concrete slabs can be a serious problem and affect the integrity of bridges and structures. The common method for detecting delaminations in steel reinforced concrete structures was the chain drag and sounding hammer. However they are not very effective when used in high traffic areas due to the traffic noise.

**Purpose:** The electronic delamination tool allows quicker and more accurate assessments of damaged concrete structures.

**Test Procedure:** The district will evaluate the effectiveness of the electronic delamination sounding tool over two years in saving manpower and reducing the possibility of employee injuries.



## Maintenance Research

### Equipment and Tools

**District/Office:**  
6E/Stewartville

**Contact:**  
Jim Hurley  
507-533-4413

**Project Cost:**  
\$4,200

**Start Date:**  
July 2016

**Vendor:**  
[evolutionwheel.com](http://evolutionwheel.com)

## Evolution Wheel

### *Research in Progress*



**Project Description:** The Evolution Wheel is a solid wheel used to replace tracks and pneumatic tires on vehicles in heavy-duty, wet or swampy field applications. The district will use this product to replace logging tracks on brush removal vehicles.

**Purpose:** The district expects these wheels to provide longer uptime when working with forester units. Ordinary tracks get torn and tires get punctured, wasting time and costing money to repair or replace them. Evolution wheels are designed to provide better traction and long service life.

**Test Procedure:** The district will evaluate the effectiveness of the Evolution Wheels over two years in saving time, manpower and money. These savings are expected because the wheels are easier to install than bolt-on tracks, are usable in rough terrain and wet areas, and do not need frequent repair as do tracks.



## Maintenance Research

### Equipment and Tools

**District/Office:**  
3B/Cambridge

**Contact:**  
Tony Demars, Kelvin Smith,  
Dan Meinen  
763-689-7086

**Project Cost:**  
\$6,500

**Start Date:**  
February 2017

**Vendor:**  
[grainger.com](http://grainger.com)

## Gantry Crane

### *Research in Progress*



**Project Description:** Mechanics currently use either a loader or a skid steer to lift and maneuver heavy plow parts during installation. There is a lack of fine control, and visibility is not adequate with this method. In addition, the loader or skid steer cannot be used inside truck stations due to limited space and diesel emissions. The gantry crane is a more appropriate and safer tool for these jobs.

**Purpose:** The district will evaluate the gantry crane for one year. The crane is expected to save time, manpower and money because mechanics will have better control over the heavy parts they are installing, and one person will be able to do what it now takes three to accomplish. Positioning equipment should be much easier, improving safety and reducing injuries.

**Test Procedure:** The district will track the number of projects completed with the gantry crane that were previously sent to other areas or handled with a skid steer or loader.



## Maintenance Research

### Equipment and Tools

**District/Office:**  
Metro/5B

**Contact:**  
Patrick O'Brien  
651-366-5820

Joseph Podobinski  
651-558-2150

**Project Cost:**  
\$10,033

**Start Date:**  
January 2017

**Vendor:**  
[gradientlens.com](http://gradientlens.com)

## Hawkeye V2 Video Borescope

### Research in Progress



**Project Description:** When large slabs of concrete must be lifted, the crew often has difficulty finding the best location to pump foam material, because they are unable to see anything below the surface. Many times they drill holes only to find they are not even near the area that needs repair. The Hawkeye V2 Video Borescope camera enables crews to see beneath the surface.

**Purpose:** The camera will allow crews to visualize the terrain underneath a sunken slab, so they can better estimate the location and size of a void before attempting to make repairs. The district expects the borescope camera to save time, manpower, money and material, as well as help reduce accidents by shortening the time spent on the roadway and right of way.

**Test Procedure:** The district will evaluate the Hawkeye V2 Video Borescope camera by using it on every sunken slab project throughout the 2017 construction season. These jobs will be compared to similar projects done without the camera for time, manpower and material savings.



## Maintenance Research Equipment and Tools

**District/Office:**

4A/Fergus Falls, Moorhead

**Contact:**

Brent Holland  
218-332-5640

**Project Cost:**

\$2,033

**Start Date:**

June 2017

**Vendor:**

[us.lewiswinch.com](http://us.lewiswinch.com)

## Lewis Chainsaw Winch

### *Research in Progress*



**Project Description:** Operating or working near winches may potentially expose district crews to hazards such as being struck by a broken line or cable. The district is seeking an alternative to come along and chain winches that is safer and more powerful. A stronger, more reliable winch will minimize potential injuries.

**Purpose:** The Lewis Winch 400-MK2 is a heavy duty, yet lightweight, portable winch that can pull up to 4,000 pounds. An adapter kit allows the attachment of any chainsaw to the Lewis Winch. Because the winch operates from a chainsaw's engine, it can quickly pull heavy loads thereby saving time in the field. Additionally, the Lewis winch is made of a rugged cast-aluminum alloy housing and galvanized cable. Both features make it extremely strong, and safer to use than other types of winches.

**Test Procedure:** The district guardrail crews will use the Lewis chainsaw winch for repair work on median cable barriers. They will test it for one year and evaluate if it will pull cables together more efficiently. They will also note if fewer crew members are needed to perform the work.



## Maintenance Research

### Equipment and Tools

**District/Office:**  
6W/Red Wing

**Contact:**  
Greg Peters  
507-263-2323

**Project Cost:**  
\$12,500

**Start Date:**  
July 2016

**Vendor:**  
[marshalltreesaw.com](http://marshalltreesaw.com)

## Marshall Tree Saw

*Research in Progress*



**Project Description:** The Marshall Tree Saw offers an alternative to the conventional chain saw. The unit mounts to any skid steer and can enable an operator to clear, move and stack numerous trees in a shift, right from the skid steer cab. No dozer clearing is required and no stumps are left to grind.

**Purpose:** The district expects this saw to replace chain saws, and its use should result in time and manpower savings, since operator efficiency will increase. There will be fewer chainsaw accidents and because the operator stays in the cab, reduced chances of a tree falling on anyone.

**Test Procedure:** The district will evaluate the Marshall Tree Saw for six months to one year, to determine whether it performs as claimed on rights of way, roadsides and in ditches.





## Maintenance Research Equipment and Tools

**District/Office:**  
4B/Morris

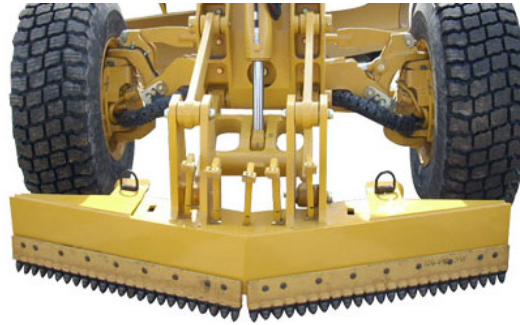
**Contact:**  
Rob Kloos  
320-208-7022

**Project Cost:**  
\$12,000

**Start Date:**  
May 2017

**Vendor:**  
[monroetruck.com](http://monroetruck.com)

## Monroe Eradicator *Research in Progress*



**Project Description:** Plowing road surfaces compacted with snow and ice requires an enormous amount of manpower and deicers to remove the compaction. Plow blades alone are ineffective, so in many instances, the additional use of expensive chemicals and/or salts are required in the complete removal of compacted ice. The district is seeking to test an eradicator to scarify compacted ice so that less deicer would be needed.

**Purpose:** The Monroe Eradicator is a scarifier designed to break up hard-packed snow and thick ice. Its 91-inch tooth coverage with a V-angled design effectively chips and loosens compacted ice, even more so when used with optional rotating carbide bits. Because of its effectiveness, using the Monroe Eradicator requires less manpower and deicers to clear the roads, thereby saving time and money. The Eradicator fits most John Deere and Caterpillar motor graders with scarifier or B-hook lift groups.

**Test Procedure:** For one year, the district will evaluate the Monroe Eradicator by comparing bare pavement regain times when using regular plow blades in combination with chemical deicers and salts. They will also evaluate its effectiveness by comparing similar routes' cost per lane mile.



## Maintenance Research

### Equipment and Tools

**District/Office:**  
3A/Little Falls

**Contact:**  
Todd Fussy  
320-616-2492

**Project Cost:**  
\$1,600

**Start Date:**  
June 2017

**Vendor:**  
[irobot.com](http://irobot.com)

## Robotic Vacuum *Research in Progress*



**Project Description:** The Little Falls district office moved into a larger office area which requires staff to spend more time sweeping floors. The district is seeking a solution that will allow staff to spend less time sweeping floors.

**Purpose:** By using the Roomba, a robotic vacuum that can be programmed to navigate itself around areas to vacuum floors, staff time dedicated to cleaning would decrease. Even after factoring in maintenance costs such as replacement filters, the investment in a Roomba should cost less than regular janitorial service fees.

**Test Procedure:** The district will test the Roomba at the Little Falls headquarters to determine if the use of a robotic vacuum will save staff time in sweeping floors. They will also assess quality of cleanliness, cost of maintenance and durability of the Roomba in a commercial setting.



## Maintenance Research

### Road and Bridge Maintenance

**District/Office:**  
7E/Mankato

**Contact:**  
Tony DeSantiago  
507-304-6233

**Project Cost:**  
\$3,300

**Start Date:**  
October 2015

**Vendor:**  
[brockwhite.com](http://brockwhite.com)

## Elephant Armor *Research in Progress*



**Project Description:** Elephant Armor is a fast-setting, permanent concrete patch product that can be used year-round. The district wants to identify a fast repair material that will be long lasting. Test results from a single bag look promising, so the district would like a formal, two-year test of the product.

**Purpose:** Often there is a single hole to patch at a job site, and it takes longer to set up traffic control than to make the repair. A fast-setting, permanent repair will get traffic back on the road faster and minimize workers' exposure to hazards. The district will assess product claims of ease and permanence of installation.

**Test Procedure:** The district will monitor product performance and document all patched holes with times, dates and photos. A two-year test will provide freeze-thaw cycle information. Evaluation criteria include durability (not having to repeat the repair), ability for a smaller crew to patch holes more quickly, and the ability to use the product year-round. The product will also be included in a larger study of patching products.



## Maintenance Research

### Road and Bridge Maintenance

**District/Office:**  
Metro/Traffic Services

**Contact:**  
Sheila Johnson  
651-234-7935

**Project Cost:**  
\$7,100

**Start Date:**  
May 2015

**Vendor:**  
[pavement-repair-products.com](http://pavement-repair-products.com)

## FastPatch DPR *Research in Progress*



**Project Description:** When signs are installed in concrete medians, the work crew has to mix and pour concrete in the core, then leave it to cure for a day or two before returning to finish installing the sign. With FastPatch DPR and its Kicker catalyst, that process is reduced to just 20 minutes. Crews can install signs in a single visit. Since the crew needs to visit the job site only once, traffic disruption and workers' exposure is minimized.

**Purpose:** The district will evaluate FastPatch for one year for cost and time savings. The district is also interested in durability, because as many as one third of concrete cores fail, whether due to sign vibration or vehicle strikes. Safety improvements will also be evaluated.

**Test Procedure:** The district will track installation time and compare it to historical data for the concrete core method currently in use. In addition, the number of failures will be tracked and compared to historical data.



## Maintenance Research

### Road and Bridge Maintenance

**District/Office:**  
7/Mankato

**Contact:**  
Randy Glaser  
507-304-6234

**Project Cost:**  
\$15,000

**Start Date:**  
May 2017

**Vendor:**  
concastinc.com

## Fibercrete

### *Research in Progress*



**Project Description:** Crack sealing of concrete pavement can be time consuming and costly. Cementitious repairs are prone to failure due to their stiffness. The district is seeking an alternative crack sealant material that is durable and long-lasting.

**Purpose:** Fibercrete is a hot applied flexible concrete repair sealant. Because of its flexibility, the material is resistant to heavy traffic and changing temperatures. Its durability makes it an ideal long-term solution for road maintenance projects. Using Fibercrete can eliminate the need to repave roads and make continual repairs when using stiffer crack sealants, thereby saving time and money.

**Test Procedure:** The district will use Fibercrete to seal cracks on concrete pavement at multiple locations. They will also apply it on various crack sizes and evaluate its effectiveness of durability and longevity.



## Maintenance Research

### Road and Bridge Maintenance

**District/Office:**  
2/Southwest

**Contact:**  
Dave Larson  
218-277-7961

**Project Cost:**  
\$15,000

**Start Date:**  
July 2015

**Vendor:**  
[uretekusa.com](http://uretekusa.com)

## Uretek Slab Lifting *Research in Progress*



**Project Description:** Distresses in bituminous pavements can be caused by various reasons such as foundation settlement, thermal fluctuations of the surface or insufficient compaction of the pavement courses. These changes can lead to cracks, ripples and dips in the road which needs to be repaired. An alternative to replacing the pavement, which can be costly, is to correct the problem by using Uretek's slab lifting process.

**Purpose:** The process to accurately lift and realign sunken concrete slabs or pavements involves injecting expansive geopolymer into the underlying soil through a series of small holes drilled through the slab or asphaltic concrete. The expanding geopolymer then lifts the slab to the required level. This quick lifting process costs much less than repaving. Other benefits include less lane closure downtime and less materials, equipment and manpower needed in pavement replacement jobs.

**Test Procedure:** The district materials and lab department will compare costs using Uretek's slab lifting process versus a repaving project. The district will also evaluate whether or not less time, materials and workers were needed to perform the pavement repair work as expected.





## Maintenance Research

### Roadside Maintenance

**District/Office:**  
6W/Albert Lea

**Contact:**  
Brad Peterson  
507-379-3414

**Project Cost:**  
\$7,800

**Start Date:**  
July 2016

**Vendor:**  
[titanmachinery.com](http://titanmachinery.com)

## Bi-Directional Shoulder Reclaimer *Research in Progress*



**Project Description:** Road shoulder problems can quickly undermine the road foundation. The shoulder reclaimer is a claw attachment that is used to fill in ruts and smooth the shoulder. The unit currently in use is mounted on the right side of the tractor and can only be used on that side. The Tiger Claw model is positioned in the middle of the tractor for transport and can be used on either side.

**Purpose:** The district expects that using the bi-directional shoulder repair claw will save time, money, manpower and material because it drives with the flow of traffic, even on left shoulders. This is in contrast to the current unit, which must go against traffic, taking part of a lane on the left side. This bi-directional feature should also reduce injuries and accidents.

**Test Procedure:** The district will evaluate the claw for eighteen months, working on both sides of the road. Operators will test the center-mounted feature for driveability on the road, as well as performance on both shoulders of the road.



## Maintenance Research

### Roadside Maintenance

**District/Office:**  
6W/Albert Lea

**Contact:**  
Brad Peterson  
507-379-3414

**Project Cost:**  
\$3,474

**Start Date:**  
December 2016

**Vendor:**  
[j-craftinc.com](http://j-craftinc.com)

## Gate Saver *Research in Progress*



**Project Description:** Brush and debris are currently hauled with truck tailgates down, making it possible for some of the load to come out of the box during transport. The Gate Saver allows the gate to be closed securely, but makes emptying easier with up to fifteen inches of extra clearance at the top. This product would also make sander removal easier.

**Purpose:** The district will install and evaluate one of the Gate Saver units for eighteen months. The Gate Saver could also reduce injuries and accidents by keeping loads and debris in the truck and off the roadway.

**Test Procedure:** District operators using the truck will compare it to the current conventional tailgate for time, manpower and money savings. They will also evaluate its convenience in sander removal.



## Maintenance Research

### Roadside Maintenance

**District/Office:**  
3A/Aitkin

**Contact:**  
Isaiah Doty  
218-427-4493

**Project Cost:**  
\$525

**Start Date:**  
February 2017

**Vendor:**  
[i-c-mor.com](http://i-c-mor.com)

## I-C-MOR Rearview Mirror

*Research in Progress*



**Project Description:** Skid-steer operators have a hard time seeing what is alongside or behind them, and they often must stand up to look over the lift arms of the skid steer to be sure of their path. The I-C-MOR rearview mirror allows the operator to see these areas while remaining safely seated.

**Purpose:** The mirrors are easy to install on all types of skid steer loaders. The kit consists of two fully adjustable 8.5" convex mirrors and all mounting hardware for easy and permanent installation. The district expects these mirrors to save money by helping operators avoid obstacles, thus reducing damage to equipment and structures. The mirrors should also reduce injuries and accidents by improving the operators' range of vision while backing, and by reducing fatigue.

**Test Procedure:** The district will evaluate these mirrors for one year to determine whether they save money and reduce injuries and accidents.



## Maintenance Research

### Roadside Maintenance

**District/Office:**  
6E/Stewartville

**Contact:**  
Brian Wolfgram  
507-533-4413

Jerry Gunderson  
507-286-7616

**Project Cost:**  
\$112,000

**Start Date:**  
August 2015

**Vendor:**  
[loftness.com](http://loftness.com)

## Kwik Trim Saw

*Research in Progress*



**Project Description:** Roadside maintenance crews need the ability to safely reach and trim trees on a sloping or hilly right of way. Sometimes the trees are as far as twenty to thirty feet away from a safe setup point. The Kwik Trim saw enables an operator to reach these otherwise difficult cuts, quickly and safely.

**Purpose:** The Kwik Trim saw is expected to replace bucket trucks which must be purchased, rented or contracted. These trucks are not always available when needed, can be costly, and are not always safe to use. The Kwik Trim saw is expected to save time, manpower, money and material, as well as reducing injuries and accidents.

**Test Procedure:** The district will evaluate the Kwik Trim for speed and safety for one year and will prepare a safety report on the saw.



## Maintenance Research

### Roadside Maintenance

**District/Office:**  
4A, 4B/Detroit Lakes

**Contact:**  
Joe Stegmaier  
218-846-7943

Anthony Karlen  
218-846-7964

**Project Cost:**  
\$5,091

**Start Date:**  
December 2016

**Vendor:**  
[titanmachinery.com](http://titanmachinery.com)

## Rubber Tracks

### *Research in Progress*



**Project Description:** Roadside maintenance often takes place in wet, environmentally sensitive environments that do not offer much traction. When skid loaders are used, the current metal and rubber tracks can damage the surface and the skid loaders frequently get stuck.

**Purpose:** The rubber track will improve skid loader traction while minimizing damage to sensitive environments. Better traction means improved safety on steep slopes and better operator efficiency. The district expects to save time, money, manpower, and to reduce injuries and accidents through the use of rubber tracks.

**Test Procedure:** The district will install rubber tracks on one skid loader and evaluate it for one year, monitoring track wear, the number of times the unit gets stuck, and the number of rollovers.



## Maintenance Research

### Safety, Traffic Control and Work Zone Safety

**District/Office:**  
Central Office

**Contact:**  
Steve Blaufuss  
651-366-3548

**Project Cost:**  
\$2,500

**Start Date:**  
November 2016

**Vendor:**  
[astrooptics.com](http://astrooptics.com)

## Traffic Guard Worker Alert System

### *Research in Progress*



**Project Description:** Road construction work can be dangerous for district crews due to closely passing vehicles. According to the American Traffic Safety Services Association, around 37,000 people are injured in work zone crashes nationwide each year. The district is seeking to implement safety measure to decrease potential injuries to district crews at work zones.

**Purpose:** The Traffic Guard Worker Alert System consists of a lightweight, easy-to-setup trip hose and sensor assembly that wirelessly sends a signal up to 1,000 feet away to a flashing rechargeable siren alarm safety device. The trip hose is placed in a location that provides enough warning for workers to get out of harm's way. When a work zone intrusion occurs, a vibration and siren signal on the safety device notifies the worker of impending danger. This cost-effective tool can potentially save lives and prevent injuries to district road crews.

**Test Procedure:** The Traffic Guard Worker Alert System will be tested in two districts for one year. Supervisors and field personnel will evaluate the device's effectiveness on alerting workers in two different settings and traffic schemes. The number of false-positive alerts will also be evaluated.





## Maintenance Research

### Safety, Traffic Control and Work Zone Safety

**District/Office:**

Metro/Mendota Bridge

**Contact:**

Mike Anderson  
651-366-5941

Tony Werner  
651-366-5940

**Project Cost:**

\$6,014

**Start Date:**

December 2016

**Vendor:**

ledusa.com

## Truck Mounted LED Lights

### *Research in Progress*



**Project Description:** Night work brings a special hazard of trying to accomplish work with insufficient lighting. Working in the dark makes an already difficult task even more so, and can make it dangerous as well. Truck mounted LED lights will provide better lighting for night bridge deck repairs and other operations.

**Purpose:** The district expects the truck mounted LED lights to save time and money by allowing workers to do the job faster and more efficiently by providing better lighting. The lights should also help reduce injuries and accidents by illuminating tripping hazards and other obstacles on the job site.

**Test Procedure:** The LED lights will be evaluated for six months during night work to determine whether the job site is sufficiently brighter to make the work safer, easier and more efficient.



## Maintenance Research

### Safety, Traffic Control and Work Zone Safety

**District/Office:**  
8/Hutchinson

**Contact:**  
Rick Deckert/Jerry Eggert  
320-234-8475

**Project Cost:**  
\$6,200

**Start Date:**  
September 2016

**Vendor:**  
[ledusa.com](http://ledusa.com)

## Truck Mounted Light Tower

### *Research in Progress*



**Project Description:** Work zone safety is always a concern, and night work elevates this concern due to insufficient lighting. Traffic is often unable to see flaggers in an emergency or maintenance operations in the dark. Night work is dangerous, and truck mounted LED lights are easy to set up and would illuminate the flagger position.

**Purpose:** The district expects the truck mounted LED lights to reduce injuries and accidents by illuminating flaggers, helping them to avoid being hit by moving traffic. The lights may even help prevent crashes by better illuminating the work site.

**Test Procedure:** The LED light tower will be evaluated for one year during any emergency or night operations to determine whether it makes flaggers more visible to traffic.



## Maintenance Research

### Winter Maintenance

**District/Office:**  
Office of Maintenance  
Central Shop

**Contact:**  
Robert Ellingsworth  
651-366-5704

**Project Cost:**  
\$3,000

**Start Date:**  
January 2017

**Vendor:**  
[rhomar.com](http://rhomar.com)

## Corrosion Prevention Coating *Research in Progress*



**Project Description:** Deicing agents cause corrosion on plow trucks. The district will test a corrosion prevention coating on several new plow trucks, applying the coating before the trucks are used in the field.

**Purpose:** The coating is expected to prevent corrosion to treated snow and ice removal equipment. This should provide savings in terms of fewer corroded parts to replace as well as the manpower to replace them.

**Test Procedure:** Several new plow trucks will be treated with corrosion prevention coating by applying the product to one half (lengthwise) of each truck. The other half will remain untreated. After one year in the field, the trucks will be evaluated for corrosion.



## Maintenance Research

### Winter Maintenance

**District/Office:**  
7W/St. James

**Contact:**  
Mark Larson  
507-375-8127

**Project Cost:**  
\$9,800

**Start Date:**  
January 2015

**Vendor:**  
[ameritrak.biz](http://ameritrak.biz)

## Plow Up/Down Sensors *Research in Progress*



**Project Description:** Plow up/down sensors provide data on how much time the plow's cutting edge actually spends in use. The district will equip plow trucks with sensors and train operators on how to use them. The vendor also provides a web interface report for comparison and decision making purposes.

**Purpose:** This data will help maintenance supervisors evaluate the different cutting edge products. Currently, pre-winter planning and budgeting of cutting edge inventory is based on operators' opinions and vendor claims. Documentation of the longevity of cutting edges will provide data-based information to supervisors making purchasing decisions. The district expects to save time and money on blade purchasing decisions, and to reduce injuries by reducing the time operators must spend checking and changing cutting edges.

**Test Procedure:** Ten plow trucks will be equipped with plow up/down sensors, and the collected data will be compared across cutting edge product brands to determine which responds best to different roadway surfaces.



## Maintenance Research

### Winter Maintenance

**District/Office:**  
3B

**Contact:**  
Josh Larson/Mike Piram  
763-682-1633

**Project Cost:**  
\$3,095

**Start Date:**  
December 2016

**Vendor:**  
[avalancheliners.com](http://avalancheliners.com)

## Pro-Slide Asphalt UHMW Truck Liner

*Research in Progress*



**Project Description:** When snowplow drivers use trucks with unlined or painted bed liners, road salt has the tendency to freeze and stick to the bottom of the truck box. During snowplowing, this problem forces drivers to raise the box high to loosen the salt. This can result in dispersing clumps of salt on the roads.

**Purpose:** The Pro-Slide Asphalt Ultra High Molecular Weight Polyethylene (UHMW-PE) Liner is a tough truck bed liner designed to easily unload sticky, wet or frozen materials including salt and hot asphalt. The ease of emptying materials allows drivers to concentrate on the road, increases the lifespan of the hydraulic system on trucks (by not having to continuously lift the box high) and reduces the amount of salt used for snowplowing.

**Test Procedure:** Two snowplow truck drivers will test the liner's durability over the course of a year hauling different types of materials. During the winter season, they will evaluate the ease of salt removal after each trip, the amount of salt used when compared with an unlined truck and monitor the number of times the truck box had to be raised high to loosen the salt.



## Maintenance Research

### Winter Maintenance

**District/Office:**

7

**Contact:**

Heidi Sexton  
507-304-6117

**Project Cost:**

\$1,000

**Start Date:**

July 2016

**Vendor:**

[truckclaws.com](http://truckclaws.com)

## Truck Claws

### *Research in Progress*



**Project Description:** Trucks can get stuck in snow and ice during winter operations, no matter how skilled the driver. This can slow operations due to wait time for tow trucks or other equipment to assist the stuck vehicle.

**Purpose:** Truck Claws are traction enhancers that strap or chain onto a truck's tire and wheel, requiring no other parts or special tools to install. The claws can enable a driver to get unstuck without a tow truck or other assistance. The district expects to save money, time and manpower as well as reducing injuries and accidents.

**Test Procedure:** The district will evaluate the Truck Claw for one year, to determine whether the unit saves time, reduces the need for tow trucks, and reduces injuries to workers.





## Maintenance Research

### Winter Maintenance

**District/Office:**

8/Willmar and Marshall

**Contact:**

Craig Gertsema  
507-537-2059

**Project Cost:**

\$5,880

**Start Date:**

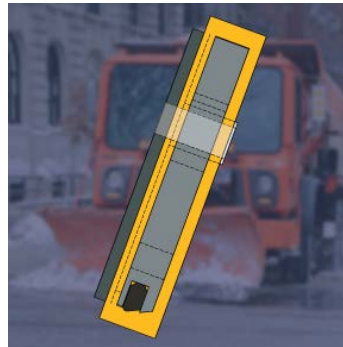
June 2016

**Vendor:**

[evolutionedges.com](http://evolutionedges.com)

## VST Poly-Carbide Cutting Edge Innovation

### *Research in Progress*



**Project Description:** Most plow blades are made from steel, carbide or a type of polyethylene (poly) material. Even though stainless steel blades are resistant to rust damage, they can often dent more easily and cause damage to road surfaces. Poly and carbide blades can last longer and perform better on snowy surfaces than steel blades. The district is seeking to replace their current carbide JOMA blades with Vibration Suppression Technology (VST) Poly-Carbide blades.

**Purpose:** VST Poly-Carbide cutting edge blades use an innovative technology that combines four essential snowplow pieces into one complete unit: front poly, back poly, steel carbide blade and cover blade. The blade design system decreases damage to the roads and prevents corrosive materials from compromising the carbide blades, therefore making the lifespan longer than JOMA blades. The district can save money by replacing plow blades less often. They may also be quieter than JOMA blades because of the sleek blade edge design.

**Test Procedure:** The district will evaluate the VST Poly-Carbide blades to determine if they last longer than other blades, causes less damage to roads and if they are quieter.



## Maintenance Research

### Winter Material

**District/Office:**  
6W/Austin

**Contact:**  
Mike Mehling  
507-434-2776

**Project Cost:**  
\$16,635

**Start Date:**  
August 2016

**Vendor:**  
[klineweldinginc.com](http://klineweldinginc.com)

## Stainless Steel Slurry Tanks

### *Research in Progress*



**Project Description:** Deicing trucks use a slurry that requires tanks in the truck bed for hauling liquid material. The tanks are configured one on each side, and salt gets poured between the tanks. This causes problems when the salt solidifies in the truck bed and must be chipped out, which happens repeatedly. The configuration also makes it difficult to use the truck bed for any other purpose, such as hauling trees away after a storm.

**Purpose:** The new stainless steel tank will replace the old configuration, and should correct the problem of sticking salt. The new tank will also be constructed in such a manner as to allow other materials to be hauled on top of it. The district expects to save time, manpower, money and material, in addition to reducing injuries and accidents.

**Test Procedure:** The district will test this unit for two years on its ability to provide sufficient liquid for the slurry operation, its ability to dump salt into the spreader/sander without sticking to the tank, and on its durability when used to haul other materials when needed.

## Previous Statewide MOR/NTREC Project Reports

In the infancy stages of the MOR/NTREC Program, the initial research focused on snow and ice field studies and projects were very limited. As the MOR/NTREC Program matured and developed, it expanded into other fields of maintenance including roadside and bridges. Other offices became involved with the quality and evaluation of the projects. As projects were completed and possibly implemented, there was a need to communicate these results to the rest of the state and others.

Following is a list of the project reports that have been published since 1992. Some projects had been carried over from year to year due to improvements made as results are reached. The projects listed below are in the report as it was first introduced to the program and may have conclusions in later reports. If you are interested in any of these projects, you may contact the Maintenance Operations Research Engineer.

### 1992-1993 Winter Season Report:

- Camden Pre-wetting Field Study
- Lakeville Pre-wetting Field Study
- Plymouth Anti-icing Field Study

### 1993 Report:

- Corrosion Research
- Road Weather Information System
- Truck Ergonomics Task Force
- Snow Fence Research
- Vehicle Conspicuity Research
- Solar Powered Culvert Deicer
- Quality Control of Premixed Sand/Salt Blender Hopper
- Laserlux Road Striping Management
- Smooth Pavement Task Force
- Remote Driven Vehicle
- Remote Slope Mower
- Zero Velocity Salt/Sand Spreader
- Timesheet Generated Interface
- Short Grass Research Plots
- Extendable Snow Plows
- Portable Interactive Weather Prediction System
- Municipal Waste Salt Water as a Pre-wetting

Agent

### 1994 Report:

- Culvert Rehabilitation
- Thermal Mapping
- Portable Interactive Weather Prediction System
- Temperature Sensors
- Snow Fence Research
- Work Zone Safety Projects
- Circuit Rider Program
- Finnish Emulsion Gravel Pavement
- Automated Call-Out System
- Timesheet Generated Interface & MMS/TIS Interface
- Bar-Coding
- Maintenance Research Project Tracking System
- CB Radios
- Innovative Sprayers
- Band Cleaner
- NIDO Liquid Spreader
- Wash Water Recycling System
- Salt Brine Mixing Systems

- SHRP cutting edges
- Gravel Shoulder Reclaimer

### 1995 Report:

#### Winter Maintenance

- Maintenance Concept Vehicle Partnership Project
- System 2000 Stationary Salt Speeder
- Automated Liquid Bridge Deck Deicer
- Brine Applicator
- Power Liquid Spreader Control Unit
- Electronic Pre-wet hang Tanks
- Integrated Tailgates Research
- Improved Snow Plow Design
- Grader End Gates
- Combined Front-Slush Plows
- Ice Buster
- Norsemeter Friction Meter
- Magnetic Pavement Taping Road and Bridge

#### Maintenance

- Slurry Seal Patching Machine
- MicroSurfacing
- Automated Pothole Patcher
- Cascadia Enduraseal 300 Asphalt Rejuvenator
- Highlift Flatbed
- Earth Penetrating Radar Concrete Delamination Detecting System
- Lightweight Power Screed
- Retrofit Dowel Bars
- Culvert Rehabilitation Project
- Culvert Grapple Extractor (Beaver Dam Grapple)
- Stenciling Unit for Message Painting

#### Maintenance Management

- Thermal Mapping
- Pavement Condition and Weather Reporting
- Interactive Travel Information Systems (Minnesota Travel Partners)

- Travel Partners Demonstration Project
- Mobile Road Weather Information Systems
- Timesheet Generated Interfaces & PMS/MMS/TIS Interface
- Pavement Marking Management System
- Dial in Server for Operations Management System Pilot
- Bar-coding
- Paperless Field Data Collection
- Maintenance Research Project Tracking System

#### Roadside Maintenance

- Herbicide Sprayer
- Flexstake Weedmats
- Remote Slope Mower
- Biological Control of Canada Thistle

#### General Maintenance Management

- All Terrain Crawler Tractor; Posi-Track
- Tracks and Dozer Blade on Skidsteer Loader
- Kentrol Gate Material Control System
- Tire Experiment, Michelin

#### Technology Transfer

- International Worker Exchange Program
- Finnish Emulsion Gravel Partnership Project

### 1996 Report:

#### Winter Maintenance

- Heated Truck Box Using Exhaust System
- Truck Box with a Fiberglass Floor
- Snow Shield Research
- Combined Front Slush Plows
- Anti-icing using Brine from Wash Water Recycling (North Branch)
- Anti-icing using a Herbicide Sprayer Attachment, Spraytroics (Metro)
- MnDOT – Hennepin County Anti-icing Project
- Fiber Optic Lighting Research
- Wing Plow Research (mounted at the rear of

the truck)

- National Friction Measurement Study (FHWA)
- Integrated Tailgate Research
- Extendible Hood Snow Plow
- 21-Foot Snow Plow
- Cutting Edge Research
- Multiple Uses for Low-Boy Tractor
- Dual Spinner
- Elkin Spreader
- Salt Brine Mixing Systems
- Oscillating Underbody Scraper

#### Road and Bridge Maintenance

- Evaluation of Radar for Snowplows
- Automatic Pothole Patcher
- Front mounted Shoulder Retriever
- Bunyan Friction Screed
- Crack Sealing
- Color Flexi Probe Inspection System
- Culvert Rehabilitation Project
- Peel-A-Way Lead Paint Removing Process for Bridges
- Lite Stripe Laser and Camera Pointer Systems

#### Maintenance Management

- Automatic Low-Visibility Warning System Using Video Cameras
- ARTIC Dispatch Center
- CD Authoring, Writing, and Sharing Project
- Automated Route Planning and Optimizing Software

#### Roadside Maintenance

- Boom Sprayer Rebuild
- Hooded Ground Sprayer
- Polecat Obstacle Mower

#### General Maintenance Research

- Reusable Energy Absorbing Crash Terminal

- ProPatch Head Cover, Prototype
- Bioremediation Pilot Project
- Portable Hot Water Pressure Washer
- Multi-purpose Utility Vehicle with Electrical Power tool Package
- Demo Maintenance Truck with Updated Hydraulic System

#### Work Zone Safety

- Remote Driven Vehicle Unit #3
- Flashing Stop/Slow Paddle Implementation Project

#### Technology Transfer

- Maintenance Expos – Fall and Spring
- Saving Salt – Simple Solution

#### 1997-1998 Report:

##### General Maintenance

- Aerosol Alternative
- Drillco Sawblade
- Easy Bend
- Ford Smith Four Post Hydraulics Lift
- Multiple Uses of Hot Water Pressure Washers in Highway Maintenance
- Plasma Cutter
- Remote controller for Boom on Sign Truck
- Vacutec Leak Detector
- Video Image Scope

##### Maintenance Management

- Blowing and Drifting Snow Control Market Research
- Evaluating Locating and Record Keeping Technology
- Fleet Management System Coordinator
- GIS Project Specialist
- Maintenance Business Planning: Measuring

**Quality**

- From the Customer's Viewpoint
- Pavement Marking Market Research RFP
- Transmap GIS Mapping for Sign Inventory
- Striper Record Keeping/Downloading Using a Laptop Computer
- Maintenance Business Planning: Winter Operations Survey.

**Road and Bridge Maintenance**

- Epoxy Striper Research Project
- Heated Dump Box-Tapping System
- Laser Level Plane
- Patchrite Self Propelled Pothole Patching Machine
- Silane
- Vibratory Concrete Floats

**Roadside Maintenance**

- Box Beam Guardrail
- Contour Tree Planter
- E-Z Dig and E-Z Grader
- Funda Flex
- Power Broom/Trimmer for Light Duty Sweeping
- Weld on Wear Pads
- Wheeled Debris Blower
- Wood Chip Blower

**Technology Transfer Partnerships**

- DNR Tandem Truck
- Truck Driving Simulator

**Winter Maintenance**

- ALLU Screen Crusher
- Athey Force Feed Loader
- Automated Data Logger for Odin System
- Blending System for Mixing Sand and Salt
- Chemical Storage Building
- Commercial Visibility Instrument
- Continuous Friction Measurement Techniques

**Research**

- Culvert Deicing Resistance System
- Cutting Edge Study
- Dresbach Anti-Deicer System
- Dual Auger Spinner Sander
- Dual Rear Wing Truck
- Elkin Sander
- Enclosed Salt Brine System
- Enhanced Snowplow Visibility Using Radar Technology
- Etnyre Anti-Icing Unit
- Extendable Hood Snowplow
- Heads Up Research Summary
- Henke Heavy Duty Wing
- Hydraulic Snowblower
- I-35 Fixed Bridge Deicer System
- IceBan (Liquid Deicer)
- Large Capacity Integrated Tailgates
- Nokian Tires Part One and Two
- Pick up mounted Anti-icing units
- Rebuilding Frame Work on CL-35 Snowplow
- Road Closure Gates
- Salt Conveyor
- Salt Solutions
- Snake Creek Bridge
- Stainless Steel Integrated Tailgates
- VLB Industrial Snowblower

**Work Zone Safety**

- Cone Reflective Spinners
- Cone Setter/Retriever Research Trip
- Message/Arrow Brickboard
- Portable Advisory Roll-Up Sign Assemblies
- React 350 Reusable Energy Absorbing Crash Terminal
- Remotely Driven Vehicle
- Speed Control Display Systems
- Striper Crew-Programmable Light Emitting Diode Sign on Shadow Vehicle



**1999-2001 Report:****Winter Maintenance**

- Cryogenically Treated Cutting Edges
- Non Rotating Carbide Bit System for Underbody Blades
- Hydraulic Driven Snowblower
- Infrared Ice Detector Maintenance Upgrade
- Swenson Precision Placement System
- Expansion and Implementation of Anti-ice Methods
- Adaptable “Slide-in” Anti-ice/Herbicide Spray Unit
- Critical Area Spot Spreaders
- New Component Test Bed Truck

**Winter Material**

- Ice Ban M-50
- Medium Grade Salt (Nu-Salt)
- Anti-icing Liquid (Caliber)

**Road and Bridge Maintenance**

- Air Prep System
- Laser Based Clearance measuring System
- For the Birds
- Rubberized Asphalt Melter Applicator
- Aging Optimization Study
- Hot Box
- Spaulding RMV Hot Patcher/Reclaimer

**Traffic/Work Zone Safety**

- Smart Arrow Messenger Board
- Scorpion Truck Attenuator
- Solar Powered Warning Signals/Flashers

**Roadside Maintenance**

- Noxious Weed GPS/GIS Mapping
- Posi-Track Soil Compaction Reduction Project
- Harley HST 6 Shoulder Reclaimer
- Geotextile Fabric Laying Machine
- Living Snow Fence

- Dynamic GPS Performance Evaluation
- New Holland Disc Mower
- TRACC System
- ET-2000 Guardrail End Treatment
- (GS-ED-60-50) Side Dozer

**Equipment – Tools**

- Spray on Box Lining and Irathane Systems
- Wire Feed Welder
- Laxo Quick Lock System
- Brake Watch
- JAGZ Interlocking System
- Retractaflap
- Mud Flap Jack
- Clear View Wiper Mirror
- Lane Scan Mirrors
- Heated Windshield Wiper Blades/Blizzard Blades
- High Intensity Discharge Lighting
- Trailer Safety Lights
- Cordless Impact Drivers
- Mini Skid Loader
- Underbody Grease Banks
- Truck Mounted Roller
- Collision Avoidance Monitors
- Electronic Hearing Protectors
- On-board Truck Scale
- Connect Under Pressure Hydraulic Couplers

**Building**

- Pre-cast T Panels for Cover-all Storage Buildings
- Wireless for Truck Stations

**Technology Transfer**

- Truck Weight Education Project
- Field Works
- Snow and Ice Pamphlet
- Snowplow Simulator Phase I
- Electronic Multi-meter

- Electronic Technical Data Collection

## 2001-2003 Report:

### Winter Maintenance

- Critical Area Anti-icing D-8
- Dultmeir Brine Production System
- Hydraulic Driven Snowblower
- LED Wing Lights
- Stainless Steel Hopper
- Precision Placement System
- Plow Guards
- GPS Tire Road Friction
- GPS Gang Plowing
- Expansion of Anti-icing Methods
- D-3A Rear Mount Wings
- Micro-Trac Anti-icing
- Blizzard Plow
- Pre-wetting Liquid Storage Tank
- Anti-icing Equipment
- Wing Wheels
- Crash Attenuator Anti-icing
- Dultmeir Anti-ice Unit
- Liquid Chemical Transfer Pump Station
- Dual Carbide Underbody Edges

### Winter Material

- Anti-icing Liquid

### Road and Bridge Maintenance

- Hollow Deck Machine
- Over-height Vehicle Detection System
- Silicone Pump
- High Mast Light Pole Inspection
- Night Time Wet Line Recovery
- Air Prep System
- Laser Based Clearance Measuring System
- GL 3000P Laser Guidance System
- Aging Optimization Study
- Wedge Paver

- Bridge Sweeper
- Universal Maintenance Unit

### Traffic Control and Work Zone Safety

- Voice Activated Message Sign
- Roo Guard Barriers
- Active Portable Warning System
- Emergency traffic Control Truck
- Scorpion Truck Attenuator
- Stabilization of Aggregate Shoulders
- Safety Light Wand

### Roadside Maintenance

- Sprout Guard
- Brown Mower
- Tree Shear
- Erosion Control Equipment
- Noxious Weed GIS/GPS Mapping
- Ditch Hitch
- New Holland Disc Mower
- ATV Swisher Mower

### Equipment – Tools

- Lane Scan Mirrors
- Dynamic Performance Evaluation
- Rear Vision Color Monitor
- Backup Safety Cameras
- Ready Welder
- HID Sander Lights
- Clear View Mirror Wiper
- Underhood Air Compressor
- Protective Coated Oil Pans
- Reiter Plastic Truck Body
- Hydraulic Ground Level Trailer
- Laxo Quick Lock System
- Boss Light
- Mud Flap Jack
- Mini Concrete Mixer
- Trailer Safety Lights
- Test Bed Tandem

- Accu Place Spreader
- Ribbon Lift
- Retro Reflective Mud Flaps
- Electro Luminescence Light Signs
- Open Systems Architecture for RWIS
- RWIS RPU Modifications
- Sylvania Silverstar Lights
- Quicksilver Bed Liner

#### **Building**

- Wireless for truck Stations

#### **2003-2005 Report:**

##### **Winter Maintenance**

- Dultmeir Brine Production
- Expansion and Implementation of Anti-icing Methods
- Anti-ice Unit and Geomelt M
- Anti Ice Unit
- Joma 6000 Edges
- Salt Brine Injection
- Pre-wet Tanker
- Dual Carbide Underbody Edges
- Hydraulic Wing Push Arm
- KT-90 Active Adapters
- Transfer Pump Station
- Slap Me Wipers
- Quick Edge Replacement
- Mobile Anti-ice System

##### **Winter Material**

- Cargill Clearlane
- Geomelt M
- Geomelt
- LCS 5000
- Andersons Additive

##### **Road and Bridge Maintenance**

- Top Down Cracking

- GPS-GIS Edge Drain Mapping
- Bituminous Thermal Crack Repair
- Tailgate Paver
- Ribbon Lift
- Safety Traffic and Work Zone Safety
- Solar Traffic Lights
- Cone Setter
- El Conspicuity Light Signs
- LED Lighting
- Avoiding Collisions With Plows
- Lighted Vests
- Lighted SMV Signs
- El Lighted Mudflaps

##### **Roadside Maintenance**

- Beaver Abatement
- Just in Time Sign Replacement
- Bobcat Wolf Disc

##### **Equipment – Tools**

- Reiter Plastic Truck Body
- Motorvac MCS245 – 50
- Skidloader Backhoe
- 6 Way Dozer Blade
- Snap-on HD35 Fluid Changer
- Heated Bituminous Box
- 6x9 BDS Mirrors
- Cut Off Saw
- Porta Shear
- Truck Washing Soap

#### **2005-2007 Report:**

##### **Winter Maintenance**

- Hot Wash Cleaning Unit
- Slap Me Wiper
- Clear Fast/Hot Shot Comparison
- Joma Blades
- Stainless Steel Water Tank
- Boom Mounted Snow Blower

- Brine Maker Injection
- Dye Injection
- Pre-Wet Tanker
- Dual Carbide Underbody Edges
- Hydraulic Wing Push Arm1
- Granular Spreader Epoke Sirous
- Ecco Wing Lights
- El Tail Light Strip

#### **Winter Material**

- Geomelt
- Andersons Additive

#### **Road And Bridge Maintenance**

- Bypass Scaffold
- Cold Planer
- York Front Mounted Rotary Broom
- Moa Bridge Shark
- Electric Heated Pickup Box
- Epoxy Crack Filling

#### **Safety, Traffic Control And Work Zone Safety**

- Litesys Intellectom Cms
- Mold Board Lights
- Scorpion Truck Attenuator
- Solar Traffic Lights
- Pack A Cone
- Ecco Rear Vision
- Lighted Slow Moving Vehicle (SMV) Signs
- Flame Proof Vest

#### **Roadside Maintenance**

- Shoulder Reclaimer
- Beaver Abatement
- Roo Guard Barrier
- Skid Steer Rubber Tracks
- Stump Grinder
- Wolf Disc
- Loegering Track System

- Auger Bucket
- Skidloader Backhoe
- Rubber Tire Roller
- Rotary Mower

#### **Equipment – Tools**

- Pro Press Crimping Tool
- Portable Wheel Stud Remover
- Wireless Mobile Lift
- Gooseneck Lamps
- Safety Work Platform
- Snap-On Hd35 Fluid Changer
- Tree Puller
- GPS Cameras

#### **2007–2009 Report:**

#### **Winter Maintenance**

- Guidance Laser
- Henderson Zero Velocity Sander
- HID Headlights
- Iowa Snow and Ice Innovative Equipment
- Modified Augers
- Rubber Cutting Edges
- Salt Skirt
- Slurry Auger
- SNO-FLO
- Spray Nozzles
- Tow Plow
- Tuff Tech Bag
- Wiper Shakers.

#### **Road And Bridge Maintenance**

- ChemGrout
- Road Shoulder Groomer
- Roll Master 5000
- Wheel Saw

#### **Roadside Maintenance**

- Three Point Jetter
- Apache Bullseye 6 Laser
- Compressed Air Bottle
- Forward Looking Sonar
- Guardrail Sprayer
- Herbicide Head/Pump
- Hydraulic Plate Compactor
- Mini Might Patrol
- No Mow Grass
- WeedEnder

#### **Equipment – Tools**

- Auto Greasing System
- Headset with Foot Switch
- Mud Cannon
- Nitrogen Tire Inflation System

#### **Safety, Traffic Control And Work Zone Safety**

- Horizon Portable Traffic Control Signal
- In Vehicle Video Camera
- Reflective Shirts
- Swift Hitch Wireless Cameras

#### **2009–2011 Report:**

##### **Equipment - Tools**

- Bevel-Mill Model 8000
- Blue Tork
- Diagnostic Scan Tool
- EnviroTabs

##### **Road and Bridge Maintenance**

- Concrete Batch Plant
- Concrete Chuter
- Hitch Mounted Core Drill

##### **Roadside Maintenance**

- Concrete Pipe Joint Sealer
- LIMBHOG

- Magnetic Manhole Cover Removal
- Propane Hammer
- Rotary Screener
- Weed Wiper

#### **Safety, Traffic Control and Work Zone Safety**

- LED Lights for Stop/Slow Paddles
- LED Solar Barricade Flashers

#### **Winter Maintenance**

- Air Foil
- Air Vizion
- Blending Station
- Calibration Scales
- Crystal Fusion
- I.C.E Blades
- LED Sander Lights
- Manhole Protection Ring
- Molded Slurry Tanks
- Rock Salt Moisture Tester

#### **Winter Material**

- ArctiClear Gold
- GeoMelt
- IceBan 200
- Thawrox Treated Salt
- Road Guard Plus 8
- MeltDown Apex

#### **2011-2013 Report:**

##### **Equipment and Tools**

- Conveyor Stand
- Fluke Thermal Imager
- Induction Heating System
- IRISPen
- Jack Jaw Post Extractor
- LED Safety Lights and Flares
- Q-Star FlashCam

- Skid Steer Grout Pump
- Tire Pressure Safety Cap
- Tire-SafeGuard Tire Monitoring System
- TorcUp Wrench
- Valve Extenders

#### **Road and Bridge Maintenance**

- Material Control Gate
- Motor Grader, Wedger Attachment
- Pipes for Spray Injection Patcher
- Slip-In Pre-Mix Heater

#### **Roadside Maintenance**

- Centri-Pipe
- Cone Setting Cage
- Laser for Sign Height
- Metal Shears
- Rota-JETTER
- Side Shift Mower

#### **Safety, Traffic Control and Work Zone Safety**

- RoadQuake Rumble Strips

#### **Winter Maintenance**

- Bag Reel
- Brine Bags
- LED Headlights
- LED Warning Lights for Plow Trucks
- Monroe Roller Mill
- Mr. Slick
- NEUTRO-WASH
- Salt Brine Flow Meter
- Stainless Steel Hydraulic Couplers
- Tailgate Slurry Sander
- Winter Snowplow Cutting Edges

#### **Winter Material**

- SOS Salt Pretreatment

### **2013-2015 Report:**

#### **Equipment and Tools**

- Emulsion Oil Storage Scale
- Hydraulic Hose Cleaning System
- Laser Range Finder
- Multiplaz 3500
- Torrent 400 Parts Washer
- Tweel Skid Loader Tires
- Winter Tire Studs for Skid Steer Loaders

#### **Road and Bridge Maintenance**

- Crack Jet II
- Fiber Rods for Bridge Rail Replacement
- HP Concrete Cold Patch
- Manhole Grade Adjustment Rings
- Portable Emulsion Storage Tank
- Tailgate Chip Spreader
- Winter Patching Mix

#### **Roadside Maintenance**

- Culvert Heat Tape System
- Envirotac II
- Ground Shark Brush Cutter
- Guardrail Post Driver
- REDI Driver

#### **Safety, Traffic Control and Work Zone Safety**

- AutoCone 500 Cone Setter
- Barricade Trailer
- Cone Setting Basket
- Sequential Traffic Safety Lights

#### **Winter Maintenance**

- Air-Weigh LoadMaxx Truck Scale
- Combination Snowplow Headlight System
- Falls Poly Trip Moldboard Plow
- Fluid Film
- High Sierra Mobile IceSight
- LED Plow Lights



- Native Planting Snow Drift Control
- Plow Balance System
- Posi-Shell
- Power Mirrors for Plow Trucks
- Wausau Space Patrol Wing
- Wikco Truck-Mounted Sweeper
- Winter Roadway Friction Meter



**DEPARTMENT OF  
TRANSPORTATION**

*For more information, please visit:*

Minnesota Department of Transportation:  
<http://www.dot.state.mn.us/>

MnDOT Office of Maintenance Research Unit:  
<http://www.dot.state.mn.us/maintenance/research.html>

MnDOT Research Services Section:  
<http://www.research.dot.state.mn.us/>

MnDOT Library:  
<http://www.dot.state.mn.us/library/>