



# 2011–2013

Office of  
Maintenance

STATEWIDE  
BIENNIAL

Maintenance  
Operations  
Research Report



*Your Destination... Our Priority*



#### 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/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**

**2011–2013**



Prepared by CTC & Associates LLC and shu shu design  
September 2013

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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 that have the potential to significantly improve the efficiency and safety of MnDOT maintenance activities. This report presents the program and project highlights of the 2011–2013 funding biennium.

The report includes five sections:

- **About the Program** looks at the history of the Maintenance Operations Research Program, its goals and objectives and the staff throughout MnDOT who make it a success.
- **Project Funding and Selection** describes the funding breakdown for 2011-2013 and the criteria used to evaluate proposed research and implementation projects in-progress.
- **Implementation Projects** lists the FY 2012 and FY 2013 projects selected for inclusion on the statewide implementation list.
- **2011–2013 Projects** reports on every completed and in progress research project for FY 2012 and FY 2013. 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

## Background

The Minnesota Maintenance Operations Research program was initiated in 1990 to study the effectiveness of salt additives in reducing the corrosiveness of road salt. A chemist had approached MnDOT with a sample of road salt treated with an additive he had developed and claimed it made the salt less corrosive. Driven by the possibility of the legislature mandating the use of this new, less corrosive salt, which would have had a profound impact on MnDOT's snow and ice budget, the Office of Maintenance received \$1.5 million for a two-year field study to determine how effective salt additives really were. The Maintenance Operations Research Program was created, and this proactive study was just the beginning. MnDOT continued to receive \$750,000 in additional annual funding, allowing the Maintenance Office to establish a robust maintenance research program.

MnDOT created a part-time maintenance operations research engineer position to direct the program in 1992. A full-time position and additional staff soon followed. The maintenance operations research staff now works closely with the New Technology, Research and Equipment Committee; area maintenance engineers, superintendents and supervisors; MnDOT's Research Services Section; Destination Innovations; and other MnDOT offices. NTREC, which oversees the Maintenance Operations Research Program, has approximately 25 members representing a range of specialties and offices within MnDOT.

MOR's annual budget each year for 2012 and 2013 was \$500,000, which includes funding for salaries, research projects and implementation projects. Although budget cuts and downsizing have made the current program budget noticeably lower than the original \$750,000, the commitment to improving highway maintenance operations throughout the state remains strong.

## Goals and objectives

The Maintenance Operations Research program strives to maintain an active and visible applied research effort that involves all MnDOT maintenance areas, including snow and ice control technology/winter maintenance, road and bridge maintenance, roadside maintenance, work zone safety and traffic control, advanced technologies and technology transfer. The goal is to identify, develop and implement the most effective maintenance procedures, materials and equipment throughout the state.

Building on research conducted by others, like Federal Highway Administration (FHWA), Local Road Research Board (LRRB), Transportation Research Board (TRB), universities and industry, the program encourages and funds innovative, real-world studies aimed at improving highway operations. The program's proactive approach to identifying and implementing solutions is driven by the desire of MnDOT Maintenance staff to save money, lives and time.



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Joe Huneke  
*MDSS/AVL*

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*ITS*

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*Materials Lab*

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Rick Shomion  
*Training*

Ted Ulven  
*Office of Traffic and Safety  
Technology*

Mark Vogel  
*Environmental Services*

District Staff  
*MOR/SS/MDSS Chairs*

Vacant  
*Transportation Generalist Senior*

# Project Funding and Selection

## Funding distribution

The annual budget for the Maintenance Operations Research Program is \$500,000. The funds are distributed among maintenance research projects, product implementation and staff salaries.

### Annual program funding breakdown

Research projects:	\$200,000
Implementation:	\$100,000
Staff salaries:	\$200,000
<b>Total:</b>	<b>\$500,000</b>

The MOR program funds research projects across the state in the areas of Winter Maintenance; Winter Material/Chemicals; Road and Bridge Maintenance; Roadside Maintenance; Equipment and Tools; and Safety, Traffic Control and Work Zone Safety. See the chart at right for the FY 2012/2013 distribution of funds by research category.

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

Budgets for FY 2012 and FY 2013 are summarized in Table 1 (by category) and Table 2 (by district). See the location of districts throughout the state in Figure 1.

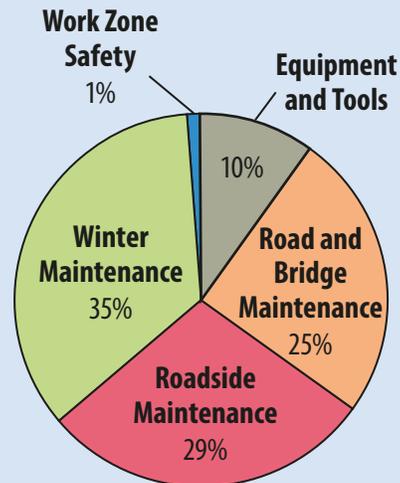
## Selection criteria

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

### FY 2012 – FY 2013 Funding Distribution by Research Category

Equipment and Tools	\$53,360.17
Road and Bridge Maintenance	\$134,861.45
Roadside Maintenance	\$151,045.40
Winter Maintenance	\$185,978.68
Work Zone Safety	\$5,651.32
<b>Total</b>	<b>\$530,897.02</b>



- Opportunity for statewide implementation
- Innovation

Research proposals with funding requests of more than \$15,000 require approval from NTREC, which meets twice a year to consider proposals. Funding requests of less than \$15,000 require approval from the mainte-

nance operations research engineer. See pages 8 to 84 for details about each research in-progress and completed research project for 2011-2013.

Although MnDOT tests numerous products each year, funding is available to implement only a portion of them. The Maintenance Research Unit, in collaboration with the Research Services Section, 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. 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.

See pages 6 and 7 for the lists of projects funded for implementation in FY 2012 and FY 2013.

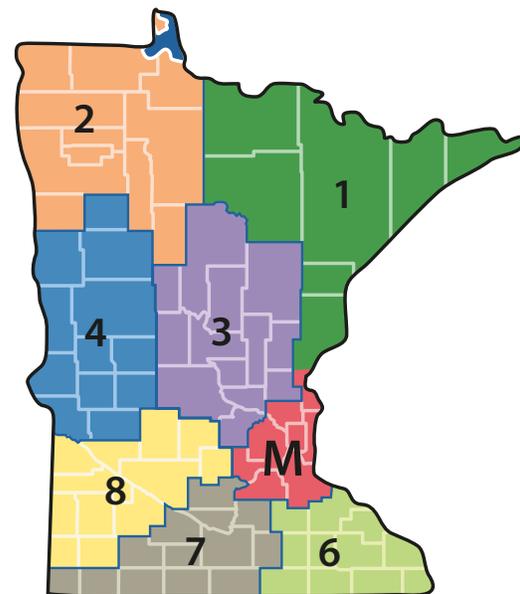
**Table 2. FY 2012 and 2013 MOR/NTREC Budget by District**

District	No. of Projects	Funds Received	% of Total Funds
1	9	\$100,637.00	19%
2	7	\$46,759.00	9%
3	12	\$80,498.00	15%
4	1	\$ 4,000.00	1%
6	24	\$134,291.00	25%
7	7	\$64,348.00	12%
8	4	\$24,943.00	5%
Metro	10	\$75,421.00	14%
<b>Total</b>	<b>74</b>	<b>\$530,897.00</b>	<b>100%</b>

NOTE: Projects initiated by central office and are distributed to the districts.

**Table 1. FY 2012 and 2013 MOR/NTREC Budget by Category**

Category	No. of Projects	Funds Assigned	% of Total Funds
Equipment and Tools	17	\$53,360.17	10%
Road and Bridge Maintenance	17	\$134,861.45	25%
Roadside Maintenance	21	\$151,045.40	29%
Winter Maintenance	39	\$185,978.68	35%
Work Zone Safety	2	\$5,651.32	1%
<b>Total</b>	<b>96</b>	<b>\$530,897.02</b>	<b>100%</b>



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

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

## Implementation Projects

The products listed in the tables below yielded positive results during testing and have been placed on the statewide implementation list. For more information about each project, contact Ryan Otte at [ryan.otte@state.mn.us](mailto:ryan.otte@state.mn.us).

### FY 2012 MOR/NTREC Implementation Projects

Project Name	Description	District	Unit Cost	Year
Bevel Mill	Grinding wheels, cut-off wheels and cutting torches that are currently used for plow repair make for a time consuming process and often result in warped moldboards and lots of dust. The Bevel-Mill can bevel mild steel, aluminum and stainless steel up to 7/8" thick faster and more efficiently, working the way a router bevels the edges of wood.	3B	\$3,000.00	2012
Blending Station	The Blending Station is a trailer mounted, self-contained mobile unit that blends liquid and granular deicing materials for a uniform coat and consistency. With its own power source and onboard liquid tank, it can be used to create limited quantities of treated material. It can also be connected to a larger tanker and be used for days in one location to create larger stockpiles of treated material for entire sub areas or districts. Using a machine of this kind could result in a savings of \$250,000 per year statewide.	Metro	\$150,000.00	2012
Blue Tork Pneumatic Wrench	The Blue Tork reduced the arm-twisting typical when hand torquing and eliminated the vibration and shock previously absorbed when reaching torque. The wrench exposed technicians to fewer than 85 decibels, eliminating the need for hearing protection. In addition, the tire replacement time was reduced by 50% while maintaining torque accuracy.	3B	\$5,265.00	2012
Concrete Pipe Joint Sealer	Crews installed 24" and 36" joint seals in several concrete pipes and found them quicker, easier and safer to install than metal joint sealers. They are expected to outlast metal joint sealers, which corrode and require replacement.	2	Depends on size	2012
LED Flares	The LED electronic Safety Flare Light is 4.25" diameter and 1.25" tall. It can be placed on the ground in a pattern instead of using flares or triangles to warn the traveling public that something ahead is happening.	6W	\$80.00 per set of 3	2012
LED Safety Lights	Night Stick is a 2-in-1 full-size LED light designed specifically for maintaining public safety during flagging operations, when controlling traffic for accidents and during natural disasters (flooding, tornadoes, snow storms, etc.). It is especially effective at nighttime. Night Stick is hand held and runs on batteries to direct traffic from lane to lane or to mark hazardous areas. It has ultra-bright LED lights with a life span of 35,000 hours.	6W	\$40.00 ea.	2012
LIMBHOG	The LIMBHOG is a chain saw that attaches to a skid-steer bucket and allows an operator to trim limbs 8 feet higher than the bucket can reach. The LIMBHOG allows for trimming in hard-to-reach places so that crews can trim only the branches that require it without cutting down the entire tree, retaining trees and saving time that would be spent chipping downed trees.	6W	\$2,495.00	2012

## FY 2013 MOR/NTREC Implementation Projects

Project Name	Description	District	Unit Price	Year
Brine Bags	These bags, along with a protective sheet, hang from hooks welded on the outside of the box by "D Rings." Using the pull of gravity, a spray bar mounted in the sander can be supplied with material with little or no modifications done to the truck. The bags are cheaper, more flexible and much easier to install than other alternatives. Since they are not rigid, the material in the box helps to push brine to the sander and pre-wet the granular material prior to being placed on the road surface.	D7	\$1,200 to 1,500	2013
Metal Shears	Replacing and repairing guardrail is a very dangerous job. Stored energy in bent guardrail can release when being dismantled or repaired, injuring employees. When using a torch or a plasma cutter, galvanized metal produces smoke. This smoke causes an unhealthy work environment because employees inhale it. Torch or plasma cutting can also produce fire hazards in dry conditions while working in dry grass. The steel shear is a skid-steer attachment used to cut up the old damaged guardrail. The steel shear will help eliminate some of these hazards because it does not use an open flame and does not call for employees to stand near the stressed guardrail being cut up and replaced.	D3	\$22,000.00	2013
Salt Brine Flow Meters	With the increased usage of salt brine across the district and state, we need to be able to track real data on how much material is used. It is currently an inaccurate estimating process because the information is entered by operators that make a best guess of how much brine was used. The flow meters will help provide accurate data on usage.	D6W	\$600.00 ea	2013
Skid Steer Grout Pump	The D3522 concrete/grout pump is a one of a kind, peristaltic pump that has reversing capabilities not found in current piston pump designs. The peristaltic pump squeezes concrete out the tube for a quick and efficient pour. Simple to operate, the pump cleans up in less than 10 minutes. Add this innovative design to the versatility and mobility of having it is a universal quick attach to any skid steer and you have a mobile grouting station.	D3	\$14,000.00	2013
Stainless Steel Hydraulic Couplers	During snow and ice season, couplers are used to attach snow and ice components to the hydraulic system of a plow truck. These steel couplers get full of rust because salt and moisture get inside of them, causing corrosion and bonding. The stainless steel couplers are supplied with hardened stainless steel locking detent balls, along with heat-treated surfaces to resist wear. All springs and retainer rings are stainless steel for increased corrosion resistance. This prevents rust or corrosion and allows for easy removal with a wrench.	D6W	\$80.00 per set	2013
Tailgate Slurry Sander	When using our current sander when pulling a tow plow, operators can only use about 1/3 of their load. The tailgate slurry sander allows operators to lift the hoist all the way up and use 100% of their load. In addition, the sander does not need to be removed for attaching trailers for non-snow and ice operations.	D6W	\$2,500.00	2013

## **2011-2013 Completed Projects**



## Maintenance Research

### Equipment and Tools

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

**Contact:**  
Ben Boldt  
(651) 385-6416

**Project Cost:**  
\$4,500 (10 units)

**Start Date:**  
July 2012

**Completion Date:**  
November 2012

## Conveyor Stand *Completed Research*



**Project Description:** Conveyors that spread material are typically installed on a truck with the use of a loader or skid loader outfitted with forks. In an effort to improve safety, increase efficiency and protect equipment from damage, district staff designed and constructed a conveyor stand as an alternative to the use of skid loaders for conveyor installation and removal.

**Purpose:** While lessening the risk of a conveyor being dropped from chains when using a skid loader for installation or removal, the conveyor stand is also expected to reduce the staff needed to install or remove a conveyor.

**Test Procedure:** The district will assess the functionality of the conveyor stand, its ability to save staff time when installing and removing conveyors, and the stand's impact on increasing staff safety.

**Conclusions:** The 10 units tested performed well, and district staff noted that only one staff person is needed to easily install or remove a conveyor when using the conveyor stand.

**Recommendations:** The district recommends the conveyor stand for statewide implementation.

**Implementation:** This project has not been selected for the statewide implementation list.



## Maintenance Research

### Equipment and Tools

**District/Office:**  
3B/St. Cloud

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

**Project Cost:**  
\$10,500

**Start Date:**  
December 2011

**Completion Date:**  
May 2013

**Vendor:**  
fluke.com

## Fluke Thermal Imager *Completed Research*



**Project Description:** This handheld thermal imager scans objects (such as vehicles, equipment and buildings) and displays temperature differentials within them, which allows problem spots to be identified quickly. Images can be scanned, recorded and saved for before-and-after-repair comparisons. The instrument is user-friendly and durable, and imaging software upgrades are free.

**Purpose:** Utilizing thermal imaging capabilities is expected to greatly reduce diagnostic time in numerous applications by identifying hot spots on vehicles, in buildings and other systems. Identifying problem areas before they lead to catastrophic failures has the potential to significantly lower repair costs. For example:

- Hydraulic systems with restrictions can be identified; these systems generate greater heat than normal.
- Diesel engines with a cylinder miss can be identified quickly by the variations in exhaust manifold heat.
- Bearings in all applications can be checked for variations in heat and replaced before shaft and housing damage occurs.

**Test Procedure:** The district will test one Fluke Ti32 thermal imager for six months. During the evaluation period, the district aims to identify as many successful applications for the thermal imager as possible. The district will also assess the cost savings generated through the capability to recognize and prevent premature catastrophic equipment failures.

**Conclusions:** The thermal imager performed well, saving time in diagnosing problems currently assessed with tools such as a multimeter. The unit can “see through” components and wiring for problems that may be intermittent and therefore difficult to diagnose.

**Recommendations:** While the thermal imager performed well in quickly diagnosing equipment problems, given its cost and the limited need in some districts, district testers do not recommend statewide implementation for the product.

**Implementation:** This project has not been selected for the statewide implementation list.



## Maintenance Research

### Equipment and Tools

**District/Office:**  
1/Virginia

**Contact:**  
Dave Ollila  
(218) 742-1078

**Project Cost:**  
\$3,250

**Start Date:**  
August 2008

**Completion Date:**  
April 2012

**Vendor:**  
inductothermgroup.com

## Induction Heating System *Completed Research*



**Project Description:** The Autotron 3300 is an induction heating system that supports automobile repair operations. Using the Frame Pro Inductor attachment, workers can heat automobile frame rails and structural panels rapidly for straightening and relieving stress. The heat is very focused, easily monitored and controlled by the handheld inductor, and is safer than a torch flame for nearby heat-sensitive materials. The inductor can heat ¼-inch steel to 1300 F in just a few seconds.

**Purpose:** The district tested whether the induction heating system would give mechanics the ability to heat vehicle parts such as frozen nuts and bolts without damaging heat-sensitive materials, wires and hoses nearby.

**Test Procedure:** District 1 evaluated the Autotron 3300 for its ability to speed up windshield replacement and molding repairs.

**Conclusions:** Although the heating system has many useful applications, it wasn't effective for the purpose being tested: heating bolts, pins and stuck parts for safe removal. The district found that the system's notched heating element didn't conduct heat evenly and was not large enough to conduct sufficient heat to the parts.

**Recommendations:** District 1 did not recommend the Autotron 3300 for statewide implementation. The district plans to use the tool in the shop for tasks such as removing decals, moldings and windshields.

**Implementation:** This project has not been selected for the statewide implementation list.



## Maintenance Research

### Equipment and Tools

**District/Office:**  
Metro

**Contact:**  
Marv Hayes  
(651) 366-5248

**Project Cost:**  
\$610 (3 units)

**Start Date:**  
June 2010

**Completion Date:**  
March 2012

**Vendor:**  
irislink.com

## IRISPen *Completed Research*



**Project Description:** The IRISPen Executive 6 is full-featured optical character recognition scanning pen that works like a highlighter—simply slide it over printed information and the pen instantly types and displays editable text on your computer screen.

**Purpose:** The Metro district will use the IRISPen to transfer handwritten trainers' notes electronically rather than manually. This product may lower labor and material costs by reducing the number of clerical personnel needed and office supplies used at training classes.

**Test Procedure:** Metro maintenance training staff conducted an evaluation of the product's effectiveness, quality of reproduction, and time and labor cost savings. The IRISPen was evaluated for its electronic compatibility with district equipment, ease of use and the amount of time required to become proficient in the use of the device.

**Conclusions:** While the IRISPen provided excellent recognition of typed text, the product did not conform to the testers' expectations for the transfer of handwritten notes. Testers identified formatting and recognition issues that required more time to correct than if the data had been entered manually.

**Recommendations:** The district does not recommend statewide implementation of the pen scanner for transferring handwritten notes; however, the product could be useful for smaller projects such as scanning excerpts from magazines, manuals and other print publications.

**Implementation:** This project has not been selected for the statewide implementation list.



## Maintenance Research

### Equipment and Tools

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

**Contact:**  
Tom Wryk  
(218) 828-5734

**Project Cost:**  
\$1,375 (3 units)

**Start Date:**  
April 2012

**Completion Date:**  
November 2012

**Vendor:**  
constructionaccessories.  
com

## Jack Jaw Post Extractor *Completed Research*



**Project Description:** Currently, when broken traffic posts, culvert markers, seasonal snow fence posts and other unneeded sign posts must be removed, maintenance staff manually pull them or dig to remove them, which can result in back and shoulder injuries. The Jack Jaw 300 extractor is a lightweight, nonmotorized tool that allows maintenance crews to pull stakes and posts straight up out of the ground or subgrade without bending them. Pulling straight up eliminates side loading and the resulting strain on the operator's back.

**Purpose:** This simple tool is expected to maximize efficiency and reduce the number of back and shoulder injuries associated with current post removal practices. The 20-pound tool can be put in the back of a truck and transported to the work site, eliminating the need to bring a tractor to a work site to pull a post that cannot be pulled by hand.

**Test Procedure:** The district tested the Jack Jaw to assess its ability to save time and reduce injuries.

**Conclusions:** The Jack Jaw saves time by allowing a single crew member to remove a post without requiring the assistance of other crew members and a larger piece of equipment that must be separately transported to the job site.

**Recommendations:** District testers found the tool easy to use and recommend it for use throughout the state.

**Implementation:** This project has not been selected for the statewide implementation list.



## Maintenance Research

### Equipment and Tools

**District/Office:**  
6W/Northfield

**Contact:**  
Ron Finnila  
(507) 649-1174

**Project Cost:**  
\$2,051

**Start Date:**  
June 2011

**Completion Date:**  
December 2011

**Vendors:**  
baycoproducts.com  
ingramproducts.com

## LED Safety Lights and Flares

### Completed Research



**Project Description:** This project tested two LED lighting tools: a handheld safety light designed for flagging operations (shown at left above) and an LED flare (above right) that can be placed on the ground to warn approaching traffic of an incident ahead.

- The NightStick safety light has red and white lights for use in traffic control and can also be used as a high-powered flashlight.
- The EZ Flare discs can be placed on the ground or inside a cone, or adhered to a vehicle with magnets.

**Purpose:** The LED tools' brighter lights are more visible to motorists than traditional lights and flares, increasing worker and driver safety by providing an earlier warning of a traffic control site. The district used the two tools together to improve traffic control safety in work zones and in emergency situations. Compared with traditional flares, the reusable LED flares don't need to be relit, are nonflammable and emission-free, reducing worker safety risks. Both tools are rugged, moisture-resistant and have a long life, saving money compared with the replacement costs associated with traditional lights and flares.

**Test Procedure:** The district evaluated the LED lights' ability to be seen by traffic compared with traditional safety lights and flares.

**Conclusions:** Both tools performed very well. Workers reported that traffic was more responsive to the red and white lights on the handheld safety light than to traditional safety lights. The LED flares stayed lit continuously and could be easily re-set if run over by traffic.

**Recommendations:** The district recommends both tools for statewide implementation. Staff envision the lights being used in first responders' road hazard kits, and in other applications for marking hazardous items.

**Implementation:** This project has been selected for the statewide implementation list.



## Maintenance Research

### Equipment and Tools

**District/Office:**

Metro

**Contact:**

Jeff Streeter  
(651) 366-5191

**Project Cost:**

\$24,000

**Start Date:**

April 2010

**Completion Date:**

September 2011

**Vendor:**

qstartech.com

## Q-Star FlashCam *Completed Research*



**Project Description:** The Metro District spends significant time and money each year cleaning up graffiti and dumped materials on or near roadways. FlashCam cameras from Q-Star Technology could serve as an effective deterrent to vandals as part of a Graffiti and Illegal Dumping Prevention Public Safety Program for the district. The cameras use voice commands and flash photography to deter criminal activity when movement is detected.

**Purpose:** The cameras can be moved from one location to another, discouraging graffiti and illegal dumping with the fear of getting caught on camera. The payoff could be significant. In six months alone, Metro spent more than \$33,000 on materials and labor to clean up graffiti. A reduction in graffiti and illegal dumping would also allow MnDOT staff to focus on traffic control and other maintenance operations instead of cleanup efforts.

**Test Procedure:** Metro tested six Model 770 cameras and two decoy cameras for one year in areas known for repeat graffiti and dumping problems. The district evaluated the cameras' ability to deter graffiti and illegal dumping.

**Conclusions:** The cameras were highly effective at reducing illegal dumping. The problem was completely eliminated at locations where cameras were installed, which saves the district time and money. The cameras also appeared to be effective at deterring graffiti, but many locations with graffiti problems did not have suitable locations for mounting the cameras. District staff had some problems with the cameras' settings, but are happy with their overall effectiveness.

**Recommendations:** The district recommends the cameras for use in areas that have illegal dumping and graffiti problems if there are locations where the cameras can be mounted. The district is considering additional applications for the cameras, and may explore whether less expensive alternatives exist.



## Maintenance Research

### Equipment and Tools

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

**Contact:**  
Doug Adamek  
(320) 616-2492

**Project Cost:**  
\$13,500

**Start Date:**  
January 2012

**Completion Date:**  
April 2013

**Vendor:**  
blastcrete.com

## Skid Steer Grout Pump *Completed Research*



**Project Description:** The Blastcrete Model D3522 concrete/grout pump is a peristaltic pump (a type of positive displacement pump used for pumping fluids) with reversing capabilities not found in current piston pump designs. The peristaltic pump squeezes concrete out the tube for a quick and efficient pour. Simple to operate, the pump cleans up in less than 10 minutes. With its universal quick attachment to any skid steer, the pump can be used as a mobile grouting station.

**Purpose:** The grout pump offers the mobility and versatility needed for MnDOT crews to grout and line centerline culverts, repair stormwater catch basins, and make curb, pedestrian ramp and certain bridge repairs. Contractors perform these maintenance activities because the district lacks specialized equipment.

**Test Procedure:** The district evaluated the functionality of the grout pump and its impact in reducing costs and material use by using MnDOT staff to complete grouting projects that had been contracted out.

**Conclusions:** Performance of this pump exceeded the district's expectations. Operators report that the grout pump performs well and is easy to use and clean. Pumping its own grout allowed the district to reduce costs and material use by preparing grout as it is needed and in the specific amounts needed for repairs.

**Recommendations:** The district recommends this product as a necessary piece of equipment for districts that line culverts.

**Implementation:** This project has been selected for the statewide implementation list.



## Maintenance Research

### Equipment and Tools

**District/Office:**  
3A

**Contact:**  
Tom Wryk  
(218) 828-5734

**Project Cost:**  
\$476 (100 units)

**Start Date:**  
December 2011

**Completion Date:**  
January 2013

**Vendor:**  
accu-pressure.com

## Tire Pressure Safety Cap *Completed Research*



**Project Description:** The district's maintenance staff check the tire pressure on class 33 and class 35 trucks before each use. This process takes time, and every time an operator checks the tire pressure there is some leakage, which causes wear and tear on valve stems. The Accu-Pressure Safety Cap allows for a much faster visual inspection that tells the operator of the vehicle if the tire is safely inflated or if it requires a manual pressure check and more air.

**Purpose:** The district will use this inexpensive tire pressure safety cap on class 33 and class 35 trucks as well as its fleet vehicles. An operator can determine if tire pressure is at the appropriate level by simply looking at the valve cap. By allowing for a visual inspection that is much faster than manual pressure checks, the safety caps will save time while ensuring properly inflated tires to help reduce the risk to the public and district employees due to low-pressure blowouts.

**Test Procedure:** The district evaluated the Accu-Pressure Safety Cap for its performance and its ability to save time and reduce costs and material use.

**Conclusions:** The district estimated time savings of 15 minutes each time tire pressure is checked on class 33 and class 35 trucks before use. The safety cap reduced wear and tear on valve stems caused by manual checks of air pressure and allowed for faster pre-checks before snow and ice events.

**Recommendations:** The Accu-Pressure Safety Cap is inexpensive, easy to install and use, and proved to be reliable in district tests. The district recommends it for statewide implementation.

**Implementation:** This project has not been selected for the statewide implementation list.



## Maintenance Research

### Equipment and Tools

**District/Office:**  
Central Office

**Contact:**  
Andrew Kubista  
(651) 366-3560

**Project Cost:**  
\$900

**Start Date:**  
March 2011

**Completion Date:**  
March 2012

**Vendor:**  
tiresafeguard.com

# Tire-SafeGuard Tire Monitoring System *Completed Research*



**Project Description:** The Tire-SafeGuard monitoring and alarm system keeps operators continually informed of tire issues related to under- or overinflation, air leaks and excessive tire temperatures. The unit monitors all tires on a vehicle and displays the results to the operator, providing immediate alerts of abnormal tire pressure.

**Purpose:** New Class 33 and Class 35 snowplow trucks with rear-mounted wings provide limited access for operators to check tire pressure. The tire monitoring system saves time and improves safety by eliminating manual tire pressure checks. The system is also expected to reduce the need for tire replacement and repair, and reduce the chance of accidents and injuries resulting from tire failure during operation.

**Test Procedure:** The district evaluated the Tire-SafeGuard monitoring system for performance and reliability as well as for its ability to save costs and materials. The system's performance was also compared to the performance of the HawksHead HD Plus tire monitor, which was evaluated in a separate project.

**Conclusions:** The monitoring system performed as expected. It was easy to install and use, saving time for operators compared with performing manual pressure checks. The district expects to see cost savings through reducing repair and replacement expenses for flat tires.

**Recommendations:** The district recommends the Tire-SafeGuard system for statewide implementation. Staff recommend hardwiring the system into the vehicle to ensure that it remains charged.

**Implementation:** This project has not been selected for the statewide implementation list.



## Maintenance Research

### Equipment and Tools

**District/Office:**  
Metro

**Contact:**  
Dale Dombroske  
(651) 234-7939

**Project Cost:**  
\$35,295

**Start Date:**  
March 2012

**Completion Date:**  
August 2013

**Vendor:**  
midwestmachinetool.com

## TorcUp Wrench *Completed Research*



**Project Description:** To ensure that overhead sign structures meet engineering standards, the leveling nuts must be turned to specifications without exceeding allowable torque limits. The current practice to turn frozen base plate nuts is problematic, requiring the use of open-end wrenches, breaker bars and flame heat to tighten them. Field personnel perform this repair without knowing the actual torque being applied. The district is testing the TorcUp wrench in an effort to improve safety for workers and allow for the repair of overhead signs while controlling the amount of torque.

**Purpose:** The purpose of this project is to safely repair overhead sign structures, prolonging their life and avoiding costly replacement. The TorcUp wrench will be used to tighten overhead sign anchor bolt nuts to exact torque specifications.

**Test Procedure:** The district assessed the functionality of the TorcUp wrench and its impact in reducing staff time and costs and enhancing safety when repairing overhead sign structures.

**Conclusions:** The wrench has performed well, and field personnel know exactly how much torque is being applied to every anchor. Use of the wrench allows crews to increase their efficiency, with a crew half the size of the usual crew completing eight to 10 signs per day with the new wrench as compared to one sign per day using previous repair methods.

**Recommendations:** Given its cost and specialized use, rather than recommending statewide implementation the district suggests that the wrench be loaned to other districts as needed.

**Implementation:** This project has not been selected for the statewide implementation list.



## Maintenance Research

### Equipment and Tools

**District/Office:**  
3A

**Contact:**  
Tom Wryk  
(218) 828-5734

**Project Cost:**  
\$339 (25 sets)

**Start Date:**  
December 2011

**Completion Date:**  
January 2013

**Vendor:**  
accu-pressure.com

## Valve Extenders *Completed Research*



**Project Description:** Checking the tire pressure and filling the rear dual tires on class 33 and class 35 trucks can be challenging when trying to reach the inside dual tire valve stems. To make this process more accessible, the Accu-Pressure flexible braided wire valve extender will be placed on the rear dual tires of the maintenance class 33 and class 35 trucks.

**Purpose:** The valve extenders are designed to make valves on rear dual tires easier to reach with a tire gauge and air compressor. With the valve stem in an easy-to-access location on the outside tire, checking pressure and inflating tires will take less time and reduce valve stem damage.

**Test Procedure:** The district evaluated the Accu-Pressure valve extenders for their performance and ability to save time and reduce equipment wear when checking tire pressure and filling rear dual tires.

**Conclusions:** The district estimated time savings of 5 to 20 minutes for each instance of checking and filling rear dual tires. The valve extenders also reduced damage to the valve stem from improper alignment of the tire chuck. Use of the valve extenders requires replacement of valve stems if corrosion or rust starts to build up; annual replacement may be advisable.

**Recommendations:** The district recommends the valve extenders for statewide implementation.

**Implementation:** This project has not been selected for the statewide implementation list.



## Maintenance Research

### Road and Bridge Maintenance

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

**Contact:**  
Gene Lorentz  
(651) 234-7934

Kelly Cramer  
(651) 639-4053

**Project Cost:**  
\$8,960

**Start Date:**  
July 2010

**Completion Date:**  
November 2011

**Vendor:**  
j-craftinc.com

## Material Control Gate *Completed Research*



**Project Description:** The material control gate replaces a conventional tailgate and is used for dispensing hot mix and shouldering material. This multifunction tailgate was mounted on a Class 35 dump truck with an elliptical box.

**Purpose:** The material control gate controls the amount of material needed for each job, reducing material waste and labor costs.

**Test Procedure:** The district assessed the gate's ability to reduce material waste and labor costs, increase productivity, and improve safety by reducing the amount of shoveling of excess material, which reduces workers' back strain.

**Conclusions:** Using the material control gate allowed crews to complete a job using two to three times less equipment, fuel and time. With the gate installed, one truck and operator was able to do the work of three trucks, trailers and operators. For example, the gate allowed crews to haul 10 tons of material in one truck instead of transporting multiple 4-ton loads in a hopper trailer pulled by a truck. The gate delivered asphalt mix directly to the roadway, minimizing spillage compared with shoveling the material by hand. The gate fits on newer elliptical-box trucks that have automatic transmissions, which allows easier maneuvering and a smoother operation that helps keep asphalt mix from hardening in the corners of the box. The gate was easy to install and operate.

**Recommendations:** The district recommended the material control gate for statewide implementation. Staff envision other applications for the gate as well, such as spot shouldering and placing rock around drains.

**Implementation:** This project has not been selected for the statewide implementation list.



## Maintenance Research

### Road and Bridge Maintenance

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

**Contact:**  
Curt Kiefer  
(507) 676-2555

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

**Start Date:**  
August 2010

**Completion Date:**  
August 2011

## Motor Grader Wedger *Completed Research*



**Project Description:** The district built a wedger to attach to its motor grader to provide greater flexibility in repairing shoulders. Mounting the wedger on the blade of the motor grader allows the blade to slide left and right to do the shouldering work that is typically performed by a shouldering machine. The grader stays on the mainline pavement while the wedger smooths the shoulder.

**Purpose:** By mounting a wedger on a motor grader, the district can repair damaged bituminous shoulders using its current motor grader without requiring investment in a shouldering machine at a cost of more than \$100,000. The retrofitted equipment may also be used to perform mainline wedge paving, allowing the operator to go directly from shouldering to mainline wedging in the same lane closure.

**Test Procedure:** The district evaluated the ability of the motor grader wedger to produce results that compare favorably with those produced by a traditional shouldering machine, and generate time and cost savings by reducing the number of processes required to produce a smooth shoulder. During testing, braces were added to better support the sides of the wedger.

**Conclusions:** The wedger's performance exceeded the district's expectations. It produced smooth shoulders while giving crews the flexibility to continue shoulder operations even if it has recently rained, since the grader rides on the mainline pavement rather than on the shoulder. This would reduce delays in completing scheduled work, saving time and money. They also determined this unit works well for filling/patching rutted areas of bituminous roads.

**Recommendations:** The district felt the wedger added value to the motor grader, and would recommend the equipment to other areas.

**Implementation:** This project has not been selected for the statewide implementation list.



## Maintenance Research

### Road and Bridge Maintenance

**District/Office:**  
6W

**Contact:**  
Steve Lueken  
(507) 446-5530

**Project Cost:**  
\$1,384

**Start Date:**  
August 2011

**Completion Date:**  
February 2012

**Vendor:**  
klineweldinginc.com

# Pipes for Spray Injection Patcher

## Completed Research



**Project Description:** A spray injection patching machine fills potholes and cracks by delivering patching material to the pavement through a metal pipe. The original pipes supplied by the equipment manufacturer wear out over time; they must be turned periodically to prevent wear and typically need to be replaced halfway through the season. In this project, District 6 evaluated two alternative replacement pipes fabricated by a local welding company—one stainless steel pipe and one Schedule 120 pipe.

**Purpose:** The alternative pipes are made of heavier material, designed to last longer than the manufacturer's stock pipes before needing to be turned or replaced. The new pipes save time and money by reducing the crew downtime and labor required to turn and replace the pipes.

**Test Procedure:** The district evaluated one stainless steel pipe and one Schedule 120 pipe for six months, assessing the pipes' durability compared with the original pipes.

**Conclusions:** The pipes performed well. Neither pipe needed to be replaced or turned during the season. Although the fabricated pipes are more expensive than the stock pipes, they are more cost-effective.

**Recommendations:** The district plans to continue to purchase these alternative pipes from the welding company, and recommends this approach to other districts as well.

**Implementation:** This project has not been selected for the statewide implementation list.



## Maintenance Research

### Road and Bridge Maintenance

**District/Office:**  
1A/Lakes

**Contact:**  
Tom Gustin  
(218) 768-3043

**Project Cost:**  
\$15,952

**Start Date:**  
July 2010

**Completion Date:**  
July 2011

**Vendor:**  
steppmfg.com

## Slip-In Pre-Mix Heater *Completed Research*



**Project Description:** To patch asphalt roads, the district currently uses a trailer pulled behind a truck to heat and transport the patching material. Once the material has been applied, staff must drive back to the shop, load a new supply of material and begin heating it, all of which is time-consuming. In addition, the large trailer reduces parking and maneuvering options at repair sites, placing workers closer to traffic. The Stepp Slip-In Pre-Mix Heater slides into the box of a Class 33 truck and holds 60% more material than the district's current kettle.

**Purpose:** The slip-in heater's increased capacity allows more patching to be completed between material refills. By sliding into the truck box instead of being pulled by trailer, the unit decreases the equipment's footprint and improves the operator's ability to maneuver.

**Test Procedure:** Staff evaluated the unit for one year, documenting work times, ease of use and worker safety.

**Conclusions:** The slip-in heater performed well. Its diesel heating system heated the patching material much more evenly than the propane-powered patch trailer, and the hot patches applied using the slip-in heater were durable, especially compared with cold-mix patches. Longer-lasting patches may lead to material savings in the long term.

**Recommendations:** The district recommends the slip-in heater for patching operations in areas with hills, narrow shoulders and blind curves. In these areas, the unit's smaller equipment footprint would be most valuable in increasing worker safety, justifying its higher cost.

**Implementation:** This project has not been selected for the statewide implementation list.



## Maintenance Research

### Roadside Maintenance

**District/Office:**  
6E/Rochester Sub Area

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

**Project Cost:**  
\$11,500

**Start Date:**  
June 2010

**Completion Date:**  
October 2012

**Vendor:**  
permaform.net

## Centri-Pipe Culvert Lining *Completed Research*



**Project Description:** Thousands of centerline roadway pipes in District 6 are deteriorating due to large-scale rust, holes and pipe separation. There is an increased risk of culvert/roadway failures if these defects are not corrected, but it is cost-prohibitive to fully replace the pipes. A new culvert lining called the Centri-Pipe, a centrifugally cast concrete pipe, appears to be a cost-effective way to extend pipe life by 50 to 100 years.

**Purpose:** Centri-Pipe lines the entire culvert interior with an engineered mortar that provides defect correction while creating a structural interior pipe. This engineered mortar combines special high-density polypropylene reinforcing fibers and other additives to provide the mortar with structural properties and the capability to adhere to the interior culvert surface. The mixture can be sprayed, cast, pumped or gravity-flowed onto any area. Without digging or replacing liners, Centri-Pipe provides quick-setting, waterproof protection against corrosion.

**Test Procedure:** The district installed the Centri-Pipe lining in one deteriorated corrugated metal culvert, assessing its performance as a cost-effective alternative to pipe replacement and other culvert liners. The district installed the lining in October 2010 and inspected the culvert in spring of 2011 to assess the liner's performance over the winter season.

**Conclusions:** The spring inspection found that the concrete had adhered successfully throughout the length of the pipe. A small area of alligator cracking near a high-stress area was successfully repaired with epoxy.

**Recommendations:** The district recommends the Centri-Pipe based on the first inspection conducted. The district plans to monitor the liner's performance over a second winter season.

**Implementation:** This project not been selected for the statewide implementation list.



## Maintenance Research

### Roadside Maintenance

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

**Contact:**  
Tom Johnson  
(507) 379-3414

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

**Start Date:**  
August 2012

**Completion Date:**  
November 2012

## Cone Setting Cage Completed Research



**Project Description:** Currently, crew members stand or sit on the lift gate of a truck when setting cones on roadways to identify lane closures. This practice limits crew members' mobility and can expose them to the risk of injury, particularly when setting up longer lane closures on Interstates. The district designed and fabricated a cone setting cage that can be attached to the tailgate of a truck to allow crews to set cones for traffic control safely and quickly.

**Purpose:** The new cone setting cage improves safety by giving crew members a hand rail to hold on to while setting cones for traffic control. The cage also allows crew members to be only six to 10 inches off the ground while setting cones, reducing the possibility for injury and making it easier to adjust cones that have tipped over or moved.

**Test Procedure:** The district will evaluate the functionality of the cone setting cage and its ability to reduce injuries and increase efficiency by reducing the number of crew members needed to set cones for lane closures.

**Conclusions:** The cone setting cage allowed district crews to set up lane closures more safely and with a smaller crew. The district recommends fabricating future cone setting cages with aluminum rather than the 1-inch steel tubing used to construct the first cage to permit easier installation and removal.

**Recommendations:** The district recommends the cone setting cage for statewide implementation as a safer way to set cones to identify lane closures.

**Implementation:** This project has not been selected for the statewide implementation list.



## Maintenance Research

### Roadside Maintenance

**District/Office:**  
8/Marshall

**Contact:**  
Richard Persoon  
(507) 537-2078

**Project Cost:**  
\$2,982

**Start Date:**  
April 2009

**Completion Date:**  
June 2012

**Vendor:**  
spectraprecision.com

## Laser for Determining Sign Height Completed Research



**Project Description:** Sign panels must be installed so that the bottom of the sign is 7 feet above the roadway and 12 feet out from the traveled way. Currently there is no way for one- or two-person crews to accurately measure the height of a sign before it is bolted into place. This project tested whether the Spectra Precision laser would allow workers to measure these distances before securing the sign.

**Purpose:** Currently, workers installing signs must repeatedly move between the ditch and the roadway to measure and adjust sign height, which is time-consuming and increases their exposure to traffic. This project's goal was to improve sign crews' productivity and safety by eliminating these back-and-forth trips to the roadway.

**Test Procedure:** The district evaluated the Spectra Precision laser for its ability to help sign crews install sign panels accurately and efficiently.

**Conclusions:** This project was unsuccessful. The laser's green light was not visible enough during daylight to allow crews to use the tool as intended. At the vendor's suggestion, the district purchased a target unit to pair with the laser, but this still required one worker to hold the target in order to allow for continuous adjustments.

**Recommendations:** The district does not recommend that MnDOT use the laser with one- or two-person sign installation crews. It could be used by larger crews to record precise measurements.

**Implementation:** This project has not been selected for the statewide implementation list.



## Maintenance Research

### Roadside Maintenance

**District/Office:**  
3A

**Contact:**  
Mark Gallus  
(320) 616-2492

**Project Cost:**  
\$21,648

**Start Date:**  
January 2012

**Completion Date:**  
January 2013

**Vendor:**  
quick-attach.com

## Metal Shears Completed Research



**Project Description:** Replacing and repairing guardrail can be dangerous. Stored energy in bent guardrail can release when being dismantled or repaired, injuring employees. Using a torch or plasma cutter to cut galvanized metal produces smoke, which is inhaled by maintenance crews. Torch or plasma cutting can also pose a fire hazard when working in dry grass. The Quick Attach Power Shear Metal Shears is a skid steer attachment that can be used to cut up damaged guardrail to eliminate some of the hazards produced by current guardrail repair and replacement practices.

**Purpose:** The Power Shear Metal Shears will be used to cut scrap metal and to cut plate beam into small pieces when replacing and repairing guardrail. The metal shears cut plate beam without the use of an open flame, and its use allows maintenance crews to stand clear of the stressed guardrail being cut up and replaced.

**Test Procedure:** The district evaluated the Power Shear Metal Shears to determine if it provides for a more efficient use of time and labor, and a safer method of repair for district maintenance staff than hand-cutting or torching guardrail, culverts or scrap metal.

**Conclusions:** District staff found the metal shears to be easy to use with minimal maintenance, and allowed for cutting of plate beam without operator exposure to loaded material and the toxic fumes associated with using a torch.

**Recommendations:** The district recommends the metal shears for statewide implementation.

**Implementation:** This project has been selected for the statewide implementation list.



## Maintenance Research

### Roadside Maintenance

**District/Office:**  
7/Window

**Contact:**  
Tony Desantınago  
(507) 831-8041

**Project Cost:**  
\$28,300

**Start Date:**  
July 2008

**Completion Date:**  
August 2013

**Vendor:**  
rotajetter.com

## Rota-JETTER Completed Research



**Project Description:** The Rota-JETTER is a culvert cleaning machine that cleans culverts from 8 inches to over 36 inches in diameter. The machine's tools, cutting heads, water tank, and 110 feet of cleaning rods are mounted on a trailer; more cleaning rods can be added, up to 200 feet. Tools for smaller culverts are available, and the machine can be used to make horizontal bores of 8 feet or less.

**Purpose:** Currently, District 7 is limited in its options to clean culverts. Hiring or borrowing a culvert cleaning machine is inefficient and, with a culvert drainage inventory in process, the district needed a better method of cleaning culverts so that their condition can be rated.

**Test Procedure:** The district evaluated the efficiency of the Rota-JETTER by comparing the number of culverts cleaned with and without use of the Rota-JETTER over the same period of time.

**Conclusions:** The unit as delivered was not suitable for district needs and necessitated extensive changes in its operational format for the unit to function properly in the field. District testers found that cleaning culverts with the modified unit required more time and effort than anticipated.

**Recommendations:** The district does not recommend this product for statewide implementation.

**Implementation:** This project has not been selected for the statewide implementation list.



## Maintenance Research

### Roadside Maintenance

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

**Contact:**  
Steve Lueken  
(507) 446-5530

**Project Cost:**  
\$4,501

**Start Date:**  
May 2010

**Completion Date:**  
April 2013

## Side Shift Mower *Completed Research*



**Project Description:** A side shift mowing system allows mowing crews to mow the entire area next to median cable guardrail in one cut using a tractor mounted with the Spider guardrail mower. The two-disc mowing system can simultaneously cut from both sides and underneath an obstacle.

**Purpose:** The side shift mowing system will mow areas adjacent to median cable guardrail with a single tractor, eliminating the second mower now required for mowing operations. Less equipment required for mowing operations saves time and money and increases safety by limiting the personnel exposed to roadway traffic.

**Test Procedure:** The district evaluated the ability of the side shift mowing system to complete mowing operations next to median cable guardrail in a single cut.

**Conclusions:** The side shift mower used in conjunction with the Spider guardrail mower is an efficient unit that has become a mainstay of the district's mowing operations. The side shift mower saves an estimated 40 hours for each cable guardrail mowing operation by eliminating the need for a second tractor and operator.

**Recommendations:** The district recommends the side shift mowing system for statewide implementation.

**Implementation:** This project has not been selected for the statewide implementation list.



## Maintenance Research

### Safety, Traffic Control and Work Zone Safety

**District/Office:**

3B/St. Cloud

**Contact:**

Randy Reznicek  
(320) 223-6568

**Project Cost:**

\$3,600

**Start Date:**

April 2009

**Completion Date:**

January 2013

**Vendor:**

plasticsafety.com

## RoadQuake Rumble Strips *Completed Research*



**Project Description:** RoadQuake temporary, portable rumble strips alert drivers to reduce speed. This device can be used in highway and road construction applications, including short-term work zones, temporary lane closures or law enforcement checkpoints. RoadQuake is a temporary device and does not require adhesives or fasteners for installation.

**Purpose:** This project aims to reduce the number of near misses and personal injuries suffered by both MnDOT and private contractor personnel by using rumble strips to create a sudden jarring, noisy experience that captures drivers' attention.

**Test Procedure:** The district evaluated the effectiveness of the rumble strips in alerting drivers that they are approaching a work crew by interviewing flaggers and work crews.

**Conclusions:** The district identified no savings in staff time, with the RoadQuake rumble strips being too heavy for one person to move. The rumble strips shattered when driven over in below-freezing temperatures, prompting a vendor redesign. In field tests, when work crews moved away from the temporary rumble strip installation, motorists incorrectly identified the rumble strips as debris and drove around them and into the other lane in the work zone.

**Recommendations:** The district does not recommend this product for statewide implementation.

**Implementation:** This project has not been selected for the statewide implementation list.



## Maintenance Research

### Winter Maintenance

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

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

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

**Start Date:**  
December 2009

**Completion Date:**  
March 2012

**Vendor:**  
[www.tufftechbags.com](http://www.tufftechbags.com)

## Bag Reel Completed Research



**Project Description:** While in the field, winter maintenance crews need to move back and forth between liquid and granular applications based on weather conditions. The faster this transition can take place, the more efficiently crews can address current road conditions for the traveling public. The Tuff Tech Bag used by District 7 for liquids can attach to the truck on a reel, allowing the operator to change the type of material being applied without completely removing the bag from the truck.

**Purpose:** The reel mechanism for the Tuff Tech Bags has the potential to add needed flexibility in how trucks address winter road conditions. Being able to move quickly between 100 percent liquid and granular applications as needed allows operators to focus on applying the correct materials for the conditions.

**Test Procedure:** District 7 truck operators used the reel when moving between liquid and granular applications over one winter to document efficiencies gained in reaching level of service requirements and reducing material waste.

**Conclusions:** When used with the brine bag, the reel made it easier and faster to put the truck into and out of service. There was no need to lift the bag out of the truck when changing from all liquid to granular materials, saving time and labor. The reel moves the bag up for storage or down for use with the simple push of a remote button.

**Recommendations:** The district recommends using the bag reel when the brine bags are also used.

**Implementation:** This project has not been selected for the statewide implementation list.



## Maintenance Research

### Winter Maintenance

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

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

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

**Start Date:**  
August 2010

**Completion Date:**  
January 2013

**Vendor:**  
[www.tufftechbags.com](http://www.tufftechbags.com)

## Brine Bags Completed Research



**Project Description:** MnDOT has traditionally used molded tanks to dispense liquid material during snow and ice operations. These tanks are cumbersome to maneuver and require a pump or pressure system to operate. As a potentially more flexible, cheaper alternative, District 7 wanted to test the effectiveness of brine bags. These bags hang from hooks by D rings and use a gravity flow system pressurized by the granular material in the box to supply a spray bar mounted in the sander.

**Purpose:** Field personnel in other districts have observed more efficient use of granular material when using brine bags. More liquid is able to flow, which reduces the granular output. Operators have reported using 350 pounds of salt and nine gallons of brine per lane mile. The typical system used by District 7 uses 500 pounds of salt per lane mile with some brine for pre-wetting.

**Test Procedure:** District 7 installed and tested one set of bags capable of holding 1,200 gallons of liquid in a class 35 truck and another set capable of holding 400 in a class 33 truck. They evaluated the bags for ease of installation and durability.

**Conclusions:** The bags hold more than the molded alternative and were easier to install. The material does not get caught on the bags, and there is no mounting hardware in the truck box to get bent. The operators were able to reduce application rates for the granular materials and activate the salt more quickly using additional brine.

**Recommendations:** The district recommends using the brine bags as an alternative to the molded tanks.

**Implementation:** This project has been selected for the statewide implementation list.



## Maintenance Research

### Winter Maintenance

**District/Office:**  
Central Office

**Contact:**  
Ryan Otte  
(651) 366-3585

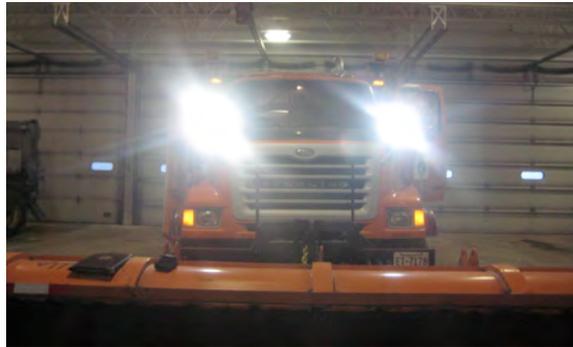
**Project Cost:**  
\$4,000 (5 sets)

**Start Date:**  
January 2011

**Completion Date:**  
April 2012

**Vendor:**  
truck-lite.com

## LED Headlights *Completed Research*



**Project Description:** Offering brighter, crisper and whiter light output than incandescent alternatives, LED headlights are slowly becoming the norm across the trucking industry. This project tested 12-volt LED headlights on five snowplow trucks across the state. LED headlights offer longer life—they are expected to last five years or more—and greater dependability than the halogen headlights MnDOT currently uses.

**Purpose:** LED headlights give snowplow operators a better view of the road and help identify potential dangers that lie ahead. LED headlights also reduce the overall energy draw on the truck, which may prolong the life of alternators and reduce downtime for repairs.

**Test Procedure:** The LED headlights were evaluated for their dependability, potential for reducing wear on truck components, and effectiveness in providing a safer driving environment.

**Conclusions:** The LED headlights performed very well, providing a brighter field of view for plow operators compared with conventional headlights. Operators reported that the LED headlights dramatically increased their sight distance, both under normal conditions and in fog or heavy snow. The lights are also visible to oncoming traffic at a greater distance but are directed at an angle that does not create a blinding light for other drivers. Improving operators' view of the roadway will yield safety benefits for all motorists and reduced eye fatigue for operators.

Note that some operators did complain of visibility issues during heavy, wet snowstorms. The lights would freeze over with snow, making them useless, and the falling snow would become blinding and cause great eye fatigue.

**Recommendations:** The districts that tested the LED lights recommend them for statewide implementation. However, given the severity of the issues encountered, some of the districts have discontinued their use.

**Implementation:** This project has not been selected for the statewide implementation list.



## Maintenance Research

### Winter Maintenance

**District/Office:**  
Central Office  
6W

**Contact:**  
Ryan Otte  
(651) 366-3585

Steve Lueken  
(507) 446-5530

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

**Start Date:**  
February 2010

**Completion Date:**  
April 2012

**Vendor:**  
whelen.com

## LED Warning Lights for Plow Trucks *Completed Research*



**Project Description:** The cost of the strobe light system currently used on MnDOT snowplows has been rising, and is now approximately \$300 more than a new LED warning light system. This project tested the effectiveness of this alternative to the higher-priced strobe lighting.

**Purpose:** The visibility of the LED warning light is as good as the current strobe lighting system if not better. With the LED's low amperage draw, MnDOT operators can shut down engines while leaving the LED warning lights on, saving on fuel costs and reducing emissions.

**Test Procedure:** This project tested the LED lights on six snowplows selected on the basis of climate and location. Staff monitored the lights for their effectiveness at alerting surrounding traffic to the plows' presence both at night and on sunny days.

**Conclusions:** Based on the behavior of surrounding traffic, it appeared that other motorists could see the LED lights better than the current lighting system. Operators observed that nearby drivers seemed to move to a safe lane sooner than when the strobe lights were used, and operators reported no close calls with other traffic while using the LED lights.

**Recommendations:** The district recommends the use of the high-visibility LED lights on plow trucks statewide in all conditions. The district envisions other applications for the lights as well, such as on mowers that must operate partly on the roadway.

**Implementation:** This project has been selected for the statewide implementation list.



## Maintenance Research

### Winter Maintenance

**District/Office:**  
7/Mankato

**Contact:**  
Randy Glaser  
(507) 304-6235

**Project Cost:**  
\$22,000

**Start Date:**  
August 2008

**Completion Date:**  
April 2012

**Vendor:**  
monroe.com

## Monroe Roller Mill *Completed Research*



**Project Description:** Demonstrations have shown that applying salt as a slurry mixture reduces salt application rates and improves regain times. The Monroe RTS Replacement Tailgate Sander with roller mill slurry spreader can be used for this type of salt application. While the roller mill slurry spreader was developed for a live bottom V-box spreader, the spreader's manufacturer indicated that the unit can be used with the district's newer plow trucks that have elliptical boxes.

**Purpose:** The roller mill slurry spreader was tested on an elliptical plow truck to assess whether the technology could reduce salt application rates and decrease regain times.

**Test Procedure:** The district evaluated whether the roller mill slurry spreader was compatible with its existing trucks, and whether it was more effective than the units the district currently purchases.

**Conclusions:** When it was operating as intended, the roller mill spreader yielded impressive results at reduced salt application rates. However, several factors prevented the salt from consistently reaching the mill. The truck's shape and tank framework were not optimal for use with the spreader, and both treated salt and salt that contained many fines were unable to flow smoothly toward the mill.

**Recommendations:** The district concluded that the spreader should be used with a V-bottom truck for proper functionality, and does not recommend purchasing additional units for use with the department's existing trucks. The district recommends investing more resources into brine tanks, as the brine tanks in the truck box appeared to independently lower costs.

**Implementation:** This project has not been selected for the statewide implementation list.



## Maintenance Research

### Winter Maintenance

**District/Office:**  
6E/Rochester

**Contact:**  
Kong Douangdy  
(507) 286-7577

**Project Cost:**  
\$1,400

**Start Date:**  
November 2010

**Completion Date:**  
March 2012

**Vendor:**  
teamlab.net

## Mr. Slick Completed Research



**Project Description:** Mr. Slick is an anti-stick liquid used to prevent snow and slush from sticking to metal surfaces and building up on snowplow equipment. The product is also used seasonally as an anti-corrosive protective coating to protect metal on stored equipment.

**Purpose:** This product can be used on snowplows, truck boxes, front-end loaders, snowblower chutes and other equipment. It is designed to prevent snow and ice buildup, inhibit corrosion and reduce cleanup time.

**Test Procedure:** The district tested the product on pairs of plow trucks engaged in tandem plowing operations, treating one truck and leaving the other untreated. The product was applied to the sander, tailgate and all lights in the rear of the treated truck. District staff made visual inspections of both plow trucks at the end of each shift to assess the product's ability to keep the treated areas free of snow and ice buildup.

**Conclusions:** In side-by-side tests, the district found the product to be ineffective at preventing snow and ice buildup on plow trucks. Staff observed little to no difference in the amount of buildup on the treated and untreated trucks. The product was time-consuming to apply, and its cost did not justify the results achieved in District 6.

**Recommendations:** The district does not recommend this product for use in other areas based on its effectiveness at preventing snow and ice buildup. The district also determined it ineffective after testing this as an anti-corrosive on sanders in a side-by-side comparison throughout the summer months.

**Implementation:** This project has not been selected for the statewide implementation list.



## Maintenance Research

### Winter Maintenance

**District/Office:**  
2B

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

**Project Cost:**  
\$2,008

**Start Date:**  
November 2009

**Completion Date:**  
March 2012

**Vendor:**  
rhomar.com

## NEUTRO-WASH *Completed Research*



**Project Description:** Winter maintenance staff regularly wash snow and ice equipment to remove salt, but a corrosive white salt film reappears after the equipment dries. This salt film promotes the rusting process. NEUTRO-WASH neutralizes the corrosive effects of sodium chloride on radiators, condensers and other sensitive equipment parts, allowing the salt residue to be washed away.

**Purpose:** NEUTRO-WASH will be used to wash the district's snow and ice equipment in an effort to reduce the corrosive effects of winter maintenance materials and prolong the life of its snow and ice fleet.

**Test Procedure:** The district evaluated the ability of NEUTRO-WASH to reduce the need to replace parts that are normally subject to corrosion deterioration.

**Conclusions:** Operators noted that regular use of NEUTRO-WASH made it easier to remove brine residue from the district's snow and ice equipment. By removing this damaging residue, the district feels the product has the potential to help radiators, condensers and other equipment parts fight the corrosive effects of salt residue.

**Recommendations:** The district found the product to be easy to use and effective in removing salt residue and recommends it for statewide implementation.

**Implementation:** This project has not been selected for the statewide implementation list.



## Maintenance Research

### Winter Maintenance

**District/Office:**  
6W

**Contact:**  
Ron Heim  
(507) 446-5508

**Project Cost:**  
\$5,268

**Start Date:**  
October 2010

**Completion Date:**  
February 2012

**Vendor:**  
banjocorp.com

## Salt Brine Flow Meter *Completed Research*



**Project Description:** Flow meters on water lines leading into salt brine generators track the water and brine used to create the salt brine used for anti-icing, pretreating salt and deicing. Current estimates made without the use of such a meter are dependent on operators' perceptions. This can lead to estimating errors, particularly when partially filling tanks.

**Purpose:** The flow meter allows winter maintenance staff to improve tracking of salt brine usage per event and provide an accurate determination of the amount of salt used to make the brine. Better data on salt usage will help winter maintenance managers maintain more accurate material inventories.

**Test Procedure:** The district evaluated the ability of the flow meter to save time in maintaining accurate inventory data and reconciling stockpile numbers.

**Conclusions:** The flow meters were accurate and easy to use. They were very useful with the district's slurry truck tanks, and could have other applications where power is not available, such as herbicide spray tanks and brine distribution trailers.

**Recommendations:** The district recommended the flow meters for statewide implementation. The district suggests mounting the units in a sheltered area; one unit that was mounted beneath the roof drip line subsequently failed.

**Implementation:** This project has been selected for the statewide implementation list.



## Maintenance Research

### Winter Maintenance

**District/Office:**  
6W/Zumbrota

**Contact:**  
Ken Peterman  
(507) 732-7112

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

**Start Date:**  
May 2010

**Completion Date:**  
May 2012

**Vendor:**  
safewayhyd.com

## Stainless Steel Hydraulic Couplers *Completed Research*



**Project Description:** During the winter season couplers are used to attach snow and ice equipment to the hydraulic system of a plow truck. These steel couplers corrode due to the presence of salt and moisture, and they become bonded together. Removing or separating the rusted couplers requires a great deal of force and damages the couplers. To remedy this, the district tested couplers made with 303 stainless steel. The couplers are supplied with hardened stainless steel locking detent balls and have heat-treated surfaces to resist wear.

**Purpose:** Using stainless steel couplers on MnDOT plow trucks in highly corrosive areas will expedite removal and reattachment of snow and ice components because they will not become corroded and bond together. Stainless steel couplers can also limit costly damage that can be caused when the current steel couplers become bonded or corroded, allowing dirt, rust or moisture to enter the hydraulic system.

**Test Procedure:** The district evaluated whether the stainless steel couplers eliminate corrosion and expedite the attachment and removal of snow and ice components.

**Conclusions:** The couplers performed as expected, making disassembly much easier than with standard couplers. When snow and ice components were removed for the spring, the couplers showed no sign of rust or corrosion. None needed to be replaced.

**Recommendations:** The district recommends the couplers for statewide implementation. Although the stainless steel couplers are more expensive than those currently used, they are expected to save money and time over the long term because they will not need to be replaced as frequently.

**Implementation:** This project has been selected for the statewide implementation list.



## Maintenance Research

### Winter Maintenance

**District/Office:**  
6W

**Contact:**  
Steven Lueken  
(507) 446-5530

**Project Cost:**  
\$5,739

**Start Date:**  
July 2012

**Completion Date:**  
April 2013

**Vendor:**  
klineweldinginc.com

## Tailgate Slurry Sander *Completed Research*



**Project Description:** The sander typically used on district tow plow trucks cannot raise its dump box high enough to use its entire load of material when pulling a tow plow or other trailers. Maintenance crews must also remove a sander mounted on a truck to allow the truck to be used for activities other than winter maintenance. The tailgate slurry sander resolves these issues by allowing full use of material and reducing the staff time needed to prepare trucks for operation in the field.

**Purpose:** Unlike the current sander used on district tow plow trucks, the tailgate slurry sander provides additional clearance between the sander and the tow plow or other trailer being pulled, avoiding contact with the towed trailer and allowing the operator to lift the hoist all the way up to use an entire load of material. The tailgate slurry sander also eliminates the need for winter maintenance staff to remove the sander when changing trailers for non-snow and ice operations.

**Test Procedure:** The district assessed the impact of the tailgate slurry sander in saving time and money by permitting the simultaneous, effective use of a tow plow and sander and offering flexibility in the use of a truck mounted with the sander for activities other than winter maintenance.

**Conclusions:** The slurry sander performed well in district tests and allowed operators to use all material in a load. The sander also permitted simultaneous use of a tow plow and sander without requiring modification of either piece of equipment.

**Recommendations:** The district recommends this product for statewide implementation.

**Implementation:** This project has been selected for the statewide implementation list.



## Maintenance Research

### Winter Maintenance

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

**Contact:**  
Dennis Redig  
(218) 846-7943

**Project Cost:**  
\$3,475

**Start Date:**  
October 2010

**Completion Date:**  
February 2011

**Vendor:**  
winterequipment.com

## Winter<sup>®</sup> Snowplow Cutting Edges *Completed Research*



**Project Description:** The district's snowplow operators tested two Winter Equipment cutting edges to determine whether the blades have a longer wear life than the blades now in use.

- The RAZOR snowplow blade system combines a carbide insert blade with built-in steel cover plate protection to eliminate the need for cover blades.
- The RoadMaxx underbody blade system has a carbide insert blade with a carbide matrix face that protects the carbide inserts from washout and the lower front blade face from erosion.

**Purpose:** Longer-lasting snowplow cutting edges require less frequent replacement, saving money and operator time.

**Test Procedure:** The district tested the underbody RoadMaxx system on three plow trucks, two of which were also equipped with the RAZOR blade system (front blade). The district compared the blades' wear life to that of the current carbide cutting edge and the JOMA plow blade.

**Conclusions:** The two front plow blade systems lasted about as long as the district's standard cutting edges and cost about the same. Results for the three underbody blade systems were mixed, which may have been due to differences in operator technique and weather conditions.

**Recommendations:** Since no cost savings or performance improvements over current blades were identified, the district does not recommend that other areas switch to the Winter blade systems.

**Implementation:** This project has not been selected for the statewide implementation list.



## Maintenance Research

### Winter Material

**District/Office:**

Metro  
2

**Contact:**

Lynn Tschida  
(651) 234-7933

Curt Larson  
(218) 683-8023

**Project Cost:**

\$13,203

**Start Date:**

December 2010

**Completion Date:**

January 2012

**Vendor:**

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

## SOS Salt Pretreatment *Completed Research*



**Project Description:** SOS is liquid product designed for the pretreatment of salt and sand. Pretreatment can improve ice removal practices by reducing application rates and allowing for effective deicing at lower temperatures.

**Purpose:** This product will be used to pretreat salt to give it additional melting capabilities at lower temperatures, reduce application rates and the scatter and bounce of salt as it hits the roadway, and possibly eliminate the need for prewetting tanks on trucks.

**Test Procedure:** The districts will monitor for leaching, stockpile workability and working temperatures. The Metro district will compare the effectiveness of SOS as a salt pretreatment with Thawrox, a magnesium-chloride treated salt. District 2 will compare the performance of SOS as a stockpile treatment with prewet salt applications and with a salt blended with Road Guard Plus 8, a corrosion-inhibited liquid form of calcium chloride and magnesium chloride brine.

**Conclusions:** The district determined that SOS should not be used with its salt blending machine when temperatures dropped below 15°. At these temperatures, the material viscosity was so thick that a secondary pump was required to move the thickened product through the salt blender, requiring more time to blend and additional wear and tear on the blending machine. More gallons per ton were needed to achieve the same result as a competing product costing less, and while treated stockpiles did not leach, clumping occurred in temperatures of 5° and below.

**Recommendations:** The district does not recommend this product for statewide implementation given the challenges associated with blending and its tendency to clump at low temperatures.

**Implementation:** This project has not been selected for the statewide implementation list.

## **2011-2013 Research in Progress**



## Maintenance Research

### Equipment and Tools

**District/Office:**  
1/Duluth

**Contact:**  
Doug Weitalla  
(218) 742-1080

Chris Vest  
(218) 742-1100

**Project Cost:**  
\$2,117 (2 units)

**Start Date:**  
November 2008

**Vendor:**  
anticorrosion.com

## Anti-Corrosion *Research in Progress*



**Project Description:** Applying high voltage (very low amperage) to a truck body can diminish the electrochemical progress of corrosion. The CounterAct electrostatic corrosion control system creates a negative charge that inhibits the corrosion process and prevents dust particles like salt or other corrosive materials from attaching to vehicles. This system has been used in agriculture, salt mining and other extreme environmental conditions with great success. It comes with a power supply, two capacitive coupler pads and a wiring harness.

**Purpose:** The anti-corrosion properties of the CounterAct electrostatic corrosion control system will be evaluated on two trucks in District 1.

**Test Procedure:** District 1 is testing the system on a new and an older tandem truck. The district will evaluate the new truck for corrosion on various components of the truck, including the door panels, truck body and brake chambers, and the older truck to see if corrosion stops or slows down. This is an ongoing test and will take time to determine its success within Mn/DOT.



## Maintenance Research

### Equipment and Tools

**District/Office:**  
D3A/Baxter

**Contact:**  
Jim Anderson  
(218) 828-5729

**Project Cost:**  
\$3,209

**Start Date:**  
August 2010

**Vendor:**  
[www.bgauto.net](http://www.bgauto.net)

## Diesel Induction Service Tool

### *Research in Progress*



**Project Description:** Diesel engine emission standards are directing engine manufactures to use different procedures and engine components to provide cleaner running engines. These changes have resulted in deposits building up on components like exhaust gas recirculation valves, intake manifolds, and fuel injectors. District 3A would like investigate using a cleaning system that does not require disassembly of the engine to accomplish the necessary maintenance.

**Purpose:** The new Diesel Induction Service Tool chemically cleans the engine parts to decrease emissions, restore fuel efficiency and keep diesel engines running longer.

**Test Procedure:** District 3A will monitor fuel consumption, emissions and fuel injection component parts replacement costs using their M5 Fleet Management System for one year. The results will be compared to like vehicles within Mn/DOT.



## Maintenance Research

### Equipment and Tools

**District/Office:**  
6/Rochester

**Contact:**  
Shannon Wait  
(507) 286-7681

**Project Cost:**  
\$6,078

**Start Date:**  
June 2013

**Vendor:**  
fabick.com

## Fabick Truck Bedliner *Research in Progress*



**Project Description:** These truck bedliners are designed to protect dump truck boxes from damage and allow materials to slide out more easily. The district will apply a liner to one new truck to protect it and to one damaged truck in an effort to recondition the bed.

**Purpose:** These bedliners are designed to prevent the equipment damage that can be caused by carrying materials such as riprap, salt, sand and granite chips. The liners also give new life to damaged trucks, extending the service life of the fleet. By allowing materials to slide out of the truck boxes more easily, the liners increase efficiency by lowering cycle times (such as through timely placement of asphalt), and minimize the need for employees to climb into the trucks to chip out hardened material. This reduces the potential for employee injuries.

Currently, MnDOT protects some dump truck boxes by painting them with latex paint or adding slip plate products, but not all trucks have protective materials applied.

**Test Procedure:** The district will test two Fabick bedliners for one year, assessing how well one liner is able to restore a damaged truck bed and evaluating the other liner's performance over time on a new truck.



## Maintenance Research

### Equipment and Tools

**District/Office:**  
6W

**Contact:**  
Gary Wobschall  
Jason Schubert  
(507) 446-5509

**Project Cost:**  
\$5,540

**Start Date:**  
March 2012

**Vendor:**  
reliable-equip.com

## Hydraulic Sign Post Puller *Research in Progress*



**Project Description:** The district's current practice of pulling sign posts with a crane boom sometimes results in the post breaking, which can be hazardous for the crew, the traveling public, the sign truck and the crane boom itself. The district will test an attachment to the crane boom—the REL-SPP hydraulic sign post puller, which features a gripping jaw and chain operation to handle flange and irregular poles up to 8 inches in diameter.

**Purpose:** By replacing the crane boom to pull sign posts, the hydraulic sign post puller is expected to increase safety and limit repair expenses associated with crane use.

**Test Procedure:** The district will assess the effectiveness of the REL-SPP hydraulic sign post puller in reducing injuries and the costs associated with pulling sign posts.



## Maintenance Research

### Equipment and Tools

**District/Office:**  
8/Marshall

**Contact:**  
Craig Gertsema  
(507) 537-2059

**Project Cost:**  
\$8,177

**Start Date:**  
March 2011

**Vendor:**  
truckoffice.com

## TruckOffice *Research in Progress*



**Project Description:** The back seats of supervisors' pickups can be packed full of supplies, equipment and paperwork. These unsecured objects can be unsafe in the event of an accident and pose a security issue if valuables are in full view of potential thieves. The TruckOffice storage unit organizes paperwork, files and technical data, provides safe, secure laptop storage, and comes with an optional power inverter that can help with the use of electronics and other instruments in the field.

**Purpose:** The TruckOffice will not replace other equipment, but it is expected to organize contents in pickups, improve safety for drivers and occupants, and enhance security by providing secondary locks on valuables.

**Test Procedure:** Inspectors and maintenance supervisors in the district will test two storage unit models—TruckOffice and CargoDeck—to determine the effectiveness of the storage units in organizing and securing truck contents.



## Maintenance Research

### Equipment and Tools

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

**Contact:**  
Steve Lueken  
(507) 446-5530

Dave Redig  
(507) 286-7575

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

**Start Date:**  
January 2103

## Wireless Camera System *Research in Progress*



**Project Description:** The Vision Stat Plus is a wireless camera system that offers a low-cost installation and the ability to add and replace up to four cameras as needed, with each camera supported by wireless audio. The integrated control system includes a wireless radio receiver that simplifies camera switching and installation. The in-cab monitor indicates the camera view, automatically switching and displaying the camera placement (“backward” for a reversing camera, “left” or “right” for side-view cameras).

**Purpose:** The district will test this wireless camera system in its tow plow trucks as a possible replacement for the camera system currently used. The wireless system’s four cameras can be installed where cameras are most likely to help the tow plow operator and can be easily moved, which allows the tow plow operator to find the best location for the cameras without expending a lot of time.

**Test Procedure:** The district will evaluate the effectiveness of the wireless camera system in saving time when placing, moving and using cameras to aid in the operation of its tow plow trucks.



## Maintenance Research

### Road and Bridge Maintenance

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

**Contact:**  
Steve Lueken  
(507) 446-5530

**Project Cost:**  
\$1,487

**Start Date:**  
December 2011

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

## Ames GPS-DMI *Research in Progress*



**Project Description:** This distance measuring instrument (DMI) uses a GPS receiver to measure pavement distances. The unit is self-calibrating, so it can be moved from vehicle to vehicle; it plugs into the vehicle's 12-volt electrical system.

**Purpose:** This DMI allows maintenance crews to accurately measure distances along a roadway, such as when setting up traffic control, without the need to hardwire a speed sensor into a vehicle. In the past, some DMIs' speed sensors have affected the vehicle's transmission and have interfered with the vehicle's computer systems. The plug-in units eliminate these issues and require minimal installation time.

**Test Procedure:** The district will evaluate the performance of two GPS-DMI units for one year. The district is using its own DMI units; the research project is funding the GPS receivers.



## Maintenance Research

### Road and Bridge Maintenance

**District/Office:**  
7E

**Contact:**  
Randy Glaser  
(507) 514-1010

**Project Cost:**  
\$4,500

**Start Date:**  
October 2012

**Vendor:**  
kmiinfrared.com

## Crack Jet II *Research in Progress*



**Project Description:** Filling roadway cracks with crumb rubber or epoxy requires that the crack be blown clean and dry and heated before filling. This operation now requires a three-person crew with multiple pieces of equipment. To streamline this operation, the district will test the Crack Jet II, a self-contained heat lance, designed for an operator to walk behind, that uses hot air to dry moisture and blow cracks clean.

**Purpose:** With the Crack Jet II, a single piece of equipment eliminates the need for a separate heat lance, air compressor and blower, and two members of a three-person crew. The equipment can be carried to the job site in a pickup truck and operated by the crew member hauling it. The blow-and-heat operation that prepares a crack for filling can be completed as quickly as the operator can walk.

**Test Procedure:** The district will assess the impact of the Crack Jet II to save time and money by reducing the number of maintenance staff and the additional pieces of equipment needed to prepare roadway cracks for filling.



## Maintenance Research

### Road and Bridge Maintenance

**District/Office:**

1

**Contact:**

Roger Edstrom  
(218) 742-1110

Pat Briski  
(218) 742-1108

**Project Cost:**  
\$7,788

**Start Date:**  
December 2012

**Vendor:**  
rjdindustries.com

## Fiber Rods for Bridge Rail Replacement

### *Research in Progress*



**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 can be cut to any length needed. The fiber rods are also more adaptable when angled forms are used.

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



## Maintenance Research

### Road and Bridge Maintenance

**District/Office:**  
6/East Rochester Bridge

**Contact:**  
Steve Miller  
(507) 286-7697

**Project Cost:**  
\$19,150

**Start Date:**  
March 2010

**Vendor:**  
[www.geophysical.com](http://www.geophysical.com)

# Ground Penetrating Radar Bridge Scan System

## *Research in Progress*



**Project Description:** Mn/DOT staff evaluate concrete bridge decks for delaminations on a regular basis using manual detection techniques, such as chain dragging and core sampling. These manual techniques are labor intensive, rely on human interpretation of acoustic feedback and may yield inaccurate results. The Ground Penetrating Radar (GPR) Bridgescan System uses an electromagnetic evaluation technique that could alleviate these problems.

**Purpose:** The GPR Bridgescan System gathers data about bridge conditions without the need to remove the top layer of pavement. The companion software allows users to complete reports that accurately show the severity of concrete delaminations and the overall deterioration of the bridge deck. This information will help Mn/DOT determine the need for future overlay replacement, deck replacement, and concrete repairs. In addition, the system should allow staff to inspect bridge decks four times as quickly as with manual methods.

**Test Procedure:** Staff will evaluate the effectiveness of the system for six months when inspecting bridge decks, but the system has potential application in multiple assessment areas: pre-stressed concrete beams, approach panels, concrete culverts, roadways, sidewalks and sound/retaining walls. The system could also be used to determine location, size and depth of rebar, wire mesh, and PVC pipe and obtain overall depth of concrete slabs.



## Maintenance Research

### Road and Bridge Maintenance

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

**Contact:**  
Daryl Johnson  
(507) 446-5507

**Project Cost:**  
\$7,000

**Start Date:**  
January 2011

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

## Hot Patch Heater *Research in Progress*



**Project Description:** This heated truck bed insert uses the truck's engine coolant to heat asphalt patching mix to a workable temperature within half an hour year-round and keep it pliable throughout the day. The system's hydraulic shoveling platform lowers materials from the bed of the truck to a comfortable shoveling height. The system allows leftover hot mix from the previous workday to be reheated to a workable temperature, eliminating the need to chip out hardened mix each morning.

**Purpose:** This equipment is designed to make patching easier, safer and more cost-effective. The system could improve or replace existing patching units that run off diesel or gas. It will reduce the necessary manpower and time to get the patching material hot enough to apply to the roadway, and it is a "green" solution because it uses the engine's own coolant to heat the mix rather than requiring additional fuel. The ergonomic shoveling platform aims to reduce worker injury potential.

**Test Procedure:** The district will evaluate one Hot Patch Heater for six months. A separate auxiliary heater from another manufacturer (Webasto) will be added to the equipment being tested to ensure that the mix stays as hot as intended.



## Maintenance Research

### Road and Bridge Maintenance

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

**Contact:**  
Don Nosbisch  
(507) 273-3122

Jerry Gunderson  
(507) 286-7616

**Project Cost:**  
\$5,183

**Start Date:**  
July 2011

**Vendor:**  
jamartech.com

# Jamar Distance Measuring Instrument

## *Research in Progress*



**Project Description:** Maintenance crews often need to measure distances while driving. This distance measuring instrument plugs into a vehicle's 12-volt electrical system, which eliminates the need for a separate power source and remote sensors. Two types of units will be tested, including one that records GPS coordinates of roadway features and stores distance and GPS data.

**Purpose:** This distance measuring instrument will save time and money compared with existing units that require mechanics to install and maintain a remote power source and sensors. The new units can be moved easily from one vehicle to another, such as when a truck is being serviced or sold, which means fewer units may need to be purchased.

**Test Procedure:** The district will evaluate the durability and accuracy of four units over a six-month period.



## Maintenance Research

### Road and Bridge Maintenance

**District/Office:**

3A

**Contact:**

Doug Adamek  
(320) 616-2492

**Project Cost:**

\$3,799

**Start Date:**

December 2011

**Vendor:**

wikco.com

## Skid-Steer Cement Mixer *Research in Progress*



**Project Description:** This cement mixer attaches to a skid-steer loader, allowing crews to mix and pour cement on-site for maintenance and repairs such as grouting culverts. The mixer has a 5-cubic-foot capacity and is powered by the hydraulic system on the skid-steer loader. It attaches to all skid-steer loaders that are compatible with the quick-attach system.

**Purpose:** The district currently contracts out all culvert grouting operations or rents the needed equipment. However, contracting out the repairs can be three times more expensive than using MnDOT crews, and it is cumbersome to rent bulky equipment that must be transported by trailer to the work site. The skid-steer cement mixer will allow maintenance and bridge crews the mobility to bring the mix directly to the job site, which will reduce repair times and save money.

**Test Procedure:** The district will test one skid-steer cement mixer for one year. Bridge and Maintenance crews will share the mixer, evaluating time and cost savings compared with contracting out the work or renting equipment.



## Maintenance Research

### Road and Bridge Maintenance

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

**Contact:**  
Ben Boldt  
(507) 676-2302

**Project Cost:**  
\$2,186

**Start Date:**  
September 2012

**Vendor:**  
vibco.com

## Vibratory Roller *Research in Progress*



**Project Description:** The throw-and-go procedure currently used to make hot and cold pothole patches does not involve compaction. Providing an alternative to this procedure is the Vibco GR-1600, a gasoline-operated vibratory roller with an 8-inch diameter and 12-inch-long drum that provides a compaction depth up to 8 inches with a compaction force of over 1,000 pounds at 6,500 vibrations per minute. While requiring only an extra 1 to 2 minutes to compact the patches, the Vibco GR-1600 can provide better water runoff and a tighter pothole patch for traffic to drive over without creating depressions.

**Purpose:** Compacting pothole patches with the vibratory roller is expected to improve cold and hot patching by making a semipermanent pothole patch that lasts longer than a patch made with the throw-and-go procedure.

**Test Procedure:** The district will determine the effectiveness of the vibratory roller in reducing costs and material use by creating longer lasting pothole patches.



## Maintenance Research

### Roadside Maintenance

**District/Office:**

1

**Contact:**

Brian Koczur  
Michael Hedlund  
(218) 834-4442

**Project Cost:**

\$23,135

**Start Date:**

April 2013

**Vendor:**

diamondmowers.com

## Boom Mower *Research in Progress*



**Project Description:** Brush growing on Minnesota rights of way presents a number of challenges. Brush can obstruct views of signs and present other sight line issues, and small trees can blow across driving lanes during storms and require dangerous cleanup. Removing brush in a safe and effective manner can be complicated by the lack of specialty pieces of equipment in the MnDOT fleet. The three-point hitch Diamond Boom Mower tractor attachment provides an alternative to current brush removal practices.

**Purpose:** The three-point hitch Boom Mower tractor attachment will save MnDOT staff time by permitting the removal of more trees from the roadside while they are smaller and before they become hazards and more challenging to remove. The Boom Mower also makes efficient use of existing equipment and requires a smaller investment than the purchase of a dedicated brush cutter.

**Test Procedure:** The district will assess the effectiveness of the Boom Mower in saving staff time and reducing injuries by reducing the amount of manual brush cutting required. Operators will also assess the Boom Mower's ability to cut brush effectively and the ease with which the attachment can be removed when the tractor is needed for other operations.



## Maintenance Research

### Roadside Maintenance

**District/Office:**  
2/NW

**Contact:**  
Rick Hruby  
(218) 683-8015

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

**Start Date:**  
January 2012

**Vendor:**  
[tiger-mowers.com](http://tiger-mowers.com)

## Ditching Wheel *Research in Progress*



**Project Description:** This attachment has a rotary blade that is often used to clear vegetation from roadside ditches during warmer months. The district will evaluate the tool's effectiveness during the winter, using it to cut through compacted snow and ice that have accumulated in ditches. The ditching wheel attaches to a Tiger boom mower owned by the district.

**Purpose:** The district's goal is to reduce and prevent flooding by using the ditching wheel to create a trench through compacted snow and ice and restore normal drainage. The tool could also be used for temporary or emergency ditching to lower flood waters.

**Test Procedure:** The district will test one Tiger ditching wheel for one year, evaluating its effectiveness in this winter maintenance application and its potential to save time and money and to reduce labor hours.



## Maintenance Research

### Roadside Maintenance

**District/Office:**  
8/Marshall

**Contact:**  
Chase Fester  
(507) 537-2083

**Project Cost:**  
\$611

**Start Date:**  
December 2011

**Vendor:**  
micdynamics.com

## DOT-Z1 Pro Distance Measuring Instrument

*Research in Progress*



**Project Description:** Maintenance crews often need to measure distances along a roadway or between roadside features, such as when setting up traffic control. This vehicle-mounted unit measures distance using battery power or by plugging into a vehicle's 12-volt electrical system, so no hardwire connection is needed. The unit has an internal GPS module and stores distance, speed and GPS data for later retrieval.

**Purpose:** The DOT-Z1 Pro is less expensive than the distance measuring instruments the department currently uses, and is designed to be more reliable. It does not require installation, calibration or maintenance by a mechanic, which saves time and money compared with systems that must be hardwired into a vehicle. The unit can also be used outside a vehicle by crews on foot, and can be moved easily from vehicle to vehicle, which means fewer units may need to be purchased.

**Test Procedure:** The district will evaluate the accuracy and reliability of one unit for six months.



## Maintenance Research

### Roadside Maintenance

**District/Office:**  
6E/Caledonia

**Contact:**  
Mike Aasum  
(507) 273-8701

**Project Cost:**  
\$1,200

**Start Date:**  
May 2011

**Vendor:**  
autostapler.com

## Erosion Blanket Staple Gun *Research in Progress*



**Project Description:** Erosion blankets are used to help control soil erosion in and around roadside ditches, median ditches, slopes and culvert ends before rip-rap is placed. This staple gun is used to secure erosion blankets using 6-inch staples.

**Purpose:** As the use of erosion blankets increases, this staple gun provides a more efficient method of securing them; it eliminates the need to pound stakes or staples with a hammer or by foot. This tool is especially useful on frozen or hard ground, on steep ravines, and on large landscaping projects. Using the staple gun will save time and manpower, and will reduce back injuries caused by constantly bending over to pound in stakes or staples. It weighs less than 20 pounds and can be easily transported from site to site.

**Test Procedure:** The district will test one Rifle M100 staple gun for one year, evaluating its ability to save time, save manpower, and reduce injuries and accidents. District 6W owns a similar tool manufactured by a company that has gone out of business, so this test will provide performance data on a staple gun from a different manufacturer.



## Maintenance Research

### Roadside Maintenance

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

**Contact:**  
Cameron Ihrke  
(507) 475-0352

**Project Cost:**  
\$49,000

**Start Date:**  
February 2103

**Vendor:**  
hammellequipment.com

## Highline Mower *Research in Progress*



**Project Description:** The district is testing the Highline radial contouring hitch (RCH) batwing mower with a pivoting contouring hitch and walking caster wheels to mow roadside ditches. A typical hitch mower requires the tractor to leave the roadway to mow ditches and cannot reach the wet areas that the RCH batwing mower can reach by shifting the mower as needed while the tractor stays on dry ground.

**Purpose:** The RCH batwing mower is expected to improve the district's mowing operations by:

- Improving operator safety and reducing operator fatigue by keeping the tractor on a flat roadway and away from hazards while mowing steep grades.
- Saving time and reducing the staff needed by mowing wet areas that now require the use of smaller mowers.

**Test Procedure:** The district will evaluate the RCH batwing mower in reducing the staff time needed to mow roadside ditches, and its effect on improving the safety of the operator and reducing repairs associated with the tractor encountering hazards.



## Maintenance Research

### Roadside Maintenance

**District/Office:**  
6E

**Contact:**  
Shannon Wait  
(507) 286-7681

David Redig  
(507) 286-7575

**Project Cost:**  
\$9,900

**Start Date:**  
August 2009

**Vendor:**  
[trimble.com/junosb.shtml](http://trimble.com/junosb.shtml)

## Juno Data Collector *Research in Progress*



**Project Description:** Accurate and thorough data collection is an essential part of the job for maintenance staff. The Juno SB handheld is a Global Positioning System data collector that improves and streamlines inventorying of right of way features and the planning and reporting of field operations. Data are post-processed and can be imported into existing software packages such as Excel, Access and ArcGIS for reporting and work planning.

**Purpose:** Data are gathered, maintained and stored in an easy-to-access digital format that eliminates the use of written field diaries, allowing for the easy transfer of knowledge that may otherwise be lost. The system also permits the attachment of digital images and coordinates to the file, and gives staff the ability to produce work plans in the field.

**Test Procedure:** The district will assign one unit per truck station (or section) in four of the district's eight subareas to collect project data on a daily or project basis. The system evaluation will consider how well the Juno SB handheld device bridges existing gaps in available data to generate more accurate, thorough and prompt reporting of highway maintenance activities.



## Maintenance Research

### Roadside Maintenance

**District/Office:**  
3B/St. Cloud

**Contact:**  
Dan Whebbe, Mike Kiley,  
Kelvin Smith

**Project Cost:**  
\$25,000

**Start Date:**  
November 2011

**Vendor:**  
roadwidenerllc.com

## Road Widener *Research in Progress*



**Project Description:** Small repairs to gravel shoulders are currently made using sander conveyors on the rear of dump trucks. When a load of gravel has been emptied, the truck must leave the repair site to get a new load, which creates downtime if the material is far from the repair site. The district is testing a shoulder widening unit that is powered by a skid-steer tractor, which allows crews to use several trucks to feed the unit.

**Purpose:** Using this shoulder widener would improve efficiency and reduce traffic hazards to crews and motorists. The unit allows crews to complete large projects without mobilizing several pieces of off-road equipment, and could provide a cost-effective alternative to the grader-mounted units the department currently uses for shoulder work.

**Test Procedure:** The district will use one Road Widener unit to rebuild gravel shoulders for one year. The unit will be evaluated for material handling using various grades of gravel mixtures, speed of material application, and durability. Repairs completed in the fall will be monitored for longevity and durability over the winter season, including plowing operations.



## Maintenance Research

### Roadside Maintenance

**District/Office:**  
Metro

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

Ron McDeid  
(651) 366-5193

**Project Cost:**  
\$58,834

**Start Date:**  
September 2010

**Vendor:**  
sodarestoration.com

## Soda Blaster *Research in Progress*



**Project Description:** Soda blasting is a new paint stripping technology that uses compressed air to propel a bicarbonate of soda-based media onto the surface to be cleaned or stripped.

**Purpose:** The low-impact, ecofriendly soda blaster can be used to clean and depaint (including graffiti removal) bridges, overpasses, sound walls, pavement, buildings, mechanical equipment and other surfaces for which repainting is not an acceptable option. Although it is similar to traditional sand blasting, soda blasting has the significant advantage of cleaning the surface without causing harm to the substrate or the environment.

**Test Procedure:** The district will evaluate the soda blaster for performance and reliability. The unit will also be assessed for its ability to save time with a one-step cleaning and decoating process, save material by causing minimum impact to surfaces, and reduce manpower needs with a mobile, often one-person operation.



## Maintenance Research

### Roadside Maintenance

**District/Office:**  
Metro

**Contact:**  
Dewy Jones  
(651) 234-7944

**Project Cost:**  
\$9,807

**Start Date:**  
February 2010

## Wet Cut System *Research in Progress*



**Project Description:** In right of way maintenance, mowing is an expensive and labor-intensive operation. For many years, roadside maintenance programs have used herbicides in an effort to extend the mowing cycle. A wet cut mowing system creates efficiencies by combining the operations of a right of way mower and a chemical applicator for applying chemicals such as herbicides to stubble remaining after the mowing operation has been performed.

**Purpose:** Extending the mowing cycle will save money and labor and keep rights of way in better condition, which will reduce the amount of wear and tear on other maintenance equipment.

**Test Procedure:** To assess the effectiveness of the wet cut mowing system, the district tracked vehicle routes, miles, application rates and vegetation heights through the 2010 mowing season. Mowing heights will be measured in 2011 and compared to areas where the wet cut system was not used. Cost savings in personnel and fuel associated with using one piece of equipment versus two will be computed based on vehicle miles.



## Maintenance Research

Safety, Traffic Control and Work Zone Safety

**District/Office:**  
1/Border

**Contact:**  
Mike Hedlund  
(218) 834-4442

**Project Cost:**  
\$982 (12 pair)

**Start Date:**  
December 2012

**Vendor:**  
foresterchainsawparts.com

## High-Visibility Chainsaw Chaps *Research in Progress*



**Project Description:** Cutting trees that have blown across the road on a stormy, windy night is one of the most dangerous activities conducted by maintenance crews in outstate Minnesota. Currently, the standard chaps worn by crews have flagging attached to them to increase their visibility, and the loose clothing presents a hazard to the chainsaw operator. The district is testing a cheaper alternative chap that provides reflectivity as well as protection for chainsaw operators should they come in contact with a rotating saw.

**Purpose:** The district is replacing the chaps currently used for tree cutting with chaps that have 2-inch-wide reflective strips and the protective qualities typical of other chainsaw chaps.

**Test Procedure:** The district will assess the impact of the high-visibility chainsaw chaps in reducing costs and the risk of injuries to chainsaw operators.



## Maintenance Research

### Winter Maintenance

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

**Contact:**  
Larry Anderson  
(507) 446-5535

Wayne Goldberg  
(507) 379-3414

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

**Start Date:**  
November 2011

**Vendor:**  
winddriven.com

## Aeration System for Snow Drift Control *Research in Progress*



**Project Description:** Blowing snow is a concern on the Interstate 35 bridge over Albert Lea Lake. This project will use a wind-driven aeration system to maintain open water on the lake during the winter, which is expected to capture a significant amount of the blowing snow.

**Purpose:** Using open water to capture blowing snow will significantly reduce the amount of blowing and drifting snow on the bridge. Minimizing this blowing and drifting is expected to improve pavement conditions, reduce deicing chemical use and after-hours call-outs for maintenance crews, and reduce the number of accidents on the bridge.

**Test Procedure:** The district will evaluate one Wind Driven Pond Mill aeration system for six months, assessing its effectiveness at reducing accidents and chemical use compared with previous years.



## Maintenance Research

### Winter Maintenance

#### **District/Office:**

Metro/Forest Lake Truck  
Station

#### **Contact:**

Lynn Tschida  
(651) 234-7933

Dave Hagle  
(651) 297-4437

**Project Cost:**  
\$2,280

**Start Date:**  
December 2012

**Vendor:**  
winterequipment.com

# BlockBuster Carbide Insert System

## *Research in Progress*



**Project Description:** The BlockBuster carbide plow blade insert system is multi-part plow blade assembly that includes tungsten carbide insert blades, a steel cover plate, CurbRunner plow guards, and cast steel wear blocks with carbide matrix wear pads. The system is designed to stabilize the blade while plowing, improving plow performance and reducing blade wear.

**Purpose:** The BlockBuster system eliminates the cost of buying, installing and inventorying steel cover blades. The product is delivered as a system with one part number and all needed hardware and components, allowing for quick, easy assembly. It is designed to last up to four times longer than traditional plow set-ups.

**Test Procedure:** One plow truck will be outfitted with the BlockBuster Ultimate plow blade insert system, and its performance will be evaluated for one year. The shop will monitor any part or assembly issues and determine whether using the system reduces steel inventorying. Plow operators will assess whether there is any difference in the stabilization of the blade during plowing and will visually inspect the carbide inserts for washout and damages from impacts.



## Maintenance Research

### Winter Maintenance

**District/Office:**  
Metro

**Contact:**  
Mark Fischbach  
(651) 234-7907

**Project Cost:**  
\$20,000

**Start Date:**  
April 2010

**Vendor:**  
<http://www.henderson-mfg.com/liquid.html>

## First Response System *Research in Progress*



**Project Description:** Metro staff currently use a dump box with the tow plow to distribute granular materials on the roadway. However, only a quarter of the material in the box can be used because the tongue of the tow plow prevents raising the box to move material to the spreader. The First Response System is designed to work effectively with a tow plow fleet because it can discharge material in front of the box instead in the rear.

**Purpose:** The First Response System supports application of granular material, pre-wetting of material (up to 45 gallons per ton) and anti-icing on up to three lanes, all while changing functions on the fly. The unit has 1300 gallons of liquid storage, allowing it to be used in sweeping operations as the water truck. If successful, the system could help Mn/DOT reduce fleet size by combining granular material application anti-icing.

**Test Procedure:** The system will be evaluated in the field for one year to document material usage, speed of completing operations and ease of use.



## Maintenance Research

### Winter Maintenance

**District/Office:**  
Statewide

**Contact:**  
Ryan Otte  
(651) 366-3585

**Project Cost:**  
\$2,600

**Start Date:**  
May 2011

**Vendor:**  
kueperblades.com

## Küper Cutting Edge *Research in Progress*



**Project Description:** Snowplow operators will test Küper cutting edges to assess the blades' durability, evaluate how well they clean the road surface, and determine whether they allow operators to reduce their salt use. Operators will compare the Küper blades with the carbide steel Joma blades that are currently the department's standard cutting edge replacement, and with PolarFlex blades, which are being tested separately.

Küper blades consist of a tungsten carbide cutting edge embedded in steel and rubber. Küper's Wave Technology diverts snow across a curved profile for optimal removal, then moves the snow over the mounting elements without resistance. The wave provides efficient movement of snow, and cooling openings control blade heat.

**Purpose:** MnDOT is interested in finding a durable alternative to Joma blades, which have been increasing in cost. The Küper blades are among the new blade systems and cutting edge technologies that have the potential to reduce costs and improve efficiency for the department.

**Test Procedure:** Seven trucks will be outfitted with the blades and evaluated for one year. The blades will be evaluated for their durability and for their ability to remove ice and snow and reduce salt use compared with the Joma and PolarFlex blades.



## Maintenance Research

### Winter Material

**District/Office:**  
7/Windom, Mankato

**Contact:**  
Thomas Zimmerman  
(507) 831-8038

Anthony DeSantiago  
(507) 304-6233

**Project Cost:**  
\$60,000

**Start Date:**  
October 2010

## Liquid Chemical Blending and Dispensing Unit *Research in Progress*



**Project Description:** The district will add a state-of-the-art material dispensing unit to its AccuBrine salt brine generators. The unit consists of a series of pumps equipped with flow meters that allow for accurate blending and dispensing of up to five different chemicals into either the tank on a plow truck or into larger tankers for distribution to other sites. A computer monitors and controls the mixture rate at which the pumps are flowing to give the operator an accurate mixture.

**Purpose:** With the use of this system, the district will no longer have to blend salt brine with other materials in tanks and store them, which reduces both the amount of storage capacity and the number of different materials the district can have on hand at any one time. It will also allow the district to accurately charge out materials to other agencies or entities currently sharing the district's chemical generation sites.

**Test Procedure:** The district will test the unit's ability to monitor and control the dispensing sites from a remote office. The evaluation will also include an assessment of the system's ability to generate reports that provide data on the material taken from each site.



## Maintenance Research

### Winter Maintenance

**District/Office:**  
6W

**Contact:**  
Tom Johnson  
(507) 456-5350

**Project Cost:**  
\$5,000

**Start Date:**  
March 2010

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

## Native Planting Snow Drift Control *Research in Progress*



**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 will assess the impact of the planting areas in reducing the time and material required to keep the adjacent roadway free of snow and ice.



## Maintenance Research

### Winter Maintenance

**District/Office:**  
Statewide

**Contact:**  
Ryan Otte  
(651) 366-3585

**Project Cost:**  
\$2,167

**Start Date:**  
May 2011

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

## PolarFlex Plow Blades

### *Research in Progress*



**Project Description:** Snowplow operators will test PolarFlex cutting edges to evaluate the blades' durability and ability to clean the road surface, and to determine whether they reduce operator fatigue and whether they allow operators to reduce their salt use. The PolarFlex blades' performance will be compared with the carbide steel Joma blades that are currently the department's standard cutting edge replacement, and with Küper blades, which are being tested separately.

PolarFlex cutting edges consist of 12-inch segments of carbide-tipped steel installed within flexible, reusable synthetic rubber housings. The flexible rubber allows the segments to more closely conform to the contours of the road surface. The design also isolates the plow operator from chatter and vibration caused by the plow blade making contact with the pavement.

**Purpose:** MnDOT is interested in finding a durable alternative to Joma blades, which have been increasing in cost. The PolarFlex blades are among the new blade systems and cutting edge technologies that have the potential to reduce costs and improve efficiency for the department. Their flexible rubber design may reduce operator fatigue as well.

**Test Procedure:** Four trucks will be outfitted with the blades and evaluated for one year. The blades will be evaluated for their durability, their ability to reduce operator fatigue, and their ability to remove ice and snow and reduce salt use compared with the performance of Joma and Küper blades.



## Maintenance Research

### Winter Maintenance

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

**Contact:**  
Jakim Koll  
(320) 223-6604

**Project Cost:**  
\$7,000

**Start Date:**  
January 2012

**Vendor:**  
[www.teconer.fi](http://www.teconer.fi)

## Road Condition Monitor (RCM) 411

### *Research in Progress*



**Project Description:** This mobile road condition sensor is designed to detect the road condition and friction level (how slippery the road is) using an infrared light transmitter and a receiver. As the vehicle travels down the road, this information is then sent to a cell phone mounted on the vehicle's dash. The sensor provides continuous information to the operator on real-time road conditions.

This project is investigating (1) whether the sensor can reliably detect road conditions and (2) whether this information can be transmitted automatically to MnDOT's Maintenance Decision Support System (MDSS), which helps winter maintenance staff select the most appropriate strategies for the conditions.

**Purpose:** Currently, plow operators and supervisors must manually enter road conditions into a computer or relay them by phone, a time-consuming process that operators are not always able to perform in a timely manner. Using the road condition monitor to automate this process would save operator time and would improve MnDOT's MDSS by providing more timely and accurate road condition and friction information. This would lead to more precise, efficient material application, which is expected to save materials and ultimately reduce accidents by providing a more consistent level of service.

**Test Procedure:** The district will test one RCM 411 unit for one year. If the system proves viable and effective, MnDOT could install road condition monitors on all plows and supervisor trucks that are equipped with Automatic Vehicle Location technology. In the future, the monitors could also transmit road condition information to MnDOT's 511 system to ensure that both MnDOT and the public have the most up-to-date information.



## Maintenance Research

### Winter Maintenance

**District/Office:**  
3/St. Cloud,  
Baxter

**Contact:**  
Mandy Uhrich  
(218) 828-5772

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

**Start Date:**  
February 2012

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

## Salt-Away Research in Progress



**Project Description:** Rust and corrosion take a heavy toll on maintenance and construction vehicles, including snow and ice equipment. Salt-Away rinse produces an invisible barrier that prevents salt from attaching to the equipment's surface, which makes salt removal easier. After large salt debris is manually removed by hand in the salt shed, the truck is then placed indoors in the way bay. Salt-Away is mixed with water and applied as a rinse to remove the remaining salt from the surface. District 3A is also investigating using Salt-Away as a final rinse for bridge flushings before and after the snow and ice season to evaluate whether it helps reduce corrosion from salt residue.

**Purpose:** Using Salt-Away is expected to reduce the time spent on vehicle and equipment cleaning and upkeep and reduce the amount of water and soap needed. It will decrease downtime of snow and ice equipment for cleaning and repairing rusted areas, and will ultimately increase the life span of equipment and vehicles. It may also help reduce corrosion on bridge structures.

**Test Procedure:** The district will test Salt-Away for one year, evaluating it as a potential best management practice for washing and maintaining its equipment to maximize the equipment's life span. If it is effective, Salt-Away could be used on all fleet equipment that comes into contact with winter chemicals, including fleet cars and construction and maintenance vehicles.



## Maintenance Research

### Winter Maintenance

**District/Office:**  
2A/Bemidji

**Contact:**  
Tony Bowe  
(218) 755-6567

**Project Cost:**  
\$24,785

**Start Date:**  
March 2013

**Vendor:**  
[hlasnow.com/snowwing.php](http://hlasnow.com/snowwing.php)

## SnowWing *Research in Progress*



**Project Description:** The HLA SnowWing is a combination box blade, angle blade, straight blade and reverse box blade controlled hydraulically with radio remote control. The blade's design allows the operator to change from a traditional box blade to a straight blade, with the added bonus of extra clearing width. The endplates' 180-degree rotation allows the operator to get closer to buildings and curbs with less chance of damage and better clearing results. The blade can be mounted on a variety of equipment, including tractors, loaders, skid steers and graders.

**Purpose:** The SnowWing's versatile endplates allow for operation close to buildings and curbs and for dragging the snow away for full clearing even in the tightest of spaces. The blade's versatility makes it effective in clearing snow off parking lots and bridge decks and pulling snow away from curbs and sidewalks.

**Test Procedure:** The district will evaluate the SnowWing's versatility and effectiveness in employing multiple blades on the go, without changing attachments, during snow removal and cleanup efforts in the right of way, parking lots and on bridge decks.



## Maintenance Research

### Winter Maintenance

**District/Office:**  
Metro

**Contact:**  
Mark Fischbach  
(651) 234-7907

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

**Start Date:**  
March 2008

**Vendor:**  
vikingcives.com.

## Tow Plow with Granular Capabilities

### *Research in Progress*



**Project Description:** The tow plow, a snowplow that can clear two lanes of traffic at once, has proved itself to be roadworthy, versatile and operator-friendly. The second generation of the tow plow includes an option for a granular box that is fitted on the frame of the tow plow that can be used in addition to an anti-ice spray bar for liquid application.

**Purpose:** Preliminary evaluation of the first-generation tow plow indicates a significant savings in equipment and labor costs, and an increase in efficiency in snow removal operations. The second generation of the tow plow, with its granular box, offers more flexibility in material application.

**Test Procedure:** The Metro district will compare the effectiveness of the second-generation tow plow, with its ability to apply granular materials, with first-generation tow plows lacking a granular box to determine whether the extra expense of the second-generation equipment is justified.



## Maintenance Research

### Winter Maintenance

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

**Contact:**  
Don Mehren  
(507) 459-0244

Neil Hjelmeland  
(507) 251-0139

**Project Cost:**  
\$29,978

**Start Date:**  
April 2103

**Vendor:**  
universaltruckequipment.  
com

## Universal Plow for Loaders *Research in Progress*



**Project Description:** The district will test a Universal reversible snowplow and wing assembly for use with its Case 721D front-end loader. The system includes the snowplow, wing and two mounting frames that employ a quick disconnect system on the loader.

- The first mounting frame is used for winging back operations when both the plow and wing are needed.
- The second mounting frame, used when only the plow is needed, is used to push back sight corners at intersections and piling snow in parking lots.

**Purpose:** The district will use the reversible snowplow and wing attachments to improve the performance of some of its snow and ice cleanup operations. Included in the test is the maintenance and removal of snow buildup from highway center islands, crossovers and intersection sight corners, as well as the winging operations conducted to push back snow on roadways due to wind and drifting.

**Test Procedure:** The district will evaluate the reversible snowplow and wing assembly on its ability to provide improved visibility for the operator, improved power and traction, better maneuverability, and less wear and tear on the trucks now used to remove snow from center islands.



## Maintenance Research

### Winter Maintenance

**District/Office:**  
8/Marshall

**Contact:**  
Craig Gertsema  
(507) 537-2059

**Project Cost:**  
\$16,000

**Start Date:**  
April 2013

**Vendor:**  
[wausau-everest.com/  
models/space-patrol.html](http://wausau-everest.com/models/space-patrol.html)

## Wausau Space Patrol Wing *Research in Progress*



**Project Description:** The district's current wing setup for its snowplows employs a light-duty wing that has proved to be less than effective in areas with heavy drifting and high banks. The Wausau Space Patrol Wing is a medium-duty wing with some light benching (leveling) capabilities. The Space Patrol Wing's hydraulic control could eliminate the cable assemblies currently used on the district's wings, and the 10- to 12-foot-long wing (depending on model) is longer than the 9-foot wing now in use.

**Purpose:** By having a medium-duty wing plow with a wider cutting swath, the district expects to reduce the number of passes needed to clear the roadway. Using a wing that pushes drifts further back off the roadway could also enhance safety for the traveling public.

**Test Procedure:** The district will assess the effectiveness of the Wausau Space Patrol Wing in reducing the time and manpower needed to clear snow in areas with heavy drifting, as well as its ability to push snow further back off the roadway than the current wing setup permits.



## Maintenance Research

### Winter Maintenance

**District/Office:**  
6

**Contact:**  
Brian Wolfgram  
(507) 951-2442

**Project Cost:**  
\$8,520

**Start Date:**  
October 2012

**Vendor:**  
vericomcomputers.com

## Winter Roadway Friction Meter

### *Research in Progress*



**Project Description:** A winter roadway friction meter tests the slipperiness of the roadway in icy conditions. Unlike wheel-type friction testers, the RFM4000X Friction Meter is mounted on the dash of any car, pickup or truck and measures G forces when a driver applies the brakes. This brake action can be done at a safe speed, and it takes only 1 second to get a reading. This measuring device complies with Federal Aviation Administration standards and is used by airports to check runway friction.

**Purpose:** Snowplow operators change their application rates of winter chemicals as temperatures change during a snow and ice event. The roadway friction meter will enhance the operators' ability to assess the slipperiness of a road and determine the type and amount of chemical to apply.

**Test Procedure:** The district will evaluate the friction meter's ability to reduce the time, staff and material needed to treat winter roadways by reducing the number of trips required over plow routes to check for and treat slippery roads.

## 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 Screenshot
- 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

- Retractableflap
- 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 Intellect Comms
- 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



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/maint/research.html>

MnDOT Research Services Section:

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

MnDOT Library:

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