



# OPERA

Local Operational Research Assistance Program



# 2011

## Annual Report

## 2011 Local Operational Research Assistance (OPERA) Program Annual Report

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# OPERA

## 2011 ANNUAL REPORT

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This report is a compilation of the 12 projects completed during 2011 by local government transportation organizations receiving OPERA support. Individual fact sheets on each 2011 project, as well as complete project reports as submitted by each agency, are available online at [www.mnltap.umn.edu/opera](http://www.mnltap.umn.edu/opera).

## 2011 OPERA: *Increasing Efficiency, Improving Performance*

In 2011, the Local Operational Research Assistance (OPERA) Program continued to foster hands-on transportation research by cities and counties across Minnesota.

Twelve OPERA-funded projects were completed by local agencies this year—the most of any year in the program’s history. Topics ranged from installing modified rain gardens to testing mastic patches on city streets. Other projects documented a historic covered bridge with laser scanning technology, tested an advanced deicing product, and conducted a training and equipment upgrade program to reduce chloride loading in a nearby creek.

Many of this year’s projects focused on increasing efficiency and improving performance. To accomplish these goals, some agencies researched and tested new techniques and materials, and others designed their own innovative tools.

For example, Blue Earth County evaluated the use of recycled asphalt shingles (RAS) and recycled asphalt pavement (RAP) in a gravel road stabilization project that aimed to improve roadway performance and reduce costs. Many past stabilization methods—such as bituminous stabilized gravel roads—have become unaffordable for the county due to the rising costs of asphalt emulsion. The RAS/RAP blend required almost a third less emulsion than these other methods, and it offered a hard surface that could stand up to the heavy loads traveling in and out of local farms.

“The goal was to find some new strategy where we can improve the road surface, reduce our maintenance costs, and give the citizens a better road to drive on,” said County Engineer Alan Forsberg. “We’d also like to reduce our future maintenance costs so we actually save money over time.”

The roadway performed well during its first winter, Forsberg said. Patching was needed in certain areas that experienced repeated heavy loads, and the county applied an additional chip seal to the entire roadway. “We think this will carry it for quite awhile,” Forsberg said. “Right now we’re going to watch it and see what happens.”

The City of Lakeville completed an OPERA-funded project intended to reduce costs and improve efficiency related to catch basin repair operations. The city created a specialized trailer outfitted with a service crane, cement mixer, water tank, storage containers, and other tools needed for the rehabilitation of storm sewer structures and catch basins.

“The problem with our previous method was space and organization,” said Lakeville Streets Superintendent Troy Grossman. Prior to the creation of the trailer, crews had to load and unload equipment into multiple vehicles every time they needed to complete a project.

“The OPERA Program made it possible for us to fabricate, purchase equipment, and complete the catch basin repair trailer... Now our crews have everything they need,” Grossman said, which saves staff time on both ends of a project. The trailer also allows for improved safety, with much of the equipment installed on the curb side of the trailer to keep crews out of the traffic lane whenever possible.

Although the trailer was designed for storm sewer catch basin maintenance and repairs, its equipment and supplies will also make it an asset for sidewalk repairs, water main repairs, sanitary sewer casting adjustments, and curb repairs, Grossman said.

# Implementation of a Scale-Tec Calibration Scale

**Project Number** 2008-09

**Project Leader** Alan Ryg

**Agency** Olmsted County Public Works Department  
2122 Campus Drive Southeast, Suite 200  
Rochester, MN 55904

**Phone** 507-328-7070



**Problem** During the winter months, Olmsted County uses 17 tandem-axle snowplow trucks to maintain 530 miles of roadway. The county was unable to verify the amount of salt and sand being applied to the roadway by these vehicles because it lacked a uniform method for calibrating the sanders on each truck. It was difficult to determine if the amount of salt and sand applied was sufficient or if the county was overspreading the material.

**Solution** Olmsted County used a Scale-Tec Calibrator IV to correctly calibrate the amount of salt and sand being applied by each truck. The device measures the spread of the material to an exacting level of 99.5 percent.

**Procedure** The county used the Scale-Tec Calibrator on each of its Force America 5100 spreaders. The spreader was set to scale mode, and the calibrator was placed under the spreader discharge. The dump body of the vehicle was raised, the auger filled, and the spreader turned on to allow the salt and sand material to fall into the scale. By measuring the weight of the material, the calibrator helped the county determine the appropriate settings for each spreader to ensure the correct and consistent application of salt and sand.

**Results** Since the calibration of all 17 vehicles, the county has saved money by using less salt during the past two winters. The correct calibration has also allowed the county to save fuel, labor, and materials by avoiding a second trip on the same road because of an insufficient first application. The county now knows that its trucks are applying at an identical rate and not spreading too much or too little material.

**Approximate Cost** \$3,000

**OPERA Funding** \$3,000

**Implementation** To ensure continued accuracy, the county plans to complete calibrations once a year before the start of each winter season. Spreaders will also be calibrated if work has been performed on the sander systems or if an operator is questioning the amount of material being applied.

**Status** Complete

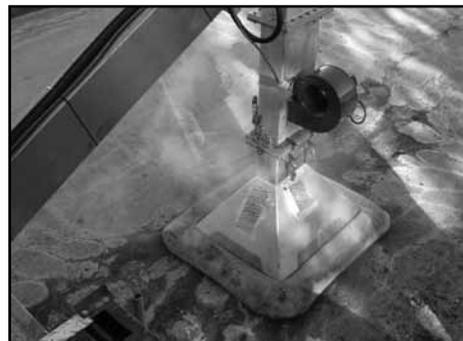
# Taconite-Enhanced Pothole Repair Using Portable Microwave Technology

**Project Number** 2009-01

**Project Leader** Charles Cadenhead, Anoka County, and Jim Foldesi, St. Louis County

**Agency** Anoka County Highway Department  
1440 Bunker Lake Boulevard  
Andover, MN 55304

**Phone** 218-720-4274



**Problem** Cold-weather pothole repairs that use conventional cold-patch mixes and methods can be unreliable and prone to early failure. Public works and transportation maintenance departments need a more effective and longer-lasting winter repair option.

**Solution** Anoka County partnered with St. Louis County and the University of Minnesota Duluth's Natural Resources Research Institute (NRRI) to test the effectiveness of mobile microwave technology for the repair of potholes and other damaged pavements. To make the repairs, the agencies used compounds containing recycled/byproduct materials, including recycled asphalt pavement (RAP)/millings, microwave-absorbing taconite materials, and recycled asphalt shingles (RAS).

**Procedure** Cold-weather field testing was completed at NRRI and select locations in Anoka County and St. Louis County using a portable microwave unit provided by Microwave Utilities Inc. Crews first preheated the pothole to melt any ice or snow and soften the pavement. Then, the mixture of RAP/millings, taconite materials, and RAS was placed in the pothole and heated to at least 230 degrees Fahrenheit using the mobile microwave equipment. Heating took an average of 8 to 12 minutes. A portable compactor was then used to compact the heated mixture.

**Results** RAP/millings that were minimally contaminated with sand and gravel worked best. The taconite materials significantly enhanced microwave absorption, and the RAS enhanced the binding characteristics of RAP. The microwave equipment quickly heated and softened the pavement surrounding the pothole, which was critical for providing a good bond and repair.

**Approximate Cost** \$20,000

**OPERA Funding** \$10,000

**Implementation** The technology shows excellent potential for more effective pothole repair. The project also demonstrated that inexpensive and abundant material such as RAP, taconite, and RAS can be combined to make an effective pavement repair compound. The next generation of mobile microwave technology, currently under development, will be higher-powered for more rapid heating and be designed for easier placement over the pavement repair target. The objective is to achieve an effective and permanent repair in about five minutes.

**Status** Complete

# Innovations in Microsurfacing Materials and Application Techniques

**Project Number** 2009-11

**Project Leader** Wayne Fingalson, Wright County, and Dan Wegman, Road Science

**Agency** Wright County  
1901 Highway 25 North  
Buffalo, MN 55313

**Phone** 763-682-7388



**Problem** Wright County uses microsurfacing to seal and protect its pavements. Although it provides a smooth ride and skid resistance, microsurfacing is not designed for the low temperatures found in northern climates. Cracking typically occurs during the first winter after placement.

**Solution** In an effort to improve the properties of microsurfacing for better performance on county roadways, Wright County partnered with Road Science to test a new flexible microsurfacing product on portions of two county roads. The new material was designed to improve the crack resistance of pavement compared to traditional microsurfacing. When cracks do appear in the material, they should also have better integrity and thus reduce maintenance costs.

**Procedure** The flexible microsurfacing system consists of an emulsion formulation enhanced with a performance additive. The Texas Overlay Test was used in the lab mix design to assure that better crack-resistant properties could be achieved with the new material. The microsurfacing product was then used on County State Aid Highways (CSAH) 18 and 37 in Wright County, both of which were experiencing slight rutting. Traditional microsurfacing was placed on the majority of each roadway, with a 1,500-foot section of flexible microsurfacing placed for comparison and evaluation on each road.

**Results** There was some construction difficulty with the flexible microsurfacing on CSAH 37, mostly associated with retarder pump and pugmill performance issues that affected the cure of the product. Surface treatment blemishes caused by the equipment problems were fixed by the contractor. Also, the performance additive sporadically clogged the additive machine. A shorter fiber additive was used, and the problem was eliminated.

**Approximate Cost** \$16,000

**OPERA Funding** \$8,000

**Implementation** The Texas Overlay Test showed that the flexible microsurfacing product could withstand more than five times the cycles before failing than traditional microsurfacing. CSAH 37 and 18 will be monitored to validate these test results and determine the additional crack resistance provided by the flexible material.

**Status** Complete

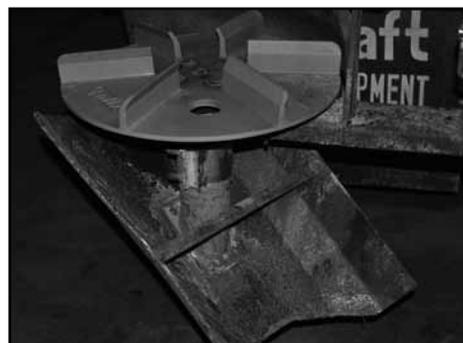
# CAD Drawing of a Simple Salter/Sander Chute

**Project Number** 2009-13

**Project Leader** Wayne Sandberg and Paul Springstroh

**Agency** Washington County Public Works  
11660 Myeron Road North  
Stillwater, MN 55082

**Phone** 651-430-4300



**Problem** There is a continued need for equipment capable of more accurate and precise salt and sand placement on roadways, such as a simple salter/sander chute. Currently, there is a lack of drawings or documentation to guide the fabrication and installation of this equipment. Such a drawing could help ensure that salter/sander chutes are accessible to any road authority seeking to cost-effectively control its salt or sand usage.

**Solution** Washington County fabricated a simple salter/sander chute that can be installed below a vehicle's spinner, allowing the spinner to disperse deicing material when necessary. An accompanying CAD drawing was created to allow other agencies to easily fabricate, install, and adjust the salter/sander chute.

**Procedure** Three chute designs were fabricated, and the chute identified as the easiest to install and adjust was chosen for the CAD drawing. The selected design is attached to the spinner motor with a clamp and can be adjusted to deliver material at different angles depending on the type of roads on a given route. The chute also remains centered under the spinner even when pivoted, ensuring that all material coming off the spinner falls into the chute.

**Results** The design was attached to one truck for the winter of 2010–11. The driver reported more accurate material placement and minimal loss of material off the road, with an estimated 25 percent less material used on the route. The Minnesota Department of Transportation also conducted extensive testing on the chute, and results indicate excellent performance at speeds between 20 and 30 miles per hour. The chute allows deicing material to be placed on the road without the loss of material commonly caused by higher forward speed.

No wear edge was installed on the chute, which caused two to three inches of the plastic to wear away where the chute came in contact with the pavement. A wear edge made of heavy rubber could be bolted to the bottom of the chute and replaced as needed to increase the overall life of the chute.

**Approximate Cost** \$2,000

**OPERA Funding** \$2,000

**Implementation** Washington County is now using chutes on a trial basis, with plans to install them on more trucks in its fleet. The county also plans to install chutes on dual-spinner trucks to ensure more accurate placement of material on roads with multiple turn lanes. It costs \$100 to \$200 and takes about three hours to build a chute.

**Status** Complete

# Use of Laser Scanning Technology to Obtain As-Built Records of Historic Covered Bridges

**Project Number** 2009-12

**Project Leader** Bill Angerman

**Agency** City of Zumbrota  
175 West Avenue  
Zumbrota, MN 55992

**Phone** 507-732-7318



**Problem** Covered bridges are part of the fabric of American history, and several hundred historic covered bridges still exist today. Although much effort is expended to preserve these structures, the high cost of restoration, neglect, vandalism, and arson often take their toll, and many are lost forever. No engineered drawings exist for many such bridges, so rebuilding them in the event of damage or destruction would require a lot of guesswork.

**Solution** The City of Zumbrota contracted with the University of Minnesota Duluth's Natural Resources Research Institute (UMD NRRI) to complete three-dimensional scanning and data processing of the Zumbrota Covered Bridge, the only remaining historic covered bridge in Minnesota. Constructed in 1869 and relocated several times, the bridge now spans the Zumbro River in a city park. The UMD NRRI had previously partnered with the U.S. Forest Service to conduct similar scanning of historic covered bridges in Wisconsin and Iowa.

**Procedure** In July 2010, UMD NRRI contractor SightLine, LLC, completed approximately 35 laser scans of the bridge from a variety of angles using a three-dimensional laser scanner. Prior to scanning, paper targets were placed in numerous locations on the bridge for use in linking multiple scans together. All visible surfaces of the bridge were documented in the scans, which were then given to the UMD NRRI for data processing. The information was used to assemble a complete digital representation of the bridge and to generate a 1/100- scale three-dimensional replica.

**Results** The scan data, images, and figures were provided to the City of Zumbrota for its records. The as-built documentation produced by the project could be used, if needed, to repair or reconstruct the bridge in the future.

**Approximate Cost** \$10,000

**OPERA Funding** \$10,000

**Implementation** In September 2010, the Zumbro River flooded, with floodwaters rising to nearly the same elevation as the bottom of the Zumbrota Covered Bridge. This situation demonstrated the importance of collecting as-built documentation, as additional river cresting could have caused substantial damage to the bridge.

**Status** Complete

# Rehabilitating/Upgrading Low-Volume Roads with Waste Shingles

**Project Number** 2010-01

**Project Leader** Alan Forsberg

**Agency** Blue Earth County Highway Department  
35 Map Drive  
Mankato, MN 56001

**Phone** 507-304-4025

**Problem** The Blue Earth County Highway system includes over 300 miles of gravel roads that provide all-weather access to the county's rural agricultural areas. These roads are dusty, bumpy, and prone to severe damage during the spring thawing period. They are also costly to maintain, requiring regular blading and replacement of gravel surfacing. Paving these gravel roads is not an affordable solution, so the county has been searching for alternatives for providing a hard, smooth driving surface.



**Solution** Blue Earth County completed a gravel road stabilization project on a section of County State Aid Highway (CSAH) 48 using a blend of recycled asphalt shingles (RAS) and recycled asphalt pavement (RAP) rather than the typical stabilizing binder used in past projects. This mix required almost a third less asphalt emulsion than bituminous stabilized gravel roads.

**Procedure** In partnership with Waste Management and Road Science, Blue Earth County applied a mix of 65 percent RAP, 15 percent RAS, 18 percent gravel, and 2 percent asphalt emulsion on a 1-mile segment of CSAH 48. County maintenance crews spread the RAP and RAS on the roadway surface and used a reclaiming machine to mix the two together. They then injected the asphalt emulsion before compacting and blading the surface.

Initially, crews used two hot in-place recycling (HIR) machines to heat the mix in two 3-inch lifts, but this proved slow and ineffective. The HIR machines were then used only on the final lift and were effective in reducing surface voids and sealing the roadway. After compaction was completed, crews placed a seal coat to further protect the surface from raveling.

**Results** To date, the roadway is performing well with no significant raveling or rutting. To ensure sufficient time for the seal coat to cure, future projects should be completed in the first half of the summer. In addition, the HIR machines were costly and not effective in placing the mix, but they did appear to contribute to a more tightly sealed top surface. In future projects, it would be useful to demonstrate a section without using the HIR machine.

**Approximate Cost** \$120,000

**OPERA Funding** \$10,000

**Implementation** The county plans to observe the performance of the shingle mix for one to two years. If it continues to perform well and funds are available, additional projects may be completed.

**Status** Complete

*View the complete project report online at [www.mnltap.umn.edu/opera](http://www.mnltap.umn.edu/opera).*

# Stormwater Pollutant Removal in Rain Gardens

**Project Number** 2010-03

**Project Leader** Glen Hodgson

**Agency** City of Grand Rapids  
420 Pokegama Avenue North  
Grand Rapids, MN 55744

**Phone** 218-720-4274



**Problem** Increased environmental awareness has led local roadway agencies to consider various means of mitigating the effects of stormwater discharge into lakes and rivers. One technique is to install rain gardens that partially treat the stormwater. Unfortunately, many urban settings do not have enough space to construct a rain garden large enough to fully absorb storm runoff.

**Solution** The City of Grand Rapids began constructing modified rain gardens as part of a 2008 street reconstruction project on First Avenue Northwest. Since the rain gardens are not large enough to be used solely as infiltration basins, they are connected and allowed to discharge to the city's storm sewer system.

**Procedure** The gardens were constructed between the curb and the sidewalk on First Avenue Northwest. Each garden is about 15 feet wide and 25 feet long, with a total size of 375 square feet. The rain garden design includes an infiltration pipe and an overflow pipe, allowing the rain gardens to discharge excess water to the storm sewer system.

**Results** During the summer of 2011, two of the rain gardens were monitored during rainfall events. Samples of stormwater runoff entering the garden were collected, as were samples from the discharge pipe from the rain gardens to the storm sewers. These samples allowed researchers to determine if the rain gardens reduced the amount of total suspended solids, nitrogen, and phosphorus in the runoff.

Although no significant conclusions can be drawn about the rain gardens' effect on phosphorus or nitrogen levels, test results indicate that the rain gardens were very effective in removing total suspended solids from the water. Data collected from 10 samples indicated that an average of 69 percent of the total suspended solids was removed as the water passed through the gardens. These results demonstrate that the modified rain gardens have potential as a best management practice for controlling and reducing stormwater pollutant discharges to receiving bodies of water.

**Approximate Cost** \$14,000

**OPERA Funding** \$8,000

**Implementation** The city plans to continue implementing this modified rain garden design where feasible. Additional research should also be completed to further quantify the potential benefits of these rain gardens.

**Status** Complete

# Minnetonka “Winter Green” Initiative

**Project Number** 2010-09

**Project Leader** Tom Struve

**Agency** City of Minnetonka  
14600 Minnetonka Boulevard  
Minnetonka, MN 55345

**Phone** 952-988-8400



**Problem** Officials at Nine Mile Creek Watershed District notified the City of Minnetonka that it was exceeding its maximum chloride loading standards for Nine Mile Creek, which runs through the city.

**Solution** The City of Minnetonka began a “Winter Green” initiative. The initiative included an aggressive and comprehensive training program as well as the purchase and installation of upgraded equipment. The city’s goal was to achieve ongoing winter chemical reduction while maintaining safe roads and meeting citizen expectations.

**Procedure** The city implemented a training program that included presentations on snow and ice control by Kathy Shaefer, an instructor with the Minnesota Circuit Training and Assistance Program (CTAP); Kevin Bigalke with Nine Mile Creek Watershed; and Connie Fortin of Fortin Consulting. The city purchased and installed pre-wetting systems with wireless electronic monitoring capabilities and ground-oriented spreading equipment for all city vehicles performing winter maintenance in the watershed. The city also installed additional pre-wetting tanks, purchased a calibration scale, updated existing Force America 5100 controllers in city trucks, installed sending units, and installed software and a wireless receiving center at Minnetonka Public Works.

**Results** The initiative has been enormously successful to date. The Nine Mile Creek representatives set a target of 4.2 tons of salt per lane mile annually in the watershed. The city’s operators embraced the challenge and did very well in all phases of training. The new equipment allowed the city to aggressively pre-wet and carefully monitor application rates. The city also installed an electronic geofence around the Nine Mile Creek Watershed in Minnetonka to accurately track material usage for the year.

The total result for the winter of 2010–2011 was 7.033 tons per mile in the Nine Mile Creek Watershed. This achieves the goal set by the watershed considering that winter snow volume was approximately 180 percent of normal.

**Approximate Cost** \$35,000

**OPERA Funding** \$5,000

**Implementation** All aspects of this effort have been fully implemented by the city and continue to yield positive results.

**Status** Complete

# Advanced Deicing Product Testing

**Project Number** 2010-10

**Project Leader** Chad Hausmann

**Agency** McLeod County Highway Department  
830 East 11th Street  
Glencoe, MN 55336

**Phone** 320-484-4353



**Problem** Highway departments are constantly reviewing ways to reduce costs and minimize impacts to the environment caused by maintenance activities. A specific area often considered is the type of deicing material used in winter road maintenance.

**Solution** The McLeod County Highway Department tested the use of IceSlicer™ granular deicing material. The study aimed to determine if the material could reduce the point of melting, the amount of material needed, and the alkalinity of runoff.

**Procedure** IceSlicer™ was used on one county truck during several winter storms so its performance could be compared to that of traditional road salt. The department also planned to apply the material according to the manufacturer's recommendations for colder weather events that would benefit from the reduced melting temperature—up to 17 degrees lower, according to the product's claims. However, a lack of extreme cold weather prevented the county from completing that procedure.

**Results** The department found that the IceSlicer™ material allowed for reduced material usage—about half as much material was needed compared to traditional white salt. The department also found the cost to be comparable to salt when the reduced usage of material was factored in. The reduction in material use also allowed plow operators to remain on the road longer during snow events. The department estimated it could double the number of lane miles plowed before having to resupply trucks with material.

One challenge was the lack of a separate storage site, which the department found inconvenient. However, with the upcoming construction of a new maintenance shop, the department will have the opportunity to construct a separate bunker for storage. An additional issue was that the department had to haul the material itself rather than having it delivered. If there were a more efficient delivery system, the material would become more cost beneficial.

**Approximate Cost** \$5,000 plus hauling costs

**OPERA Funding** \$5,000

**Implementation** Once the construction of an additional storage facility is completed, the department plans to keep material on hand for colder temperature events. Because of the cost of hauling the material and other commitments, the department does not plan to completely replace white salt with the IceSlicer™ material.

**Status** Complete

# Installation and Early Performance of Mastic Patches on City Streets

**Project Number** 2010-12

**Project Leader** Larry Tschida

**Agency** City of Bloomington  
1800 West Old Shakopee Road  
Bloomington, MN 55431

**Phone** 952-563-8771



**Problem** The transition from winter to spring normally causes the formation of potholes and other distresses as streets and highways weaken and adjust to warmer conditions. At times, this seasonal deterioration can be so widespread that maintenance crews are required to give full-time attention to the problem. Patching with asphalt mix often continues—or is repeated—as the seasons pass from spring to fall.

**Solution** The City of Bloomington partnered with the City of Minnetonka to compare the performance of mastic products to that of traditional bituminous patching. In spring 2011, the cities collaborated on a field investigation of the installation and performance of two mastic patching materials along with standard patches that were applied at the same time.

**Procedure** The materials were used to repair distresses on Minnesota Drive and East Bloomington Freeway in Bloomington and on Williston Road in Minnetonka. In Bloomington, most repairs were made to potholes at random locations in the lanes. The overwhelming distress type in Minnetonka was deteriorated transverse cracking. After the materials were installed, maintenance crews provided user feedback on preparation and application. The field performance of the repairs was monitored and evaluated after four months, and the mastic materials were compared to the standard treatment used by each city agency.

**Results** Mastic products were very successful in restoring ride quality to deteriorated transverse cracks and potholes on a short-term basis, and results indicate that the ride benefits of mastics may improve with time in transverse cracks. Patches did not lose mastic material over the four-month period, but cover rock was lost and should be considered temporary. Mastic materials also exhibited a waterproofing advantage over conventional asphalt mixtures. The labor force for mastic installation was similar to that of asphalt patching, but the mastic materials required extra cure time to ensure no-track conditions.

**Approximate Cost** \$5,000

**OPERA Funding** \$5,000

**Implementation** Additional monitoring of the test sections is recommended to verify long-term ride and durability benefits. For now, the City of Bloomington has no plans to continue using mastic patching in normal street maintenance activities.

**Status** Complete

# Catch Basin Maintenance/Repair Trailer

**Project Number** 2010-14

**Project Leader** Troy Grossman

**Agency** City of Lakeville Streets Division  
20195 Holyoke Avenue  
Lakeville, MN 55044

**Phone** 952-985-2714



**Problem** The City of Lakeville Streets Division has rehabilitated many storm sewer structures and catch basins over the last few years. In order for crews to have everything they needed to complete the repairs at each job site, the necessary tools, materials, and equipment were loaded into two or three trucks.

**Solution** An existing 15,000-pound trailer was designed specifically for catch basin repairs and maintenance. All of the necessary equipment and materials are always readily available on the trailer when projects arise.

**Procedure** The city fitted an existing trailer with all of the equipment needed for catch basin repairs. The city had a service crane installed on the rear curb side of the trailer for easy access to the catch basin manhole, and it also purchased a cement mixer, water tank, and storage container for use on the trailer. City staff fabricated the steel and placed all equipment on the trailer.

**Results** The trailer has been in service for a short time, but the city has already recognized savings in several ways. When crews are required to complete a repair, it is as simple as connecting the trailer. Time spent in the shop loading and unloading tools, supplies, and materials is no longer an issue, allowing for time savings on both ends of each project. The trailer also allows for improved safety, with the crane and cement mixer installed on the curb side of the trailer to keep crews out of the traffic lane whenever possible.

The Streets Division uses a one-ton truck with a dump body to pull the trailer. When a project requiring the trailer arises, two staff members take the trailer to the job site. Before the trailer was available, it would require two or more trucks to transport all of the equipment to and from the site.

**Approximate Cost** \$7,600

**OPERA Funding** \$3,500

**Implementation** The trailer is designed for storm sewer catch basin maintenance and repairs, but its equipment and supplies also will make it an asset for sidewalk repairs, water main repairs, sanitary sewer casting adjustments, and curb repairs.

**Status** Complete

# Application of Replay® Agricultural Oil Seal and Preservation Agent

**Project Number** 2010-15

**Project Leader** John Olson

**Agency** City of Hutchinson  
111 Hassan Street Southeast  
Hutchinson, MN 55350

**Phone** 320-234-4219



**Problem** Sealing asphalt pavements typically requires the application of petroleum-based products, which can be harmful and inconvenient in areas with high volumes of pedestrian traffic.

**Solution** The City of Hutchinson used Replay®, an agricultural oil seal and preservation agent that contains no petroleum. It penetrates over 1 inch into the pavement surface, and polymers bond the top layer of asphalt together to seal the surface. It takes about 30 minutes to dry before traffic can resume use of the pavement.

**Procedure** The city applied the material with a truck-mounted sprayer after removing debris from the pavement surface. The city chose two test sections with different pavement conditions: an old trail with raveling and cracking and a relatively new driveway with only minor deterioration. The pavement was dry to the touch within 30 minutes after the application, and the material did not track onto other surfaces or stick to shoes or clothing. To evaluate the effectiveness of the material, the city poured water onto each asphalt surface before and after Replay® was applied.

**Results** After the application of Replay®, there was a significant difference in the way water behaved on the trail and driveway surfaces. Prior to the application, water tended to wick into the upper surface of the pavements, particularly on the older trail pavement. After the application, water ran off the paved surfaces at a higher rate of speed without wicking into the surface. Visual inspections also indicated that Replay® had sealed the top layer of asphalt. The cost of applying the material was generally comparable to the cost of applying a chip seal.

This was a highly successful application for both areas because they experience significant foot traffic during the summer. Unlike other sealants, Replay® did not become soft and sticky during hot weather periods.

**Approximate Cost** \$5,800

**OPERA Funding** \$5,800

**Implementation** Overall results indicate that it would be cost-effective for an agency to apply Replay® using its own equipment and staff, particularly if a long-term strategy of treating pavements with the material every five years were implemented.

**Status** Complete

# Past OPERA Projects

## 2010

### **Magnesium Chloride Dust Coating Evaluation**

Magnesium chloride was applied to a county road to help decrease material and maintenance costs. The application eliminated the need to apply a biennial resurfacing aggregate layer and reduced the need for blading operations in areas of light traffic.

### **City of Eagan Automated Vehicle Location**

Maintenance managers have historically been challenged to allocate and reallocate resources during winter snow and ice control operations. The City of Eagan equipped its winter vehicle fleet with automated vehicle location technology, allowing managers to observe real-time operations from any computer terminal and adjust resources immediately via telephone and radio communications.

### **Cushion Release Push Frame and Weight Transfer Kits**

One Cushion Release Push Frame and two Weight Transfer Kits were installed on snow blowing and lawn mowing equipment. The Push Frame assisted a tractor-mounted snow blower in continuously scraping the surface being cleared, and the Weight Transfer Kits permitted operators to increase traction by shifting weight to the drive wheels.

### **Brunswick Township Erosion Control Project**

When a tire fill was used to repair an old corduroy road, a silt fence was required between the construction area and a nearby swamp to prevent damage to the wetland. The stabilization fabric beneath the tire fill was extended to the construction limits and attached to stakes, forming a positive erosion control barrier.

### **Evaluation of Grader Front-Mounted Retriever Hitch**

A front-mounted retriever was used on gravel roads and bituminous roads with gravel shoulders, allowing one motor grader to perform reclaiming and blading operations in a single pass. The retriever offered better visibility and prevented most of the reclaimed material from being thrown too far onto the roadway surface.

### **U.S. National Grid Field Marker Prototyping**

The City of St. Paul investigated the methodology and equipment necessary to inexpensively mark infrastructure in the field with U.S. National Grid location data. A system for generating portable markers in the field and a marker-reading application for end users were developed, and smartphones were used to obtain grid locations and drive a printer to create field markers.

### **GPS/AVL Tracking and Mapping**

A low-cost, flexible alternative to traditional automated vehicle location systems was developed using Nokia N900 cellular phones, off-the-shelf Linux-based hardware, and open source tools. The system is designed to help medium and small communities track their mobile assets.

### **Ultra Guard Cart Test**

The Ultra Guard Cart, a handheld device that can paint a 6-inch retroreflective stripe on vertical surfaces, was used to paint guardrails on several types of curves. The cart was easy to use and adjust for

different types of barriers. Paint stripes applied by the cart have shown less vulnerability to damage.

## **2009**

### **Hot-Applied Asphalt as an Adhesive on Cold Longitudinal Asphalt Joints**

An asphalt joint adhesive was used as a sealant on cold longitudinal asphalt joints and at the interface of asphalt pavement and concrete curb and gutter. The joint adhesive is pliable and will allow movement to occur without breaking, unlike the more rigid tack material formerly used to seal these areas.

### **Asphalt Emulsion Full-Depth Reclamation and Granular-Base Stabilization on Urban Streets**

Several 7-ton streets scheduled for rehabilitation had their reclaimed road base stabilized with an asphalt emulsion to a depth of 4 inches. The emulsion provided added stiffness to the base section and allowed the depth of the new asphalt to be reduced from 3½ inches to 2 inches.

### **Blind Lake Chloride Research Project**

High concentrations of chlorides were identified in the Blind Lake basin in part due to pre-treated road salt leeching into the lake. To lessen the impacts of the chloride, the city used a “liquids only” anti-icing/deicing program in the area.

### **Blue Light Use for Traffic Enforcement**

Enforcement lights, which turn blue as traffic lights turn red, were installed at a number of intersections to help police officers observe violators more effectively and reduce right-angle intersection crashes caused by drivers running red lights.

### **Crack Sealing on Cupped Joints on Bituminous Pavements**

Extensive cupping at transverse cracks in bituminous pavements allows water intrusion and accelerates pavement deterioration. By using Bergman Companies Inc. Flex-Patch material and a fine aggregate cover to seal cupped transverse cracks and improve ride, the serviceable pavement life was extended without the more expensive mill and overlay.

### **Culvert Sediment Elimination**

Three culverts installed at the same elevation often became plugged during periods of low and normal water flow. The construction of a rock weir near the inlets of two of the culverts forced the water to pass through only one pipe during low- and normal-flow periods. This kept velocities high enough to minimize the collection of sediment.

### **Road Reclamation With and Without Emulsion**

Counties run into a dilemma when the bituminous surface of older roads reaches failure but there are not sufficient funds to rebuild the road. Goodhue County split a 6-mile road project with poor surface conditions into two segments to determine if using an emulsion to build strength down into the existing structure was a viable alternative to the existing rehabilitation procedure.

### **Evaluation of Rear-Vision Systems for Snowplows**

With a tandem snowplow, vision is very limited and several blind spots occur, particularly when the snowplow is backing up. Rear-vision cameras and LCD monitors were installed on snowplow trucks to determine if they would improve drivers’ ability to see directly behind the plows during snow or ice events.

## 2008

### **Evaluation of Paving Fabrics for Isolation of Bituminous Cracking**

Existing bituminous pavements require major seasonal maintenance for both thermal and distress crack repairs. Spun-glass paving fabric was used to preserve existing bituminous pavements by isolating the effects of heavy crack sealants and reflective cracking.

### **Low-Cost Base Stabilization**

To stretch limited road funds, county officials turned to full-depth reclamation to use the existing bituminous surface as additional base material. An insufficient amount of bituminous and base material, as well as limited road width for additional material, led to the use of a low-cost base stabilizer to strengthen the existing material.

### **Improvement of Water Quality in Storm Ponds**

The Minnesota Pollution Control Agency requires public road authorities and others to construct storm-water ponds as part of its National Pollutant Discharge Elimination System. Two windmills were installed on a berm adjacent to the pond in order to use wind energy at no cost as well as a direct drive compressor to provide the airflow and oxygen necessary to aerate the pond.

### **Seal Coating of a Gravel Road Hill**

The grade and curves on the Muhle Coulee Hill make it difficult to keep the surface smooth, so a seal coating was applied to the top half mile of the hill. Gravel was applied and then graded, and hot oil and chips were put down and rolled to a smooth surface.

### **QuickView Storm Sewer Camera**

The implementation of the National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit requires that owners of MS4 storm sewer systems inspect the systems for maintenance needs. The QuickView camera system allows a single person to view and examine the sewer system as well as record video and audio.

### **Road Material Recovery**

A loss of gravel and crushed rock from road surfaces and shoulders required the installation of a wing-mount retriever on the township road grader, which created smoother transactions and a safer roadway.

### **Mini Paver**

Longitudinal cracks along curb lines and centerline streams required crews to hand-patch certain areas in order to preserve the integrity of the bituminous surface. Using the Mini Paver more than doubles the amount of patching that can be completed in a day, and roads will remain in better condition longer.

### **Evaluation of Hot Beam Wiper Blades**

Windshield wipers become coated with ice during snowplow operations, causing poor visibility out of the windshield. Hot Beam wiper blades were installed on the front of snowplow trucks to keep ice from forming.

## 2007

### **Extending the Life of Bituminous Overlays**

Fiberglass mat TruPave was used prior to overlaying with new bituminous in order to prevent reflective cracking and provide a moisture barrier. A June 2006 inspection found that roadway sealed with TruPave averaged 36 cracks per 100 feet, while the control section averaged 79 cracks per 100 feet.

### **Recycled Tear-off Shingles Road Construction Demonstration**

The use of post-industrial recycled asphalt shingles (RAS) as a partial asphalt and aggregate supplement in hot-mix asphalt (HMA) has been specified by Mn/DOT, but more field experience was required to demonstrate the use of post-consumer RAS. Several HMA blends containing RAS scraps were tested near the Town of Hassan.

### **Millings for Gravel Road Stabilization**

Millings were added to Scott County roads that required expensive maintenance because of heavy traffic. The millings were a cheaper alternative that kept roadbeds sturdier as well as less dusty in dry weather and less slick in wet weather.

### **Pick Cutting Edges**

Straight cutting edges on washboard roads disturb more gravel than necessary. Pick cutting edges were used to comb the road top instead. Picked blades also helped remove snow in the winter and helped evenly spread caught-up vegetation on the roadside.

### **Frost Boil Correction**

Geo-Tec fabric was used to seal the road bed instead of rock or gravel in order to prevent frost boiling and other road defects.

## 2006

### **Windshield Wiper Deicer**

A pneumatic system was installed to remove ice and snow on plow windshield wipers from inside the cab, keeping drivers safe and warm. The system has since been implemented by several agencies and counties.

### **Concrete Pipe Tie Bars**

A tie-bar system on the exterior of concrete pipes allowed crews to positively tie sections of pipe together without having to go inside the pipes. It also prevents debris from being snagged inside the pipes.

### **Increasing the Capacity of Slab-Span Timber Bridges**

University of Minnesota research showed that increasing the number and size of spreader beams increased the capacity and performance of a slab-span timber bridge over Buffalo Creek to accommodate increased traffic and loads.

### **Pedestrian-Activated Solar Warning Flasher**

Flashing lights activated by pedestrians drew attention to a crosswalk in St. Paul and initially re-

duced conflict points at the intersection, but traffic behavior reverted after about three months, showing the devices have short-term effects on vehicle stopping actions.

### **DuraTherm Pavement Markings**

Ramsey County tested DuraTherm pavement markings at a highway intersection for durability, ease of installation, retroreflectivity, and cost.

## **2005**

### **Improved Effectiveness of Salt Brine as an Anti-icing and Prewetting Agent**

Mankato found that liquid corn salt as an additive to the salt brine solution applied to winter roads resulted in longer-lasting road treatments and reduced need for salting trucks during snow events.

### **Advanced Warning with Solar-Powered Flashers**

Kanabec County tested three different light-emitting diode (LED) flashers to alert drivers to controlled intersections down the road that they might otherwise not notice, especially at night or in inclement weather.

### **Dust Reduction and Stabilization of Gravel Roads**

Gravel roads under heavy use in Kanabec County were treated with a soil stabilization product that increased load capacity and durability while reducing dust.

### **Construction Project Process Automation**

Software and tablet personal computers used by Morrison County construction crews eliminated many duplications of information in the office and field, saving substantial time—in the case of engineering staff, reducing hours worked by almost half.

### **Cameras for Striping Truck**

The cameras on a Washington County striping truck were inadequate for outdoor use. Operators couldn't view monitors over the glare of sun and the system was susceptible to water leaks. Upgrading to cameras used on large agricultural equipment solved the problem, reducing operator strain and eliminating the retracing of lines.

### **Blower Attachment to Remove Grass Clippings From Gravel Roads**

A blower mounted to the front end of a Marshall County motor grader cleared gravel roads of grass clippings, which not only maintained the safety of the roads but also reduced the cost of replacing gravel that previously would have been discarded.

### **Rockville X-hesion Testing**

A dust-control product was used on Rockville roads to increase the load capacity and minimize dust, but failed to meet standards of success when tested on three roads.

### **New Road Preparation Technology Prior to Overlay**

A flexible slurry system tested on a one-mile section of road in McLeod County improved smoothness, durability, and cost-effectiveness, though the procedure was more expensive than traditional methods.

## **About OPERA**

The Minnesota Local Road Research Board's Local Operational Research Assistance Program, or the Local OPERA Program, helps to develop innovations in the construction and maintenance operations of local government transportation organizations.

The Local OPERA Program encourages maintenance employees from all cities and counties to get involved in operational or hands-on research. In particular, OPERA helps to develop your great ideas locally and share those ideas statewide.

The Local OPERA Program funds projects up to \$10,000. OPERA project selections are made as projects are submitted. OPERA-funded projects also may receive support from other sources, including cities, counties, suppliers, or manufacturers.

Projects are funded in two parts. The local agency is eligible for 80 percent of the total approved project cost when initial results are submitted. The remaining 20 percent will be paid upon submission of a final report.

### **Apply for OPERA funding**

To apply for OPERA funding or to hear more about the Local OPERA Program, please contact Mindy Carlson or Jim Grothaus with Minnesota LTAP, or visit us online at [www.mnltap.umn.edu/opera](http://www.mnltap.umn.edu/opera).

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