



2012 ANNUAL REPORT



OPERA

Local Operational Research Assistance Program

2012 Local Operational Research Assistance (OPERA) Program Annual Report

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MINNESOTA LTAP
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2012 OPERA: PUTTING CREATIVITY TO WORK

In 2012, the Local Operational Research Assistance (OPERA) Program continued to foster hands-on transportation research by cities and counties across Minnesota. Local agencies completed six OPERA-funded projects on topics ranging from snow and ice control products to gravel road aggregates.

Also in 2012, a mechanical linkage technology developed in part with funding from Local OPERA—the Cushion-Release Push Frame—got some use in the field, as well as some favorable press coverage. The push frame can be installed on snow blowers, front-end loaders, and other equipment to help “walk” over obstacles by absorbing the impact. It was used in St. Paul and Bloomington this winter, and it’s also been used in Chanhassen, Alexandria, and Sauk Center, as well as in Fargo, North Dakota, and on the U of M Duluth campus. An article about the technology ran in the Minneapolis *StarTribune* in December.



Cushion-Release Push Frame

If you would like to try your hand at inventing, consider applying for funding from the Local OPERA Program. Innovative research proposals related to timely, relevant transportation topics are always welcome. You may submit more than one proposal. To apply, complete and submit the project proposal form available on the OPERA website.

NATIONAL LTAP'S BUILD A BETTER MOUSETRAP COMPETITION

Repurposing used truck tires for wing-plow cutting edges. An under-vehicle washer. A snow pusher. These were the top entries in National LTAP's 2012 Build a Better Mousetrap Competition.

The purpose of the annual contest is to collect and disseminate real-world examples of best practices and tips from the field and assist in technology transfer. The competition shares innovative ideas from around the country with others who may benefit from different concepts and perspectives. An OPERA project—a catch basin maintenance/repair trailer from the City of Lakeville—was among last year's entries.

Annual booklets with all submissions from 2009 through 2012 are available on the LTAP/TTAP website: www.ltap.org/resources/mousetrap.php.

Evaluation of Deicing and Anti-Icing Technologies

Project Number 2010-02

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Problem The deicing and anti-icing of public roadways is an annual challenge for local road agencies. In light of increasing environmental concerns and decreasing budgets, it is essential for these local agencies to use methods that minimize chemical usage and decrease operational costs. At the same time, it is important to maintain the level of service expected by the traveling public.

Solution The City of Grand Rapids has implemented alternative technologies and procedures for deicing and anti-icing that have the potential to improve roadway maintenance and save operating costs. For several years, the city has used standard tailgate spreaders to apply deicing and anti-icing materials. More recently, the city purchased an Epoke bulk spreader. To assess the operational efficiency of these two technologies, the city compared their performance on two equivalent deicing routes.

Procedure The city identified three evaluation criteria for study and comparison between the two technologies: material usage, operational efficiency (time to complete the route), and roadway condition after deicing. When a deicing event occurred, the city deployed the Epoke and tailgate spreaders on two equivalent routes. Equipment operators recorded the amount of material used and the time required to complete each route. After the operations were completed, a pair of observers drove each route and numerically rated the condition of the roadway—without knowing which technology was used.

Results Overall results show that neither the Epoke technology nor the tailgate spreader had any advantage over the other. There was no statistically significant difference in material usage between the two technologies, and observer ratings reveal no significant difference in how well each technology deiced the routes. The data collected did suggest that the tailgate spreader was more efficient at completing a deicing route; however, that spreader serviced one route more frequently than the other. Therefore, the data may be a reflection of the difference in routes rather than operational efficiency.

Approximate Cost \$8,000

OPERA Funding \$4,000

Implementation Unfortunately, the city was unable to draw any significant conclusions from the initial research. Additional research could be beneficial, including projects that compare the technologies on non-residential streets, on longer test routes, or over longer time periods with more snow events.

Status Completed

View the complete project report online at www.mnltap.umn.edu/opera.

Snow and Ice Products for Bituminous Trails in Recreational and Critical Areas

Project Number 2010-06

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Problem The City of Waconia wanted to improve winter maintenance service delivery on segments of residential bituminous trails and sidewalks within the community. The city was specifically concerned about trail segments with limited snow storage and those that received no direct sunlight. Critical sidewalk segments were located in the city's Main Square Park and near public facilities.

Solution The city began treating these trail and sidewalk areas with anti-icing and deicing winter maintenance liquids. The project included the creation of an application unit as well as the use of a blending station for winter maintenance liquids. Overall, the project allowed the city to reduce material use and staff time and to eliminate trail closures and safety issues.

Procedure A 5600 Bobcat Tool Cat unit was equipped with a sprayer tank and electric pump to serve as the application unit. During the winter of 2010–2011, the city used the application unit to apply three different deicing/anti-icing products to trails and sidewalks. Maintenance staff gathered measurements of service areas and the amount of material applied. They also compared application costs to previous practices.

Results The city experienced excellent results by implementing liquid anti-icing/deicing practices on its trails and sidewalks. Staff time and efforts on snow removal were reduced, even with the season's extreme snowfall amounts. No trail closures occurred because of snow, and even compacted snow was easily removed from pretreated surfaces. The city also experienced improvement on trails covered with snow compacted by snowmobiles.

Using the Bobcat allowed staff to maintain a consistent ground speed of 5 miles per hour when applying materials, which helped to maintain consistent application rates. Material costs were reduced by 75 to 85 percent as a result of using the liquid products instead of the dry application materials previously used.

Approximate Cost \$16,264

OPERA Funding \$5,000

Implementation The city has added a second application unit dedicated to sidewalks, complete with a hand-held wand for spraying steps and offset entrances. In addition, Waconia maintenance staff are continuing to work with other city staff to improve winter maintenance activities on sidewalks. They are specifically focused on reducing application rates and promoting the use of liquid treatment materials.

Status Complete

View the complete project report online at www.mnltap.umn.edu/opera.

Sustainable Pavement Rehabilitation Using Thin Bonded Overlay Constructed with High Taconite Mix

Project Number 2010-13

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Problem Thin bonded overlay systems have become popular options for pavement preservation and rehabilitation. The City of Duluth has several streets that require functional and structural rehabilitation, and thin bonded overlays may be a viable alternative to traditional overlays for these projects. At the same time, large quantities of locally available taconite tailings, a mining byproduct, could be used to substitute the new mineral aggregate in hot-mix asphalt. However, no standard thin overlay mixes using taconite tailings have been developed or tested in the field.

Solution The City of Duluth constructed three roadway test sections to evaluate the performance of thin bonded overlay mixes containing taconite tailings. One section was constructed using a traditional overlay, and the other two were thin bonded overlay configurations constructed with a spray-paver. The test sections allowed the city to evaluate the thin wearing course and the performance of the new fine-graded asphalt concrete mixture, which contained a significant amount of taconite tailings.

Procedure Twenty-six mixes using taconite tailings were tested, three final mix alternatives were developed, and one was selected for use in the test section projects. The test sections were constructed in September 2012. Immediately following construction, field samples were collected for additional lab tests and to verify the in-place material properties. The test sections were later revisited for a visual survey, and the city plans to make routine follow-up visits.

Results Overall results indicate that the use of taconite tailings in fine-graded asphalt concrete mixtures is a viable option. Early performance has been promising, and continued monitoring is planned. In addition, material production of the taconite mix resulted in significant energy savings and a reduction in carbon dioxide emissions. Although the transportation and construction activities for the taconite mix have higher environmental costs, the overall costs of traditional mixes are still significantly higher.

Approximate Cost \$37,000

OPERA Funding \$10,000

Implementation Although this project only looked at the preliminary performance of the thin bonded wearing course of the mixes containing taconite tailings, the City of Duluth and the University of Minnesota Duluth will continue to monitor the test sections for several more years. Based on the field performance of the thin overlay sections, the city may consider using taconite mixes for future street improvement and rehabilitation projects.

Status Completed

View the complete project report online at www.mnltap.umn.edu/opera.

Interim Report: Development of Aggregate Loss Factors for Rural Gravel Roads

Project Number 2011-01

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Problem Itasca County manages a transportation system that includes 750 miles of gravel roads. Producing aggregate for these roads, placing the aggregate on the roads, and maintaining the aggregate surfacing can be a significant budgetary challenge. Itasca County's annual budget for aggregate production, placement, and maintenance is approximately \$2 million. In today's local government funding environment, county boards are requiring a more data-driven justification for such budgets. Unfortunately, there is no system available to help transportation departments build their aggregate budget requests.

Solution Itasca County began collecting field data to measure gravel loss caused by traffic and winter maintenance activities. The county plans to collect measurements on six different gravel road segments over the next four years. Each segment of road represents different combinations of three variables: traffic speed, roadway protection from the sun, and chloride. These generalized identifiers will help categorize road segments and identify gravel needs on a system-wide basis. After four years, the county will convert the field data collected at the roadway sites into "aggregate loss factors" that can be used to predict annual gravel needs for a variety of roadway characteristics.

Procedure In spring 2012, Itasca County maintenance crews placed 6 inches of new aggregate surfacing on all six gravel road sites. Two permanent control points were established at each site. A field survey was conducted at each site, and the information was used to create a digital terrain model. Each segment was surveyed once a month from May to October. Gravel samples taken from each site were also analyzed to determine material properties and beginning particle size percentages.

Results So far, study results are inconclusive because only one year of information has been collected. Additional data are needed to indicate strong trends.

Approximate Cost \$61,200

OPERA Funding \$8,200

Implementation The first year of data collection has been completed. In the second year of the study, procedures for collecting and analyzing data will be reviewed and revised. In spring 2013, Itasca County also plans to use field measurements to review the potential loss of gravel from snowplowing operations.

Status The first year of the four-year project has been completed.

View the complete project report online at www.mnltap.umn.edu/opera.

Greener Bituminous Pavements

Project Number 2011-02

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Problem Inflationary cost increases, including dramatic changes in the cost of asphalt and fuels, have doubled the cost of bituminous pavements in Lake County over the last 10 years. In addition, bituminous surfaces in the county are subject to premature wear because the aggregates available locally are soft.



Solution Lake County developed potential reclaimed asphalt pavement (RAP) mixes containing imported, high-quality aggregates that could be tested in a low-volume pavement project. These mixes allowed the county to reduce the amount of new asphalt needed while also using surplus RAP material available from local surface renewal projects. The addition of high-quality aggregates also provided a more durable bituminous surface.

Procedure The project team analyzed characteristics of typically available milled materials from local roads, locally available screened sand, Mesabi aggregate, and locally available fine aggregate material. The team then developed a wear and non-wear bituminous mix to be used on a half-mile segment of Marble-Kane Lake Road in Lake County. The non-wear mixture used 45 percent RAP, and the wear mixture used 40 percent RAP. Project partners included the University of Minnesota Duluth, the Minnesota Asphalt Pavers Association, and the Minnesota Department of Transportation.

Results Cost comparisons show that Lake County saved about 19 percent on the non-wear and 4 percent on the wear mixture by using high percentages of RAP. The material was easy to compact and met density requirements, and the results of visual project inspections were positive. Quality improvements resulting from the addition of Mesabi aggregate and locally available screened sand are hard to measure. However, the use of these two components together with the RAP and fine aggregate from a local gravel pit allow for a higher degree of quality control.

Approximate Cost \$154,000

OPERA Funding \$8,000

Implementation Follow-up lab testing will be conducted to determine crack susceptibility and mix characteristics. Field investigations will also continue to evaluate mix performance compared to adjoining standard bituminous pavements.

Status Complete

View the complete project report online at www.mnltap.umn.edu/opera.

Implementation of an Anti-Icing Calibration Unit

Project Number 2011-03

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Problem For the City of Golden Valley, protecting its watershed while effectively providing snow and ice control on its streets is an important priority. Ensuring the appropriate application of anti-icing materials is one way to accomplish this goal. However, the city's plow trucks did not have a method for accurately quantifying the application rate of materials on city streets.

Solution The city purchased an anti-icing calibration unit so its trucks could be calibrated for consistent salt and sand application. A goal of this consistent calibration was to reduce the city's material use, resulting in both a cost savings to the city and benefits to the watershed and surrounding environment.

Procedure After the calibration of the plow trucks, drivers recorded the start and end mileage and the amount of material spread every time a vehicle left the city shop. The information was combined for all plows to determine how much material was used during each snow event. The city then compared the amount of anti-icing material spread during the 2011–2012 season with the amount used during the 2010–2011 season.

Results Overall analysis results indicate that the calibration unit reduced the amount of material applied. Specifically, salt/sand usage in the 2011–2012 season was down 62 percent compared to the 2010–2011 season. However, there were approximately 50 percent fewer events in 2011–2012—the season was very warm and there was significantly less snow. Looking at individual events, the median deployment of sand/salt mixtures decreased 42.8 percent, suggesting that the calibration unit significantly decreased the amount of material deployed for a typical event. For salt-only applications, there was no significant change.

One challenge was that mileage information collected during the 2011–2012 season was estimated to exceed the actual distance over which material was applied. This is because plow routes do not start immediately upon leaving the city shop, and drivers do not apply material during the entire trip.

Approximate Cost \$3,200

OPERA Funding \$3,200

Implementation The City of Golden Valley will continue using the calibration unit to ensure appropriate anti-icing material application rates. To fully realize the benefits of the unit, the city will also continue to add automated vehicle locating systems on its plows and other anti-icing vehicles. This will allow the city to track more precisely when and where material is being applied.

Status Complete

View the complete project report online at www.mnltap.umn.edu/opera.

Skid Loader Bituminous Screed

Project Number 2012-03

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Problem Murray County was disappointed with the quality of its bituminous patching over large areas. Often, the patches had poor ride quality and uneven lane thickness. In addition, maintenance crews had to move large quantities of bituminous mix by hand when working on large patches. The county needed a better way to handle large, lane-width patching operations that would also improve the resulting ride quality.

Solution The county built a wide-screed skid loader attachment to bridge the patch over a wider area. The screed slides on hydraulically maneuverable skids that can be raised or lowered depending on the desired thickness of the patching material.

Procedure The screed attachment is used after the hot mix has been placed in the area to be patched. Murray County uses the attachment to level the patch area—first by making a few passes back and forth to rough out the bituminous mix and then completing a final pass to leave the area just high enough to compact. To achieve the desired thickness for each side of the screed attachment, separate operators independently control the hydraulic skids. The skid loader operator maintains the proper angle for the attachment as well as speed and direction.

Results Original findings indicated that the skids were too short to adequately support the weight of the screed, making it difficult to push. The county retrofitted the original skids with truck bumpers, resulting in longer, ski-like skids that carried the load more effectively. The new design prevented the screed from sinking into loose gravel or scuffing the warm, recently placed hot mix.

Overall, Murray County's patching quality improved greatly after the initial learning curve for screed attachment operation. The amount of needed physical labor has also been greatly reduced. The county has been able to place larger patches more effectively, and the resulting ride quality has improved.

Approximate Cost \$6,340

OPERA Funding \$4,000

Implementation Murray County used the screed attachment effectively for a few large patches in the fall of 2012, and it expects proficiency to increase with additional time and use.

Status Complete

View the complete project report online at www.mnltap.umn.edu/opera.

PAST OPERA PROJECTS

2011

Implementation of a Scale-Tec Calibration Scale

Olmsted County used a Scale-Tec Calibrator to correctly calibrate the amount of salt and sand being applied by its snowplows. By measuring the weight of the discharged material, the calibrator helped the county determine the appropriate settings for each spreader.

Taconite-Enhanced Pothole Repair Using Portable Microwave Technology

The University of Minnesota Duluth's Natural Resources Research Institute partnered with Anoka County and St. Louis County to test the repair of potholes and damaged pavement with mobile microwave technology.

Innovations in Microsurfacing Materials and Application Techniques

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.

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

The City of Zumbrota used laser-scanning technology to complete three-dimensional scanning and data processing of the Zumbrota Covered Bridge. The information was used to assemble a complete digital representation of the bridge and to generate a 1/100-scale three-dimensional replica.

CAD Drawing of a Simple Salter/Sander Chute

Washington County fabricated a simple salter/sander chute to facilitate more accurate and precise salt and sand placement on roadways. Accompanying CAD drawings were created to allow other agencies to easily fabricate, install, and adjust the salter/sander chute.

Rehabilitating/Upgrading Low-Volume Roads with Waste Shingles

Blue Earth County completed a gravel road stabilization project on a section of County State Aid Highway 48 using a blend of recycled asphalt shingles and recycled asphalt pavement. The county plans to observe the performance of the shingle mix for one to two years.

Stormwater Pollutant Removal in Rain Gardens

As part of a street reconstruction project, the City of Grand Rapids constructed modified rain gardens that discharge to the city's storm sewer system. Although not as large as traditional rain gardens, the modified gardens have potential as a best management practice for reducing stormwater pollutant discharge.

Minnetonka "Winter Green" Initiative

The City of Minnetonka began a "Winter Green" initiative after being notified that it was exceeding its maximum chloride loading standards by the Nine Mile Creek Watershed District. The initiative included an aggressive and comprehensive training program as well as the purchase and installation of upgraded equipment.

Advanced Deicing Product Testing

The McLeod County Highway Department tested the use of IceSlicer™ granular deicing material. The material allowed for reduced usage—about half as much material was needed compared to traditional white salt—at a comparable cost.

Installation and Early Performance of Mastic Patches on City Streets

The City of Bloomington partnered with the City of Minnetonka to compare the performance of mastic products to that of traditional bituminous patching. The materials were used to successfully repair potholes and transverse cracks.

Catch Basin Maintenance/Repair Trailer

The City of Lakeville Streets Division modified an existing trailer for use in catch basin repairs and maintenance. All the necessary equipment and materials are readily available, including a service crane and cement mixer installed directly on the trailer.

Application of Replay® Agricultural Oil Seal and Preservation Agent

The City of Hutchinson used Replay®, an agricultural oil seal and preservation agent that contains no petroleum, to seal two sections of asphalt pavement. Unlike other sealants, the treatment did not become sticky in hot weather, making it ideal for areas experiencing high volumes of pedestrian traffic during the summer.

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

The City of Eagan equipped its winter vehicle fleet with automated vehicle location technology, allowing managers to observe real-time snow removal 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 the 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.

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 smartphone-based system for generating portable markers in the field and a marker-reading application for end users was developed.

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 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 retro-reflective 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, and 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 3 ½ 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, minimizing the collection of sediment.

Road Reclamation With and Without Emulsion

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 and 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 MnDOT, 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. The material will be used in future road repairs.

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 and 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 reduced 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. Testing continues to determine if the markings outlast traditional epoxy treatments.

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.

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