



OPERA

Local Operational Research
Assistance Program

2005 Annual Report

2005 Local Operational Research Assistance (OPERA) Program Annual Report

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About OPERA

The Minnesota Local Road Research Board's newly established 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 monthly or 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 immediately eligible for reimbursement of actual purchases after the submission of itemized bills up to 80 percent of the total approved project cost. The remaining 20 percent is paid upon submission of a final report.

The *2005 Local OPERA Program Annual Report* is a compilation of FY05 projects by local government transportation organizations receiving OPERA support.

Apply for OPERA funding

Learn more about the Local OPERA Program and apply for OPERA funding online at www.mnltap.umn.edu/opera, or please contact:

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OPERA FY05 Projects



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

Project Title	Improved Effectiveness of Salt Brine as an Anti-icing and Prewetting Agent
Project Number	2003-01
Project Leader	Bernie Fasnacht, Street Division Foreman
Agency	City of Mankato P.O. Box 3368 Mankato, MN 56002
Phone	507-387-8648
Problem	Salt brine can be applied effectively only in temperatures higher than minus 5 degrees Fahrenheit and has a limited residual effect.
Solution	Lower the freezing point and increase the residual effect of salt brine by adding Liquid Corn Salt (LCS), a corn-based product of EnviroTech Services, Inc.
Procedure	<p>The city's existing salt brine inventory was mixed with LCS to create a 9-to-1 salt brine/LCS solution, which would be used to pretreat or deice designated city streets. No modifications were necessary to the application equipment, but new equipment was purchased to mix the solutions at the prescribed ratio. A rate of 40 gallons per lane mile (gplm) was used to pretreat streets, while a rate of 60 gplm was used to deice. Air temperature, surface temperature, precipitation, application rate, and results were recorded and analyzed on 41 nonconsecutive dates from November 2002 to December 2004.</p>
Results	<p>The salt brine/LCS solution consistently prevented snow from sticking to roads, it freeze-dried without creating slippery conditions when applied at lower temperatures, and it had longer lasting residual effects than a pure salt brine solution. As a deicing agent, the salt brine/LCS solution opened roads to salt trucks, making overall deicing operations more efficient. On three dates, the LCS treatment prevented a salting event, which typically requires three salt trucks to spread 65 tons of salt over the course of four hours, all at a cost of approximately \$3,600. Fasnacht invited Mn/DOT to compare the salt brine/LCS solution alongside magnesium chloride or potassium acetate as a basis for performance and cost/benefit analysis. He also recommended that more thorough records be kept with applications, including more road weather information systems (RWIS) information.</p>
Approximate Cost	\$11,745 (\$10,000 approved for project)
Implementation	The city of Mankato proposed to continue using a salt brine/LCS solution on its roads, provided the Marshall Truck Station with 800 gallons of the solution, and will treat a Blue Earth County bridge for one season.
Status	Completed



Advanced Warning with Solar-Powered Flashers

Project Title Advanced Warning With Solar-Powered Flashers
Project Number 2003-02

Project Leader Gregory A. Nikodym, P.E., County Engineer
Agency Kanabec County Highway Department
 903 E. Forest
 Mora, MN 55051

Phone 320-679-6300

Problem Kanabec County has experienced several vehicle accidents at rural intersections as a result of drivers' inattention to STOP and STOP AHEAD signage.

Solution Use solar-powered LED (light-emitting diode) flashers on STOP AHEAD signage on rural roads to get the attention of drivers that might otherwise ignore signage, especially under low-visibility conditions.

Procedure Three models of solar-powered LED flashers, varying in diameter and wattage, were mounted atop STOP AHEAD signage for a period of 8 to 10 months. Each model was placed at a separate intersection that had previously experienced accidents, and was measured for reliability and visibility under poor weather conditions (such as fog or rain) as indicators of effectiveness.

Results The two models with the larger diameters and higher wattages had the highest visibility of the three, and were considered effective means of drawing attention to the STOP AHEAD signage well before the sign itself was visible (see Table 1 for comparisons of the three LED flasher/solar panel setups). There was also positive public feedback for each of the units. All three setups tested provided additional assistance during nighttime hours, but only Models 106 and 160818 provided assistance under poor weather conditions. In these cases, the lights were visible during poor weather conditions before the signs could be read. Nikodym said that it appears that Model 106 (K & K Systems) and Model 160818 (OKSolar) may provide additional assistance in warning motorists of approaching intersections during times of inclement weather, and that Model 106 would be most cost-effective.



Table 1

	Model 134	Model 106	Model 160818
Intersection	CSAH 2 at TH 65	CSAH 6 at TH 47	CSAH 3 at TH 65
Flasher Diameter (inches)	7	8	12
Solar Panel Power (watts)	10	50	110
Visibility (miles)	0.2	1	2
Cost (per unit)	\$475	\$1,275	\$2,175

Approximate Cost \$6,744 (\$4,900 approved for project)

Implementation The three test units will remain at their intersections within Kanabec County, and more will be put up in the future, though the number and locations have yet to be decided.

Status Completed

Dust Reduction and Stabilization of Gravel Roads

Project Title	Dust Reduction and Stabilization of Gravel Roads
Project Number	2003-05
Project Leader	Gregory A. Nikodym, P.E., County Engineer
Agency	Kanabec County Highway Department 903 E. Forest Mora, MN 55051
Phone	320-679-6300
Problem	Kanabec County has several gravel roads providing access to gravel pits throughout the county. The dust and damage from repeated loads is a concern to the residents along these roads. In addition, the cost to maintain these roads continues to increase.
Solution	Apply Base One, a soil stabilization product developed by TEAM Laboratory Chemical Corp., to aggregate surface roads.
Procedure	A 2.6-mile segment of gravel county road, with 4 to 6 inches of existing Class 5 aggregate, was widened and shaped. An additional 3 inches of modified Class 5 with a clay content of approximately 15 percent were added to the road segment. This material was placed in a wind row and compacted in three equal layers. The recommended amount of Base One chemical was added between layers. A final surface application of the chemical was applied before final compaction. The road surface was analyzed three times by Braun Intertec—once before compaction, once after compaction, and once after the spring thaw.
Results	Deflection testing and analysis conducted by Braun Intertec indicated a significant increase in load capacity as a result of the application. The amount of dust from traffic was greatly reduced, but not eliminated. There was also a significant reduction of maintenance needed after the application.
Approximate Cost	\$13,780 (\$4,900 approved for project)
Implementation	Base One has been used on an additional six miles of road in Kanabec County, more for soil stabilization than dust control.
Status	Completed



Construction Project Process Automation

Project Title Construction Project Process Automation
Project Number 2003-07

Project Leader Steven C. Backowski, Director of Public Works
Agency Morrison County Highway Department
213 S.E. 1st Avenue
Little Falls, MN 56345

Phone 320-632-0120

Problem Many stages of construction involve duplication and redundancies of information in the office and in the field. All this paperwork can lead to errors, lost time, and additional costs on projects, as well as being difficult to manage, archive, and retrieve.

Solution Use the One Office software, developed by RTVision for Morrison County to eliminate redundancies, provide mobility, provide integration with accounting, reduce administrative project time, and reduce paper and related costs (printers, ink cartridges, file cabinets and folders, and storage space). One Office is a Web-based software package that operates on a personal computer, server, or tablet PC. A central database contains all the information linked to a particular project that can be retrieved in the office or on-site. By automating the project management process, the engineering technician can control all aspects of the project with the use of the tablet PC, including completion of inspection forms, weekly diaries, or other field documents.



Procedure RTVision provided software and tablet personal computers (three Xplore iX104s) to Morrison County engineering technicians. RTVision also provided office and field software training to the engineering staff. The software was tested against project management paperwork during a 20-week reconstruction of a four-mile segment of CSAH 24. For a two-week period (one week for each method), engineering staff tracked their time performing project tasks such as field inspection and funding management. The time required of each method was then extrapolated over the entire project duration.

Results The data show that the use of One Office software saves substantial time by eliminating redundant data re-entry. During the trial period, the engineering staff's time spent documenting the project by both methods was comparable, but the time saved by not having to re-enter information was notable. Engineering staff spent 80 hours (38 of field inspection, 42 of funding management) entering data using traditional methods, while tasks using the software took only 42 hours (10 of field inspection, 32 of funding management). Support staff spent less time on projects, as did accountants. Overall, everyone viewed the software as increasing efficiency.

Approximate Cost \$9,600 (\$8,500 approved for project)

Implementation The Morrison County Highway Department now uses One Office to manage all of its construction work.

Status Completed

Cameras for Striping Truck

Project Title	Cameras for Striping Truck
Project Number	2004-03
Project Leader	Wayne Sandberg, P.E., Deputy Director
Agency	Washington County Department of Transportation and Physical Development 11660 Myeron Road N. Stillwater, MN 55082
Phone	651-430-4339
Problem	Washington County uses cameras on a long line-striper truck to view paint and glass beads applied to the county road in real time during striping operations. Two cameras are mounted on each side of the back of the truck. One camera is mounted above the paint guns to monitor paint flow and to help stay on the line when tracing over existing latex paint lines. The second camera is mounted behind the bead guns to watch the glass bead application. The camera system is not suited for outdoor use—the cameras don't provide a viewable image in direct or bright sunlight, they aren't waterproof (condensation took up to three days to evaporate), and they aren't infrared for low-light conditions. The monitors are too small to view paint and glass bead applications all day, and the video cuts in and out due to truck vibrations.
Solution	Install an AgCam system on the truck. The AgCam is designed for outdoor use with equipment such as combines, tractors, trucks, barns, and outbuildings. The system features automatic infrared illuminators, a waterproof aluminum housing, and 7.2-inch LCD color monitors.
Procedure	The system was demonstrated to staff and temporarily installed on the striping truck for proper operation. Installation of the AgCam system took two days. One camera had to be moved once to a better location and longer cables were added to complete the project. The truck was used over the summer of 2004 by department staff, and time spent restriping lines that were not properly applied was compared to the previous year.
Results	The cameras and monitors were of great value to the striping operation. Records from previous summers show restriping was necessary for several lane miles of roads with little or no reflectivity. In 2004, however, the operator was able to detect glass bead flow in any light condition, and no lines had to be retraced during striping season. The time, material, and labor saved was a quantified benefit to Washington County. To date, there have been no problems with the system. It is durable and can handle constant jarring and abuse in all weather conditions.
Approximate Cost	\$4,000 (\$4,000 approved for project)
Implementation	Three more cameras were installed on the truck in 2005—two to monitor center and edge lines while operating, and one to provide a rear view when backing up. Neighboring Ramsey County has also purchased a similar camera system for its long line-striper truck. The camera system is available for agencies to purchase.
Status	Completed



Blower Attachment to Remove Grass Clippings From Gravel Roads

Project Title Blower Attachment to Remove Grass Clippings From Gravel Roads
Project Number 2004-04

Project Leader Jeffery J. Langan, County Engineer
Agency Marshall County Highway Department
447 S. Main
Warren, MN 56762

Phone 218-745-4361

Problem Many farmers are paid to maintain the land adjacent to county or township roads. This job may involve mowing the roadside grass planted to increase wildlife habitat and minimize erosion. Since many farmers use their own equipment to mow along roads, the arrangement is a financial benefit for taxpayers. As a result of farmers' mowing methods, however, grass clippings are constantly thrown on top of the gravel road surface. These clippings mix into the gravel material and create large piles during summer maintenance road blading, which must then be spread in road ditches, effectively wasting many tons of gravel. If they are not spread, they pose a threat to drivers and mower operators in the future.



Solution A blower attachment on the front end of a motor grader can blow the grass clippings off the gravel surface and out of the way of the moldboard, preventing clippings from mixing with the gravel.

Procedure Three blower attachment assemblies were built and mounted on the front end of a motor grader: two for standard front hitches and one for a para-lift (quick hitch) attachment. The frame, front hydraulic cylinder, and hydraulic system of the motor grader were used for the blowers, the housings of which were salvaged from grain-bin blower assemblies. After a month of use on five different motor graders, necessary modifications were made and the blowers were used for another trial month.

Results After the first month, the blowers needed a few key modifications—the standard hitch attachment was redesigned to allow full lifting capabilities, the quick coupler attachments were replaced to prevent the hydraulic oil from overheating, and a plywood chute was attached at the discharge opening to better direct the blowing air to the desired location. Following these modifications, the blower proved to be an effective tool for removing grass clippings from gravel roads at a cost less than replacing gravel that mixes with clippings. The blower also increases driver safety, by keeping clipping piles off the road surface.

Approximate Cost \$4,785 (\$4,000 approved for project)

Implementation Marshall County plans to fabricate six additional blowers to equip its entire motor grader fleet. Additionally, townships in Marshall and neighboring counties purchased four blowers from Marshall County for their own gravel road maintenance activities.

Status Completed

Rockville X-hesion Testing

Project Title Rockville X-hesion Testing
Project Number 2004-05

Project Leader Greg Stang, Director of Public Works
Agency City of Rockville
P.O. Box 93
209 Broadway Street East
Rockville, MN 56369

Phone 320-250-2601

Problem Rockville has had problems keeping gravel roads smooth and dust free, most noticeably in areas with high traffic volume and extremely heavy (weighing 100 tons or more) loaders and granite-hauling trucks.

Solution Use a new dust-control product called X-hesion, manufactured by Envirotech. X-hesion is an environmentally sensitive, non-corrosive, non-chloride product that promises to increase load-bearing capacities and reduce dust on gravel roads at a cost-effective price. If X-hesion functions as advertised, the city would decrease maintenance costs of road blading and adding gravel, as well as increase the roads' safety by greatly reducing dust and washboarding, when ridges perpendicular to the direction of travel form on dry gravel roads.

Procedure In 2004, approximately five miles of Rockville's gravel roads were treated for dust-control. The traditional method of applying magnesium chloride was used on 3.5 miles of those roads, and the remaining 1.5 miles were treated with X-hesion. All roads were prewetted before application to standardize conditions. Three test roads (Rausch Lake Road, Agate Beach Road, and 205th Street) were treated with X-hesion as directed by Envirotech. Road conditions and maintenance projects were recorded and total costs were compared at the end of the test period.

Results Of the three roads where X-hesion was tested, *none* met the expected standards of success. Rausch Lake Road, the heaviest traveled of the three, was dusty within two days and required blading after a month. Agate Beach Road saw washboarding within two weeks but was not as dusty as the other roads. 205th Street needed blading less often than when treated with magnesium chloride, but still did not meet the standards for a successful application. As a result of the experiment, however, the roads treated with magnesium chloride were in better shape than in previous years.

Approximate Cost \$6,000 (\$8,400 approved for project)

Implementation None at this time

Status Completed



New Road Preparation Technology Prior to Overlay

Project Title Investigation of a New Road Preparation Technology Prior to Overlay

Project Number 2004-06

Project Leader John Brunkhorst, P.E., County Engineer

Agency McLeod County Highway Department
2397 Hennepin Avenue
Glencoe, MN 55336

Phone 320-864-3156

Problem Maintenance of asphalt pavement is performed by using a hot-mix asphalt (HMA) overlay to fill in surface cracks and ruts. One method, which is labor intensive, is to hand-patch with patching materials consisting of a fine (sand) mix. Another method is to apply a fine mix by spreading material on the road surface and “tight blading” the material into the recessed joints, cracks, and ruts. But tight blading prior to overlay can cause bumps over the crack sealant, an indication that the material being placed is cooling rapidly and has developed poor density. A viable but costly alternative is to mill the surface, which removes a portion of the surfacing and levels it prior to paving. A new product or process is needed to improve smoothness, durability, and cost-effectiveness.

Solution A “flexible slurry system,” a microsurfacing fluid product that is placed at ambient temperatures and has the capacity to fill in low spots, cracks, joints, and ruts, should be developed and used. Microsurfacing is a common treatment for minor rut filling, but its primary purpose is to provide durability. In this function, it is a quick-setting, brittle material that stands up to traffic. By using the technology of microsurfacing—but modifying its properties to provide a much more pliable material—it is possible to address the concerns of surface preparation. When used as an inter-layer material, this product could also be placed at a relatively high binder content, since there is no concern of bleeding. Further refinements to the conventional process would be to provide longitudinal leveling and adjust the spreader box to allow for better displacement of the slurry material in the depressed areas. Hand-patching would no longer be required, and since the profile has been restored and the crack sealant covered, there would be no need to mill the surface prior to overlay. Other possible uses include mitigating faulted or distressed joints, as a scratch course on a conventional microsurfacing project, addressing reflective cracking, or surfacing low-volume roads or asphalt shoulders.

Procedure To determine the feasibility of the flexible slurry system, a one-mile section of the new road preparation process was placed in September of 2004. The test section was placed on McLeod County Road 15 along with test sections using traditional tight blading and no preparation at all. The overlay consisted of a 1.5-inch conventional HMA. Constructability was monitored during placement operations. The placement process uses conventional micro-surfacing equipment and did not require any special procedures. Ride measurements were taken after the overlay was placed, and cracks were mapped prior to the operation.

Results Based on this preliminary trial, it was determined that this technology has increased smoothness and durability over traditional methods. While more expensive, the flexible slurry system is feasible, and further refinements should be explored.

Approximate Cost \$10,000 approved for project

Implementation Further trials will be carried out in the 2005 construction season to implement these improvements. \$17,000 has been granted by the Federal Highway Administration for additional work and follow-up research in 2005.

Status Completed



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