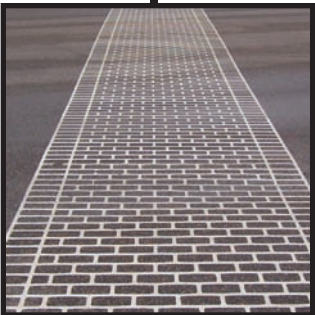


OPERA

Local Operational Research Assistance Program



2006 Annual Report

2006 Local Operational Research Assistance (OPERA) Program Annual Report

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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 monthly or as projects are submitted. OPERA-funded projects also may receive support from other sources, including cities, counties, suppliers, or manufacturers.

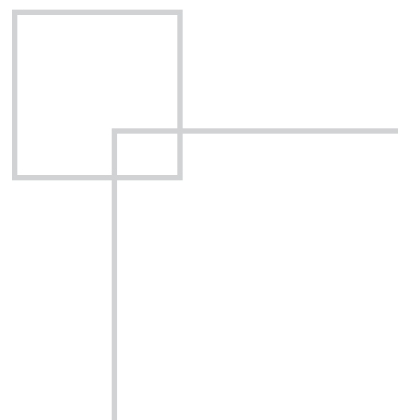
Projects are funded in two parts. The local agency is immediately eligible for reimbursement of actual purchases after the submission of itemized bills up to 80 percent of the total approved project cost. The remaining 20 percent will be paid upon submission of a final report.

This report is a compilation of projects completed during the past year by local government transportation organizations receiving OPERA support.

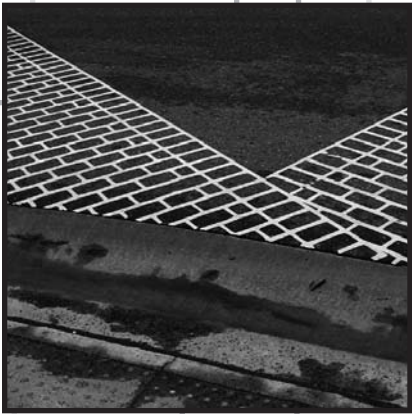
Apply for OPERA funding

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

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Local OPERA Program Projects



Windshield Wiper Deicer

Project Title Windshield Wiper Deicer
Project Number 2003-03
Project Leader Brad Thielsen, Plant Equipment Mechanic
Agency City of Hutchinson
111 Hassan Street S.E.
Hutchinson, MN 55350
Phone 320-234-4219



Problem During snow removal operations, snow and ice often accumulate near the bottom of snowplow windshields and on wiper blades, reducing wiper effectiveness. From time to time, drivers have to stop to manually remove the accumulated snow and ice from the windshield wipers. This is done typically during inclement weather and the vehicle body is often slippery, making the climb up to the windshield not only inconvenient but hazardous.

Solution Using the vehicle air system, air cylinders were mounted on the wiper arms. A button control was installed in the vehicle cab. By pushing the button, the air cylinders retract the wiper arms about 6 inches from the windshield. When the button is released, the wiper arm quickly slaps back to the windshield, driven by both the wiper arm spring and the cylinder return spring. This quick slap of the wiper arm often removes the accumulated snow and ice, making the wipers effective again and eliminating the need to stop the vehicle and climb to remove the accumulated snow and ice.

Procedure Based on the design of the wiper arms on individual vehicles, an appropriate-sized air cylinder was mounted on each wiper arm. Each wiper arm type required individual design features, including brackets, the size of the cylinder, and installation of air lines. Controls were installed in the cab in a convenient, yet out-of-the-way, location. In cases where vehicles did not have an on-board air system, an air tank was mounted on the vehicle. The air tank is charged prior to plowing and provides enough air for a typical plowing event.

Results For vehicles with bolted-down wiper arms, the system works very well, with little maintenance. It is necessary to add air-tool oil to the cylinders a couple times per year. For vehicles with quick-release wiper arms (e.g., Sterling trucks), there have been some problems. Under heavy snow conditions, operation of the device can cause strain on the wiper motor, drive arm, locking device, and wiper arm splines. Immediately after the first installations and use of these devices, vehicle operators requested these devices. The devices were installed on additional vehicles with success. The city's fleet of snow equipment is largely outfitted with these devices and operators now take them for granted as part of their equipment.

Approximate Cost \$350–\$450 per truck (\$1,800 approved for the project)

Implementation City of Hutchinson, McLeod County, City of Pipestone, Mn/DOT-Hutchinson, Mn/DOT-North Branch, Mn/DOT-Pipestone, and several other agencies have adopted this technology to their benefit.

Status Completed

Concrete Pipe Tie Bars

Project Title Concrete Pipe Tie Bars
Project Number 2003-06
Project Leader Wayne Sandberg, P.E., Deputy Director
Agency Washington County Department of Transportation
11660 Myeron Road N.
Stillwater, MN 55082
Phone 651-430-4339



Problem In August 2001, highway crews were replacing failed culverts with 24-inch reinforced concrete pipes. These pipes were of the gasketed-bell-end type, typically supplied in 6- to 8-foot sections plus a flared end apron at the exposed ends. The sections needed to be positively tied together to prevent separation and the subsequent infiltration of embankment soil through the separated joints. Several small concrete pipes with conventional tie bars have pulled apart in the past. Currently available tie bolts are basically a bent rod thrust through the tie bolt hole in the pipe and tightened by a single nut from one side through a welded sleeve on the other inside the pipe. A positive tie can only be achieved if a nut and washer are installed from within the pipe after it is placed in the trench. OSHA rules do not allow a person to enter a pipe smaller than 30 inches in diameter. As a result, a small pipe can't be positively tied together with currently available systems. These systems are also problematic on pipes with high flows or used as underpasses, since the nut and tie bolt intrude into the barrel of the pipe and can snag objects or people passing through.

Solution Fabricate a new tie bar system that positively ties the section together from the outside of the pipe

Procedure Use a bolt and washer of sufficient diameter and length to pass through the pipe wall, inserted from the inside of the pipe and screwed into a rectangular or square section of tubing (stand-off) placed on the outside of the pipe, prior to placement in the trench. There are four stand-offs per section of pipe, except for aprons, which have two stand-offs. The stand-offs are connected by a rod, which may be a continuous or partially threaded rod with a nut on each end or a long bolt with threads on one end. At the stand-offs, integral or separate large washers and one or two nuts, depending on the type of rod used, are tightened to draw the sections tightly together for a permanent seal. The stand-offs can also be used to lift and set the pipe sections in place. Washington County maintenance fabricated 100 of these new stand-off style tie bars and tested them on concrete pipes that were being replaced.

Results The pipes tied with the new style of bars did not move or come loose, and maintenance crews found them easier to use. Holes must be drilled in the pipes prior to installation in cases when there are not holes to anchor the tie bars. Halla Industries of Sleepy Eye, Minnesota, can manufacture the tie bars at lower cost than in-house fabrication (about \$17 per tie bar, including bolts, washers, and a cadmium plating treatment).

Approximate Cost \$1,500 (\$1,500 approved for project)

Implementation The stand-off tie bars are in use in Washington County.

Status Completed

Increasing the Capacity of Slab-Span Timber Bridges

Project Title Increasing the Capacity of Slab-Span Timber Bridges

Project Number 2003-08

Project Leader Wayne Fingalson, P.E.

Agency Wright County Department of Highways
1901 Highway 25 N.
Buffalo, MN 55313

Phone 763-662-7388



Problem Owners of the approximately 1,300 treated timber bridges in Minnesota are looking for inexpensive and easy ways to increase the load capacity and serviceability of existing timber bridges to accommodate both the increased number and size of vehicles now depending on local road systems.

Solution Apply University of Minnesota research analyzing the relationship between load distribution and the transverse stiffness of longitudinal slab-span timber deck systems

Procedure On bridge 86511 (CSAH 12 over Buffalo Creek in Marysville Township), existing mid-span spreader beams were relocated to the quarter-points of the respective spans, and then larger spreader beams were installed at the center point of the spans, as well as a spreader beam at the other quarter-point of each span. The bridge was resurfaced and crack control joints were sawed at each support.

Results Increasing the number and size of spreader beams increased bridge capacity and performance, resulting in an inventory rating increase.

Approximate Cost \$24,400 (\$10,000 approved for project)

Implementation No plans to use currently, but will consider use of technology as bridges need improvement

Status Completed

Pedestrian-Activated Solar Warning Flasher

Project Title Pedestrian-Activated Solar Warning Flasher

Project Number 2003-09

Project Leader Paul St. Martin, P.E.

Agencies Mn/DOT, City of St. Paul

Phone 651-266-6118



Problem New technologies are available to address pedestrian safety. This project evaluated the use and reliability of a pedestrian-activated solar-powered warning flasher under Minnesota’s highly variable climate.

Solution Install and evaluate a solar-powered, wireless pedestrian-activated flasher system (Carmanah R820 solar-powered LED beacon). The two units on both sides of Rice Street and one in the center median coordinate via a wireless radio frequency transmitter. The intensity of the LED flasher peaks at 800 candela in daylight and 400 candela at night. The flashing rate is between 50 and 60 flashes per minute in a “bouncing ball” effect. It can operate at least 30 days between solar charges. The manufacturer’s recommended maintenance is every five years (except for rechargeable battery pack replacement).

Procedure The system was installed in St. Paul at an east-west pedestrian crosswalk on Rice Street, south of University Avenue: one flasher on each side of the street and one in the median. The system flashers are activated by a push button on either end of the crosswalk. Mn/DOT then collected crossing data, including traffic speeds and stopping rates, push-button use rates, and surveys.

Results Based on the observation data, the maximum pedestrian queue was reduced after the flasher installation for both the transition phase and the after-study phase. As a result, conflict points at the crosswalk were reduced. Pedestrian flashers have impacts on driver reactions immediately (within two weeks) after the device’s installation. However, three months later, the percentage of vehicles stopping for pedestrians returned to levels similar to those prior to the flasher installation. Flashers seem to have a very short-term impact on vehicular stopping actions. Based on the observation, pedestrian safety education is highly recommended, including device and safe-crossing education. Use a confirmation light to communicate with the pedestrian when the push button has activated the flashers. Flash timing can be shortened (this project’s timing was 30 seconds). Additional signage could help to clarify how to use flashers.

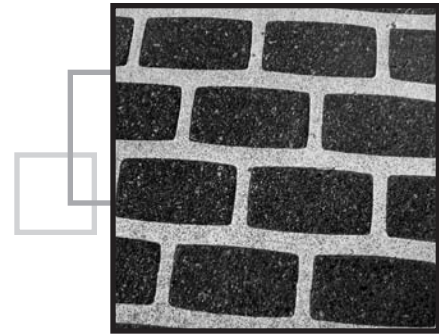
Approximate Cost \$17,000 (\$10,000 approved for project)

Implementation The system will stay in place on Rice Street.

Status Completed

DuraTherm Pavement Markings

Project Title DuraTherm Pavement Markings
Project Number 2004-07
Project Leader Daniel Soler, Traffic Engineer, P.E.
Agency Ramsey County Public Works Department
1425 Paul Kirkwold Drive
Arden Hills, MN 55112
Phone 651-266-7114



Problem Pavement markings at urban intersections experience a high degree of wear. Constant turning movements as well as increased levels of salt and sand applications in the winter months contribute to this wear. Current uses of latex paint, epoxy, and durable tape have varying levels of success on bituminous pavements.

Solution DuraTherm is a preformed thermoplastic pavement marking for crosswalks, inlaid into bituminous pavement. It can be installed in several decorative designs, including an offset brick pattern. The purpose of this test was to investigate the installation methods, impacts to pavement surface, durability, retro-reflectivity, wear, and cost.

Procedure Driveway Design installed DuraTherm crosswalks in October 2004 at the intersection of Old Highway 8 and Fifth Avenue in New Brighton (a T-intersection of two county roadways). The intersection had been realigned and paved, and a traffic signal was installed. All three approaches to the intersection included pedestrian crosswalks. Offset brick pattern DuraTherm crosswalks were installed on the new bituminous pavement. New pavement isn't needed for installation, but the pavement must be in relatively good condition without any existing pavement markings.

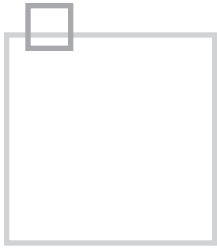
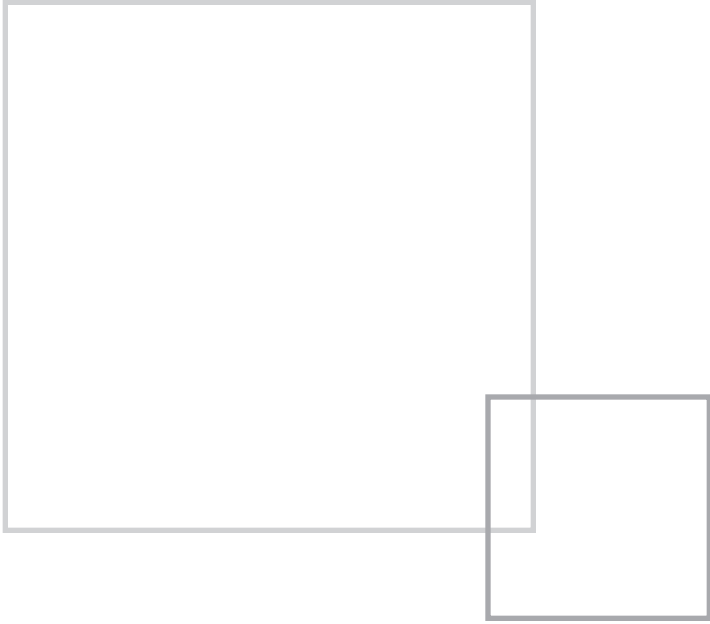
DuraTherm was installed by impressing a pattern template into the bituminous pavement using a StreetHeat SR-60 pavement reheater, preventing the bituminous from overheating. The DuraTherm thermoplastic material was then placed into the inlay and heated to melt into the pavement. The installation process runs smoothly with little mess. Similar to other materials, DuraTherm installation may be done in sections, allowing the intersection to remain open to traffic. The installation time is much longer than that of other materials: all three legs of the intersection required about eight hours to complete. Weather conditions have effects on installation similar to other materials. The impacts of the installation on the bituminous pavement were minimal. The heating of the template and material left a clean, tight fit in the bituminous pavement.

Results Ramsey County added DuraTherm as an option on its list of pavement marking materials. While the high cost makes it prohibitive as a choice for installation at most intersections, the aesthetic abilities make it a good choice in specialty situations: part of a larger streetscape project to provide a different look. The markings were in good condition after a one-year period consisting of a full maintenance cycle (including snowplowing). The color remains bright white and the crosswalks have maintained their reflectivity. The pavement surface was not measurably impacted after the installation of the markings. After a year, the pavement was still in good shape, without chipped or deteriorated edges or loose joints between the bituminous and DuraTherm marking. Agencies should determine whether the brick pattern in this test case meets the definition of a crosswalk per the *Minnesota Manual on Uniform Traffic Control Devices*, as more and more agencies are looking to use pavement markings as part of their larger streetscaping projects. Also, the longevity of DuraTherm must be compared to less-expensive options, such as epoxy crosswalks. Ramsey County's experience with epoxy crosswalks assumes a three-year lifespan at a signalized intersection. The DuraTherm markings, with a cost of five times that of epoxy, would need to last significantly longer.

Approximate Cost \$7,300 (\$7,300 approved for project)

Implementation DuraTherm crosswalks were also installed at the intersection of County Road I and Lexington Avenue in Shoreview, and neighboring agencies have expressed interest in DuraTherm.

Status Completed



UNIVERSITY OF MINNESOTA
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MINNESOTA LOCAL TECHNICAL ASSISTANCE PROGRAM

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