



OPERA

INNOVATION AT WORK:
2009 ANNUAL REPORT

2009 Local Operational Research Assistance (OPERA) Program Annual Report

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Introduction

Innovation at Work: OPERA 2009 Annual Report

In 2007, Burnsville officials realized the city had a problem with drivers running red lights. They wanted to try a new technology already in use in Florida to help with enforcement.

The city turned to the Local Operational Research Assistance (OPERA) Program for seed money to help test the “blue” confirmation light technology.

“We had to do a lot of experimenting,” said engineering assistant Bonnie Buck. “What worked in Florida didn’t work here. It’s colder here, the light didn’t respond real well.”

Burnsville’s blue-light test was one of nine OPERA projects completed in 2008. OPERA’s goal is to allow cities and counties to get involved in their own road research.

Recent projects run the gamut from crack and joint sealing, to rural and suburban road rehabilitation, to safer ways to plow streets to more environmentally friendly deicers. Driver safety and less expensive road rehab options were the top priorities of cities and counties that wrapped up recent OPERA projects.

“You’re always trying to do more with less,” said Shoreview assistant city engineer Tom Wesolowski.

Wesolowski wrapped up two OPERA projects in 2008. In the first, engineers tested an asphalt joint adhesive to help seal cracks between asphalt pavement and concrete curbs. In the second, the city added an asphalt emulsion to remilled road materials to provide added stiffness to the base and reduce the amount of asphalt needed to rehab the road.

The emulsion project was so successful, it may become the standard for the city’s bituminous rehab projects, Wesolowski said.

Goodhue County tested a similar emulsion to rehab a rural road with a narrow shoulder. The county split a 6-mile stretch of road and compared two methods: one used an emulsion and less asphalt, the other added more asphalt to build strength into the road.

The county used OPERA funds to come up with the design mix and test the final roads to see which section was stronger, said Goodhue County public works director Greg Isakson.

“Without the OPERA money, we would not have done the testing on it. Without the testing, we couldn’t tell if we’re going to get better results trying something new,” he said.

For Burnsville, local testing was the key to making the new technology work. Florida originally was using white confirmation lights, which were much harder to see, Buck said. They’re now using blue lights, like Minnesota.

The confirmation lights allow officers to enforce red lights without entering an intersection. The technology has been so successful that the city is looking at new places to install it, Buck said, including a local mall that is “utter chaos” at Christmas.

Eagan has followed Burnsville in installing the blue lights. “And we’ve had calls from other cities,” Buck said.

Wesolowski said local testing allows cities and counties to adjust new techniques for their own conditions.

“I think it’s important. A lot of what MnDOT may do, it’s good testing, but they’re testing and looking at ways to handle hundreds of trucks,” he said. “Where we’re dealing with cars and garbage trucks and all this (road rehab) has to be done while people are getting to their homes.”

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

Project Title Hot-Applied Asphalt as an Adhesive on Cold Longitudinal Asphalt Joints

Project Number 2007-05

Project Leader Tom Wesolowski

Agency City of Shoreview
4600 Victoria St. N.
Shoreview, MN 55126

Phone 651-490-4652

Problem The city's current strategy for sealing along cold longitudinal asphalt joints and at the interface of asphalt pavement and concrete curb and gutter was to use the same tack material that was placed between the asphalt lifts. The tack works well initially to seal the joint and keep out water, but as movement of the pavement and/or curb and gutter occurs, the seal is broken and water starts to penetrate the joint and undermine the asphalt.

Solution An asphalt joint adhesive was used as a sealant on the cold longitudinal asphalt joints and at the interface of asphalt pavement and concrete curb and gutter as part of the city's 2007 Road Reconstruction Project. The asphalt joint adhesive is pliable and will allow movement to occur without breaking, keeping the joint sealed.

Procedure The joint adhesive was placed over the entire face of cold joints or interface edge of asphalt pavement and concrete curb and gutter immediately in front of the paving operation.

Results The asphalt joint adhesive did provide a seal between the asphalt pavement and the concrete curb and gutter, but the adhesive will need to be evaluated over time to determine if it will provide a long-term seal.

Approximate Cost \$10,000

Implementation A majority of the streets included in the city's 2007 Road Reconstruction Project included the use of the asphalt joint adhesive.

Status Complete



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

Project Title Asphalt Emulsion Full-Depth Reclamation and Granular-Base Stabilization on Urban Streets

Project Number 2007-06

Project Leader Tom Wesolowski

Agency City of Shoreview
4600 Victoria St. N.
Shoreview, MN 55126



Phone 651-490-4652

Problem The city's current strategy for rehabilitating 7-ton asphalt street sections was to mill the existing asphalt in place, using it for base material, and place 3½ inches of new asphalt over the milled base. Typical 7-ton street sections usually consist of a 6-inch granular base with 2 or 3 inches of asphalt. This strategy has worked well but with the cost of asphalt rising sharply, the city was looking for ways to reduce the amount of asphalt placed on the milled base and still meet the load rating for the streets.

Solution The 7-ton streets scheduled for rehabilitation in 2007 had the reclaimed road base stabilized with an asphalt emulsion to a depth of 4 inches. The emulsion is expected to provide added stiffness to the base section and allow the depth of the asphalt to be reduced from 3½ inches to 2 inches.

Procedure The existing asphalt road surface was reclaimed to a depth of 6 inches, graded, compacted, and excess material removed if needed. The reclaimer was then used to inject and mix the asphalt emulsion into the reclaimed base to a depth of 6 inches. The emulsified base was then compacted with a sheepsfoot roller, graded, and compacted with a steel wheel roller. Once the emulsified base was cured and reached the specified moisture content, the 2-inch layer of asphalt was placed.

Results The reclamation and injection of emulsion into the milled road base worked well and created a stabilized base with the stiffness that was expected. The project was completed in September 2007, and the current surface condition of the streets is excellent.

Approximate Cost \$10,000

Implementation A majority of the streets that were rehabilitated as part of the city's 2007 Road Reconstruction Project included stabilization of the milled road base using an asphalt emulsion.

Status Complete

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

Blind Lake Chloride Research Project

Project Title Blind Lake Chloride Research Project

Project Numbers 2007-07, 2008-07

Project Leader Joe Wiita

Agency City of Prior Lake
4646 Dakota St. S.E.
Prior Lake, MN 55372

Phone 952-447-9899



Problem Blind Lake is a landlocked basin surrounded by a residential subdivision. Higher concentrations of chlorides have been identified in this basin in part due to pre-treated road salt leeching into the lake. The city's existing equipment does not allow it to effectively control application rates of anti-icing agents, which contribute to the problem.

Note: This project began in 2007 as a test of molasses combined with brine as a road deicer. The following year the city was able to expand that testing program to a wider liquids-only deicing program.

Solution The city intends to utilize a "liquids only" anti-icing/deicing program to lessen the impacts of the chloride. The project will measure the impact on the watershed as well as the impact on the level of service on the road.

Procedure The city already had a brine production facility where many different blends of chemicals could be mixed. Throughout the entire season, the city applied liquids only in the Blind Lake area using a three-lane, thousand-gallon applicator. Depending on the temperature, the city used different blends of brine, geo-melt, magnesium chloride, iceban, and molasses.

Results The chloride readings were high early in the project but slowly declined throughout the winter. The best results were from a mixture of 70 percent brine, 25 percent molasses, and 5 percent magnesium chloride. The city is going to continue using liquids only in the Blind Lake watershed for the next few years, and expects the chloride levels will continue to decrease.

Approximate Cost \$6,500 (combined cost)

Implementation As a result of its success, the City of Prior Lake will continue this practice for the next several years. The program not only helped reduce the chloride levels in the Blind Lake watershed, but it also helped reduce the amount of salt purchased by the city. If the liquids-only program continues to show these types of results, the city will be able to expand the program beyond the Blind Lake area.

Status Complete

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

Blue Light Use for Traffic Enforcement

Project Title Blue Light Use for Traffic Enforcement

Project Number 2007-08

Project Leader Bonnie Buck

Agency City of Burnsville
100 Civic Center Parkway
Burnsville, MN 55337

Phone 952-895-4536



Problem The City of Burnsville began investigating red-light violations in October 2007. Between 2002 and 2006, Burnsville averaged 950 crashes a year, with about 360 of those occurring at intersections. Of the intersection crashes, 70 were right-angle crashes at signalized intersections, indicating they were most likely the result of drivers running a red light.

Solution Researchers and engineers had help from the Florida Department of Transportation as they explored the installation of enforcement lights, which help police officers catch red-light violators. The enforcement lights turn blue as the traffic light turns red, allowing nearby police officers to observe violators and issue citations more effectively after the offender has passed through the intersection. After reviewing crash data at a number of intersections along Trunk Highway 13, in February 2008 officials installed blue lights where the highway meets County Roads 5 and 11.

Procedure City and Mn/DOT workers installed the confirmation lights in late February. The city then held a press conference at the end of April informing the public that officers would be enforcing red lights using this technology. Mn/DOT also installed signage along Highway 13 warning drivers of the red-light enforcement.

Results With the help of Craig Shankwitz, director of the Intelligent Vehicles Lab at the University of Minnesota, the city conducted a study to examine the effectiveness of the enforcement lights. The study found the daily violation rate per 100,000 vehicles was reduced by 41 percent at County Road 5 and by 84 percent at County Road 11. Research found violations increased in heavy traffic and that most (63 percent) occurred during peak traffic hours.

Approximate Cost \$11,000 (\$8,642 approved for the project)

Implementation The lights are installed at two intersections on Highway 13. The city will continue to use this technology at other locations throughout Burnsville.

Status Complete

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

Crack Sealing on Cupped Joints on Bituminous Pavements

Project Title Crack Sealing on Cupped Joints on Bituminous Pavements

Project Number 2008-03

Project Leader Anita Benson

Agency Steele County Highway Department
635 Florence Ave.
Owatonna MN 55060

Phone 507-444-7670



Problem Extensive cupping at transverse cracks in bituminous pavements allows water intrusion and accelerates pavement deterioration. It also makes for a rough ride for drivers. A more cost-effective repair strategy is sought in lieu of a traditional mill and overlay to eliminate cracks and improve ride.

Solution Use Bergman Companies Inc. (BCI) Flex-Patch material and a fine aggregate cover to seal cupped transverse cracks and improve ride. BCI FlexPatch is a hot-pour polymer-modified asphalt with reduced bleeding susceptibility and improved low-temperature flexibility. A repair using BCI Flex Patch has the potential to extend the serviceable pavement life without the more expensive mill and overlay. The fine aggregate cover has the added benefit of improving the ride surface.

Procedure Cracks were cleaned and dried using an air compressor and heat lance. Cracks larger than 3 inches were filled with cold bituminous mixture.

The cracks were then sealed with the BCI FlexPatch and covered with either an FA2 limestone chip or quarter-inch washed rock. The width of the sealant and cover aggregate averaged about 14 inches at each crack. Approximately 315 transverse cracks, each 24 feet in length, were sealed using this process.

Results Visual inspection shows that the BCI Flex-Patch material is effective at sealing cupped transverse cracks. The quarter-inch washed rock had better adherence to the sealer than the FA2 limestone chip. This indicates that a clean-cover aggregate is critical to the success of this crack sealing strategy. A profiler was used to evaluate the roughness of the roadway surface before and three weeks after the crack sealing. Results of the roughness evaluation show an approximate 20 percent improvement in ride quality.

Approximate Cost \$15,750 (\$10,000 approved for project)

Implementation Continued use of this crack-sealing strategy as a cost-effective method to minimize water intrusion and improve ride on bituminous pavements with cupped transverse cracks. Visual monitoring of the test section will continue in order to determine the long-term performance of the crack sealant.

Status Complete

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

Culvert Sediment Elimination

Project Title Culvert Sediment Elimination
Project Number 2008-04
Project Leader Wayne Dosh
Agency Crow Wing County Highway Department
16589 County Road 142
Brainerd, MN 56401
Phone 218-824-1110



Problem Crow Wing County Bridge 93465 consists of three 138-inch-span concrete arch pipes. All three of the culverts are set at the same elevation. During periods of low/normal flow, the river widens out at the structures with a subsequent reduction in velocities. This allows sediment to settle and remain at the inlets, outlets, and within the pipes. This creates an ongoing, expensive maintenance activity to keep the culverts clear. A local township with the same issue had its structures cleaned out recently at a cost of approximately \$10,000; within a year, the sediment was back.

Solution Remove the existing sediment and vegetation and construct a rock weir near the inlets of the two pipes that have historically become plugged. This will force the river to utilize one pipe during periods of low/normal flow and keep velocities high enough to minimize sediment dropping. During periods of high flow, the weirs will be overtopped, allowing all three culverts to come online. In addition, a rock berm was placed between the pipe that is always open to flow and the other two to ensure that flow coming through the single pipe wouldn't simply migrate to the other two outlets and create a sediment pool, which would fill the pipes from the downstream end.

Results The project is having the desired results as far as keeping the flow restricted to one pipe to a certain water level. The weir was overtopped and brought the remaining pipes online with minimal water backup. The real test of the system will be the long-term reduction in sediment. We also have yet to determine if any problems will arise during extreme high flows and springtime ice/melt conditions.

Approximate Cost \$10,575 (\$10,000 approved for project)

Implementation When possible, new multi-culvert installations within Crow Wing County have been designed with the pipes set at differing elevations. This negates the need to come back in the future to perform sediment removal or install a weir system. For this project, it was not economically feasible to reset the pipes or replace them, so a more retroactive solution was needed.

Status Complete

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

Road Reclamation With and Without Emulsion

Project Title Road Reclamation with and without Emulsion

Project Number 2008-05

Project Leader Greg Isakson

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Red Wing, MN 55066

Phone 651-385-3025



Problem Counties run into a dilemma when the bituminous surface of older, narrow roads reaches failure but there are not sufficient funds to rebuild the road. Goodhue County uses full-depth reclamation on the old bituminous surface and places a new 4-inch mat of 2360 mix over the reclaimed material to improve the ride and obtain a desirable load capacity. But adding 4 inches to a roadtop with 3-to-1 side slopes will reduce the existing shoulder by 12 inches, which is undesirable for the safety of the finished roadway where the shoulders were narrow to begin with. The challenge was to increase ride and the load capacity of the road while maintaining or increasing the shoulder width.

Solution The solution involves building strength down into the existing structure by adding an emulsion to the reclaimed surface materials compared to building strength by adding additional bituminous material above the existing structure.

The experiment split a 6-mile road project with poor surface conditions into two segments for a comparison of these two procedures to determine if using the emulsion is a viable alternative to our existing rehabilitation procedure. The surface of the west half was refurbished using an emulsion and a thinner 2-inch overlay of 2360 mix and the east half received our conventional reclaim (with no emulsion) and a thicker 4-inch overlay of 2360 mix.

Procedure Core samples were taken of the existing materials on the road, and mix designs with comparable GEs were developed. After milling 3 inches from the whole project, the west (emulsion) section was reclaimed to a depth of 6 inches and two additional passes were made to inject and incorporate the emulsion (at a rate of 4.5 percent). The east non-emulsion section was reclaimed to a depth of 4 inches.

Results The final cost for the emulsified segment was \$441,200 and the cost of the standard reclamation segment was \$359,887. The surface of the emulsion-impregnated segment was rougher than the other because the reclaimed materials were not finished as well as we would have liked before the emulsion set up. The final elevation of the emulsified section is 2 inches lower, which equates to a shoulder that is 6 inches wider.

Approximate Cost \$10,000

Implementation This process could easily be implemented on other old road segments where a narrow shoulder is a major concern and regrading is not an option.

Status Complete

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

Evaluation of Rear-Vision Systems for Snowplows

Project Title Evaluation of Rear-Vision Systems for Snowplows

Project Number 2008-08

Project Leader Brian Schrupp

Agency McLeod County Highway Department
1400 Adams St.
Hutchinson, MN 55350



Phone 320-234-0234

Problem Snowplowing and sanding can be stressful for maintenance operators. With a tandem snowplow, vision is very limited and several blind spots occur, particularly when the snowplow is backing up. In McLeod County, several crashes occurred when vehicles pulled up directly behind plow trucks as they were backing up to clean out an intersection, sanding, or turning around. County workers were seeking a way for the plow drivers to see directly behind the plow trucks.

Solution Workers had seen rear-vision cameras installed on garbage trucks and thought they might work on snowplows. For this study, they installed rear-vision cameras and LCD monitors from Pro-Vision Inc. on snowplow trucks to determine if the monitors would be effective in snow or ice events.

Procedure Two styles of rear-vision cameras and two styles of LCD color monitors (5-inch and 7-inch) were mounted on six tandem snowplow trucks in three locations to determine which setup was most effective.

Results Cameras were used in approximately 5 to 15 events. Both styles of the camera were covered quickly by salt and/or snow in any of the three mounting locations. There was no advantage of the 7-inch monitor over the 5-inch. Next steps are to find a way to keep the lens clean. The operators liked the security of having a second set of eyes when backing up.

Approximate Cost \$4,000

Implementation Due to the relatively low cost (about \$700 per system), county workers will likely consider them on all new tandem snowplow purchases.

Status Complete

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

Past OPERA Projects

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 (FDR) 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 air flow and oxygen necessary to aerate the pond.

Seal Coating of a Gravel Road Hill

The grade and curves on the Muhle Coulee Hill create a problem for keeping 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. 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 w 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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