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LTAP's bridge training to cover inspection, maintenance

"The collapse of the I-35W bridge should make us appreciate all the effort that goes into keeping bridges safe," says Ken Johnson, P.E., a consultant and former county engineer responsible for bridge inspection for the Aitkin County Highway Department. Johnson and Bob Kleinschmidt, a retired Mn/DOT senior engineering specialist, teach Minnesota LTAP's Bridge Maintenance workshop. They shared their thoughts during a visit to our offices to plan the curriculum and schedule for the next round of their classes.



Bridges continued on page 5

Wreckage from the collapse of the I-35W bridge in Minneapolis

Tips, resources shared at National LTAP Conference

Every summer staff from all the LTAP centers—one in each state plus Puerto Rico—along with staff from TTAPs (Tribal Technical Assistance Programs) and other agencies come together for the National LTAP Association (NLTAPA) conference. Participants share the latest tips, training techniques, and best practices in order to improve service to you—our customers.

Mindy Carlson, our training coordinator, and Kathy Schaefer, instructor for the Circuit Training and Assistance Program (CTAP), represented Minnesota LTAP at this year's conference in Chicago. They gave a presentation titled "Identifying and Understanding the LTAP and TTAP Market" in one of the concurrent sessions. Schaefer also attended a winter maintenance train-the-trainer workshop by the Salt Institute. She is the national liaison between NLTAPA and the Salt Institute, which is one of NLTAPA's national partners. In addition, Sue Miller, county engineer of Freeborn County, Minnesota, gave a presentation on low-cost safety improvements on local roads.

NLTAPA continued on page 2

Fog seal to protect new pavements, rejuvenate old ones

In his presentation on fog seals at the February 15, 2007, Minnesota Pavement Conference, chemist and pavement consultant Gayle King said "I've been working with civil engineers all my life, and never do I remember 95 percent of them agreeing on anything. So when I tell you that 20 of 21 civil engineers surveyed thought fog seals were cost-effective, that's amazing!" Nonetheless, King also pointed out that fog seals are banned in many states due to deadly accidents apparently caused by fog seals that reduced tire-to-pavement friction.

King showed that the root cause for much of the raveling and cracking of pavements is asphalt oxidation. He used results

of shear rheometry on an Arizona highway to explain the problem. A core, illustrated in Figure 1 (see page 4), was taken from a four-year-old pavement.

The bottom section of the core—about ½-inch thick—was found to have about the same performance grade (PG) as the original asphalt; in other words, virtually no aging had occurred. But the top ½ inch of the core had aged 3.5 PG grades. "We found that the asphalt binder at the top wasn't just getting harder," King said. "It was also getting more brittle—so brittle that it couldn't flow at lower pavement temperatures to relieve stresses." In other words, its m-value—its ability to flow in response to stress—had been reduced.

Fog seal continued on page 4



Participants shared tips and techniques at the annual National LTAP Association conference.

TECHNOLOGY EXCHANGE

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SAFETY

Driving dangerously, risking employment

Minnesotans with commercial driver's licenses who drive dangerously while off the clock risk much more than fines or higher insurance premiums: they're risking their livelihoods.

Minnesota adopted a set of federal regulations in August 2005 that tightened restrictions on commercial driver's licenses (CDLs) to reduce commercial crashes. In some instances under the new code, serious offenses in non-commercial vehicles can disqualify a driver from earning a commercial license for anywhere from 60 days to life.

Dick Norberg, a Mn/DOT program specialist in the Office of Freight and Commercial Vehicle Operations, said drivers didn't immediately understand what the changes meant. "Initially, I'd say it wasn't clear" to drivers why offenses in a personal vehicle would

affect their employment, he said.

A first-time conviction for driving under the influence of alcohol or a controlled substance in any vehicle, for instance, means a one-year disqualification for a CDL holder, the same penalty as if the driver had been operating a commercial vehicle at the time. Other non-commercial vehicle offenses that carry one-year disqualifications: refusing to be tested for DUI, leaving the scene of an accident, and using the vehicle to commit a felony.

A disqualification, Norberg said, "may mean loss of employment."

More severe disqualifications—three years or lifetime—occur as a result of many second-time or more serious offenses, such as using any vehicle in the commission of a felony involving manufacturing, distributing, or dis-

persing a controlled substance. That particular offense is a life disqualification without the possibility of a 10-year reinstatement, a particularly bad career move.

Even traffic violations can be cause for a disqualification period. A CDL-holder gets a 60-day disqualification for racking up two convictions of any combination of the following over three years if they result in him or her losing driving privileges: speeding 15 mph or more over the posted speed limit, reckless driving, improper or erratic lane changes, following too close, or any violation in connection with a fatal accident. A third conviction in the same time span is a 120-day disqualification.

But thanks to an active transportation association network and an

informative Web page, word spread of the new consequences of driving dangerously outside of the cab of a commercial vehicle. Two years later, Norberg said, drivers are well-aware of the penalties and understand that if their employment depends on a CDL, they had better stay on the friendly side of the law.

A full list of driver disqualifications and penalties is available at: www.fmcsa.dot.gov/rules-regulations/administration/fmcsr/fmcsrruletext.asp?section=383.51#.LTAP

—Jim Hammerand, LTAP intern

Norberg is presenting CDL requirements at the Spring Maintenance Training Expo next April.

NLTAPA from page 1

They and other attendees from the Gopher state brought back much useful information. Here are some highlights:

- A presentation about lobbying highlighted the fact that federal funds cannot be used for lobbying. This means recipients of federal funds must not advocate for more federal funds. They are, however, allowed to make technical presentations—in other words, let the data tell the story.

- Ron Eck from West Virginia LTAP recommended a video—"Transportation Employee as a Witness"—that he finds very useful for staff. Topics in the 23-minute video include preparing for court, giving a deposition, proper appearance and behavior, and giving accurate information during examination. The video is available through the Minnesota LTAP Web site at www.mnltap.umn.edu/publications, or by contacting Arlene Mathison, 612-623-3646, amathison@cts.umn.edu. Minnesota LTAP periodically offers a workshop on "Construction Contract Claims Avoidance and Mitigation"; for more about it, see www.mnltap.umn.edu/Events.

- Marlys Osterhues from the Federal Highway Administration (FHWA) discussed the Green Highways Partnership (GHP). This public/private initiative was launched in 2006 to combine safe and efficient transportation systems with environmental stewardship and sustainability. The GHP has formed

three teams to focus on environmental stewardship, storm water management, and recycling. The teams include members from the FHWA, the U.S. Environmental Protection Agency, AASHTO, and industry associations. The three teams will collect data and best practices and then develop fact sheets, case studies, and a toolkit to highlight effective recycling use in transportation projects. For more information, see www.greenhighways.org.

- The LTAP/TTAP Clearinghouse rolled out the new LTAP/TTAP Web site (www.ltapt2.org) in June with updated graphics and navigation. The Clearinghouse acts as a central resource of information for LTAP/TTAP centers and other industry stakeholders. It is operated under contract to the FHWA by the American Road & Transportation Builders Association (ARTBA). The FHWA and the Clearinghouse are adding new features to the site such as searchable databases for training materials.

- Minnesota's Project Memo Writer, developed by the Minnesota Local Road Research Board and Mn/DOT, will be submitted to the FHWA as a market-ready technology for improving project management and streamlining. Read more about Project Memo Writer in the summer 2006 *Exchange* at: www.mnltap.umn.edu/publications/exchange.

- A new FHWA regulation requires long-range plans to consider environmental mitigation. For



Conference attendees learned about the Roadway Safety Foundation, whose mission is to reduce the frequency of scenes like this.

information about environmental requirements, see www.environment.fhwa.dot.gov.

- The Roadway Safety Foundation is a nonprofit organization chartered by the American Highway Users Alliance. Its mission is to reduce the frequency and severity of motor vehicle crashes by improving the safety of America's roads. Members include the FHWA, state DOTs, the National Association of County Engineers (NACE), and the American Association of State Highway and Transportation Officials (AASHTO). Both NACE and AASHTO are NLTAPA partners. Learn more at www.roadwaysafety.org. **LTAP**

Technology Exchange

The Minnesota Local Technical Assistance Program is part of the Federal Highway Administration's Local Technical Assistance Program (LTAP). LTAP is a nationwide effort designed to foster and improve information exchange among local practitioners and state and national transportation agencies. Minnesota LTAP is administered by the Center for Transportation Studies at the University of Minnesota, and cosponsored by the Minnesota Local Road Research Board and the Minnesota Department of Transportation.

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LRRB UPDATE

Pilot project to ease gathering of cadastral, right-of-way data

Local government could save on resources if it had access to the state's survey and right-of-way acquisition information. The state, in turn, needs efficient and easy access to cadastral (property boundary and ownership) and right-of-way information developed and managed by local government. Institutional and technological barriers, however, prevent state and local government from exchanging this information in a timely way.

A pilot project by Mn/DOT and the LRRB is now under way to develop a data exchange mechanism. The goals of the "Cadastral and Right-of-Way Data Exchange Pilot Project" are to identify the information to share, collect the information, and create Web-based information access and transportation applications.

The pilot project area is the state's District 4, the Detroit Lakes District. Guidelines and protocols instituted

in the pilot will serve as standards for future data sharing throughout the state, says Clark Moe of Mn/DOT Research Services, the administrative liaison for the project.

The pilot is expected to produce many benefits, both for the state and local government. Benefits for the state include:

- Leveraging information collected at the local government level
- Eliminating redundant data creation
- Reducing the cost of acquiring local government cadastral information
- Reducing the time and resources required for the state to provide information to local government

Benefits for local government include:

- Gaining knowledge of the state's available data for sharing
- Eliminating redundant data creation
- Having easy and effective access to

the state's survey and right-of-way acquisition information

About 900 state projects each year require cadastral—property boundary and ownership—information. Currently, the state's personnel must collect cadastral information from local government sources, such as counties and cities, each time a project is identified. Collecting information requires researching records and performing field surveys and then following up with analysis when discrepancies arise. As a result, researching projects requires a large portion of time and funds allocated to projects.

The pilot project will take into account that the plan for data exchange must meet the complex and variable needs of local government, says Moe. Some local government agencies in District 4 have a Web-based method of accessing cadastral

data, internal to their departments. Other local government agencies have no digital data or only partial data, and no means of distributing the information.

The Web-based application, scheduled for completion in April 2008, will have multiple interfaces to meet the needs of state and local government's requests for information. The same application framework can be used for information-sharing for the remainder of the counties and cities within Minnesota at a later date.

The *Exchange* will provide further details of the Web-based application next year. For further information about the project, contact Moe at 651-366-3772, clark.moe@dot.state.mn.us. **LTAP**

LRRB to offer rural safety primer at workshops

The Minnesota Local Road Research Board (LRRB) is addressing safety by developing Rural Road Safety Solutions Workshops that will be held in early 2008 in all Mn/DOT Districts. This course, designed to create an operational "culture" where the focus is on safety, will provide attendees with information regarding the tools and technologies needed for the assessment and improvement of rural roads.

A team of experts from the Federal Highway Administration, Mn/DOT, local governments, and a consultant will present the information.

City and county engineers who attend this workshop will have the opportunity to learn about:

- Safety issues on both a local and national level
- Specific safety strategies that engineers can utilize in their jurisdiction
- Tools and techniques to improve rural road safety and how to implement them
- Steps to create a culture of safety
- How to secure funding and engage the public in safety issues

For more information, contact Renae Kuehl, senior engineer, SRF Consulting Group, Inc., rkuehl@srfconsulting.com, 763-249-6799 ext. 6822. **LTAP**



OPERA project:

Frost Boil Correction

Project title: Frost Boil Correction

Sponsor name: Gene Busacker

Agency: Scott County Public Works

Phone: 952-496-8478

Problem: Water that seeps into gravel or red rock roadbeds can cause frost boils and other road defects, as happened on heavily traveled Scott County roads on a yearly basis. These road conditions resulted in complaints and shoulder damage.

Solution: Instead of red rock or gravel, use millings and Geo-Tec fabric to seal the road bed.

Procedure: After laying Geo-Tec fabric across the road top (the entire 24-foot width and 50 feet past any bad spots to ensure a good, hard road bed), three 6-inch layers of millings are laid, graded out, watered, and compacted with a roller for a total depth of 18 inches. Two inches of class-five gravel are laid on top of the millings, and a



reclaimer mixes gravel and the top 2 inches of millings. After further watering, blading, and compacting, the new road bed is ready.

Results: The fabric kept clay and mud from being pushed up into the millings layers, and the millings sealed water out of the road bed. There have been no signs of frost boils or weak spots in the

OPERA 2007 annual report published

You can download it at www.mnltap.umn.edu/opera.

road beds after two spring seasons, and there have been no complaints.

Approximate Cost: \$10,000 (\$5,000 approved for project)

Implementation: The county plans to use the material in future road repairs.

Status: Completed

The Exchange regularly highlights projects completed under the LRRB's Local Operational Research Assistance Program (Local OPERA). A condensed sample from the 2007 OPERA annual report is reprinted above. For a copy of the report, please visit www.mnltap.umn.edu/opera.

Local OPERA helps to develop innovations in the con-

struction and maintenance operations of local government transportation organizations. Learn more about the program and apply for OPERA funding online at www.mnltap.umn.edu/opera, or contact Jim Grothaus, Minnesota LTAP director, 612-626-1077, mnltap@umn.edu.

MAINTENANCE

Fog seal *from page 1*

“That changes the way we need to think about protecting asphalt,” King said. He recommended that we target oxidation as the enemy. Preventing oxidation in a new pavement will prolong its life. Reversing oxidation in an old pavement—i.e., increasing its m-value—will rejuvenate it.

King said fog seals can perform these important tasks, but he cautioned that we need to develop a more sophisticated approach to using fog seals. “A fog seal is not a fog seal is not a fog seal!” King has been researching a variety of fog sealing applications and products in a five-year study that was scheduled for conclusion in August of 2007.

Fog seal to prevent oxidation right after chip seal

King strongly recommended fog seals on several types of new pavement surface—especially chip seals. He showed a chip-sealed pavement that had been fog-sealed only on one lane. The lane with the fog seal had no measurable chip loss, but the lane without fog seal showed a great deal of raveling and plow damage. “If you’re not losing chips to raveling or plows and your customers aren’t complaining about wind shield damage,” King said, “you don’t necessarily need to fog seal. But you can take a little bit of the emulsion out of the chip seal application and put it down on top as a fog seal instead, so it doesn’t cost much more, and it may save you a lot in terms of the length of time your chip seal lasts before you have to come back and fix it.” The blacker color of the fogged surface also looks more like hot-mix and can offer safety advantages as well, particularly when applied to shoulders.

King enthusiastically recommended one particular product for fog seal over chip seals: “the Minnesota special: CRS-2P,” as he nicknamed it. CRS-2P is a polymer-modified emulsion developed by Mn/DOT’s Tom Wood. King explained that diluting CRS with water doesn’t work: “That will break it, and it won’t come out of the distributor, and you’ve got a mess.” But if CRS is diluted with the soap from which it was made, King said “it dilutes very well, it applies very well, and it only costs 13 cents

per square yard so you can afford to fog seal all your chip seals.” He compared that with some of the “high-priced spreads”—specialty emulsions that cost as much as \$1.60 per square yard. He concluded that “fog seals can be very cost-effective if you know what you’re doing.”

King especially recommended fog seal over chip seal on shoulders, pointing out that, because shoulders receive little traffic, they don’t become as highly densified as travel lanes. This means shoulders absorb more oxygen, which eventually leads to raveling. He recommended applying the fog seal heavily on a shoulder so that it is very black. That helps drivers at night to easily see the edge of the travel lane. But he expressed caution at the idea of fog sealing the travel lanes themselves because of potential friction loss. King recommended experimentation on a small section before proceeding with a large project.

Fog seal over open-grade friction courses (OGFC)

King also recommended fog seals over Superpave coarse mixes and open-grade friction courses (OGFCs). In both of these pavement types, because there is more exposed surface and greater permeability, the pavement is more susceptible to oxidation and ages faster than other types. “Aggregate raveling caused by oxidation probably starts in three years if it’s a straight OGFC and in six years if it’s polymer-modified,” he said. “But a regularly scheduled fog seal program can eliminate the problem.”

However, King said the fog seal on these more permeable surfaces must be different from the type used on a chip seal: “On an OGFC or a coarse-mix Superpave asphalt, you’re not doing it to *avoid* oxidation; you’re doing it either to *rejuvenate* the asphalt or re-stick the aggregate with a less brittle binder to avoid raveling. Because we’re doing the fog seal for a different reason, the emulsion needs to be different.” The same factor that makes Superpave coarse mixes and OGFCs susceptible to oxidation—their permeability—also makes them good candidates for fog sealing

because the fog seal emulsion can more easily and more deeply penetrate into the pavement. This means the friction problems associated with chip seals are avoidable and that it is possible to restore m-values at greater depths in the pavement. For these pavement types, he recommended polymer-modified emulsions because the high polymer content helps to lock down the aggregate.

Don’t fog seal over SMA asphalts containing rubber

King recommended extreme caution when fog sealing stone-mix asphalt (SMA; also called gap-graded asphalt) and asphalts containing crumb-rubber. Because an SMA has very low permeability, a fog seal emulsion cannot penetrate into the pavement, thus producing a dangerously slippery surface. And he noted that some of the asphaltic materials in a fog seal can cause crumb-rubber to swell.

Developing fog seal testing methods

King’s research includes assessments of several test devices and methods, including:

- A pavement permeameter developed by the National Center for Asphalt Technology
- A “ring test” for emulsion infiltration
- A portable seismic pavement analyzer—essentially a mini-FWD
- A bending beam rheometer test for thin mixture specimens, as developed by Professor Mihai Marasteanu of the University of Minnesota
- A dynamic shear rheometer torsion bar test for mixtures
- Several friction testing methods,

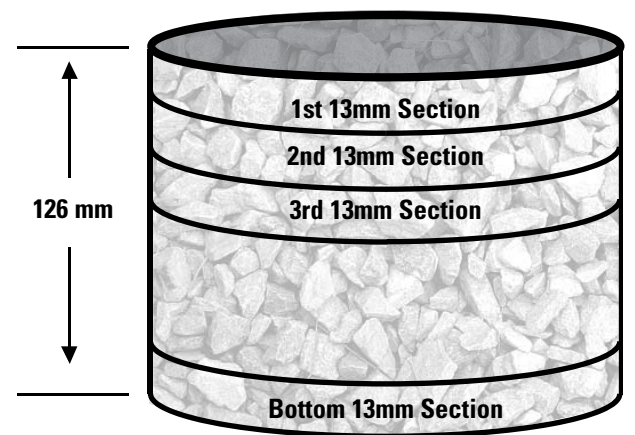


Figure 1: A core taken from a four-year-old pavement

from portable lab procedures to full-scale skid trailers. He said friction values change as a fog seal ages. “When applying a fog seal to a dense HMA surface, friction may be 30 percent lower on the first day; by the second day you may have a 20 percent loss; a month later it may be only 10 percent; and nine months later, you’re typically back to the original value.” Sanding immediately after the emulsion application will significantly improve early friction.

Detailed evaluations of testing devices and all other aspects of King’s research are on a Web site hosted by the National Center for Pavement Preservation at www.pavementpreservation.org/fogseals.

Can research overcome well-founded fears?

It remains to be seen whether King’s research will be enough to convince justifiably skittish officials to repeal their fog seal bans. But King’s research shows that, with a greater understanding of how fog seals work and more care in matching products to conditions, fog seals offer great promise in the fight against pavement oxidation. **LTAP**

—Richard Kronick, LTAP freelance writer

New options possible for late season pavement markings

Late season work provides challenges for installing pavement markings. Mn/DOT’s Office of Traffic, Safety, and Operations (OTSO) and the Chemical Laboratory are working with manufacturers of pavement-marking material to find and develop improved materials that will provide appropriate performance when installed in late season/cold weather conditions. This effort is expected to

result in additional products on Mn/DOT’s Qualified Products List for late season/cold weather pavement markings. The list is online at www.dot.state.mn.us/trafficeng/qpl/PavementMarkings.pdf.

For more information, contact Jon Jackels, Mn/DOT pavement marking engineer, at 651-234-7377, jon.jackels@dot.state.mn.us. **LTAP**

LTAP Seal Coat Operations workshops this fall

“Does your agency have so much money that you cannot spend it all? If so, this class is not for you,” says Thomas Wood, instructor of Minnesota LTAP’s Seal Coat Operations workshops.

For the rest of us, Wood says, come spend three to four hours learning and sharing the best methods to preserve your hot-mix asphalt pavements by using chip sealing. The class discusses why to design your chip seal, what makes a good chip, what asphalt emulsion is, and how to properly build the chip seal. Class members add personal case studies. “The goal of the class is to have fun and learn how to build a better chip seal,” he says.

Wood has worked for Mn/DOT for more than 20 years, much in the Office of Materials, where he works on pavement preventive maintenance methods.

As this issue goes to print, two of the four fall workshops still have openings: Baxter on November 15, and Duluth on November 16. To register, call Shirley Mueffelman, 612-624-4754, or see www.mnltap.umn.edu. **LTAP**

Report describes applied research projects

Mn/DOT's Office of Maintenance and Security published its *2005–2007 Statewide Biennial Maintenance Operations Report*. In it you will find many current applied research projects, lists of former projects, lists of potential implementation projects, program history, budget information, and much more.

The report is available at www.dot.state.mn.us/maint/research-news.html. Previous reports are also posted at the site.

For more information, e-mail Farideh Amiri of Mn/DOT Maintenance Research at farideh.amiri@dot.state.mn.us, or call 651-366-3545. **LTAP**



Maintenance Research Corner

Staff of Mn/DOT's Maintenance Operations Research (MOR), along with the members of the Mn/DOT New Technology, Research, and Equipment Committee (NTREC), publish a monthly one-page bulletin of their latest news and findings. Below are highlights from recent bulletins. If you would like to be added to the bulletin mailing list, please e-mail Farideh Amiri of Mn/DOT Maintenance Research at farideh.amiri@dot.state.mn.us.

Mini might patrol

This is an attachment for a skid-steer loader currently being used by District 4. This equipment will replace the motor grader used for maintaining shoulders and other small motor grader work. This new equipment will help us better utilize our much-needed skid-steer loaders and in certain applications reduce or eliminate the high cost of owning and operating motor graders.

For more information, contact Dennis Redig, 218-846-7943, superintendent, Detroit Lakes.



Driving simulator

Driving simulator

Mn/DOT recently purchased two driving simulators that have the ability to simulate various weather and traffic conditions. They also have the capability of converting from a snow plow truck to a regular passenger vehicle simply by changing the seat and the dash from a truck setting to a sedan setting.

These simulators will be mounted in a trailer and will travel to each district, enabling the most cutting-edge training for current and future snow plow operators. The simulators can also be used for defensive driving training for all Mn/DOT employees.

For more information, contact Rick Shomion, 651-366-3576, maintenance training coordinator. **LTAP**

Bridges *from page 1*

Maintenance is the easiest way to extend life. "It can be as easy as flushing off deicers in the spring and sealing hairline cracks," Johnson explains. "The little things pay off."

In the wake of the collapse, Johnson says people should understand two things. First, bridge inspection is very important work even though at times it may not seem glamorous—such as when inspectors have to clean off pigeon droppings. Pigeon feces can contain a pathogen that causes respiratory disease and is very harmful to humans. It also is very corrosive for bridges.

Second, while the public should demand performance, "people also need to recognize that we're still human," Johnson says. "The human element is still there."

The bridge inspector is the "foot soldier," Johnson says, and has to decide where further testing and analysis is needed. Other technologies such as ultrasound may then be used.

Local agencies can call in Mn/DOT's Bridge Office for further analysis of suspect areas, notes Kleinschmidt. Mn/DOT's Technical Memorandum No. 05-02-B-02, issued in July 2005, establishes a formal procedure for responding, reporting,

and documenting "critical deficiencies" found during scheduled bridge inspections. (The FHWA requires all states to have such plans.) A critical deficiency is defined as any condition discovered during a scheduled bridge inspection that threatens public safety and, if not promptly corrected, could result in collapse or partial collapse of a bridge. (This memorandum and others are online at www.dot.state.mn.us/tecsup/tmemo.)

Kleinschmidt says their revised workshop curriculum will correct misperceptions about bridge terminology—such as structural deficiency—that have appeared in recent media reports. Other topics will include gathering data on bridge maintenance needs, planning for bridge emergencies, and developing a scour response plan. (Scour of the riverbed near bridge piers and abutments is a major cause of bridge collapses.)

Kleinschmidt and Johnson bring decades of experience to their training. While with Bemidji's construction inspection unit, Kleinschmidt supervised bridge maintenance operations and the bridge safety inspection program, and developed the annual district maintenance program.

Johnson worked in the development and use of treated timber for highway bridges while with Wheeler Lumber, LLC.

Johnson hopes Minnesotans won't lose confidence in their infrastructure. "Minnesota is a nationwide leader in transportation," he says, "and the bridge collapse was an anomaly. Many states have bridges in much worse condition."

Eventually investigators will determine the cause of the collapse, Johnson says, and the findings will help improve future bridge inspection processes. His wish is that the tragedy will reverse the general erosion of public support for infrastructure and move public policy toward greater investment.

Johnson and Kleinschmidt will share some tips for bridge maintenance in two one-hour sessions at the Minnesota Spring Maintenance Training Expo, April 15–16, 2008. The LTAP Bridge Maintenance workshops are being planned for later next year.

LTAP

—Pamela Snopl, LTAP editor

Bridges: Did you know?

About 400 local bridges in Minnesota are defined as deficient by the federal government and targeted in the near future for replacement or rehabilitation by Mn/DOT, according to the August 16 *Minneapolis Star Tribune*.

A bridge is considered structurally deficient if it is in relatively poor condition or has insufficient load-carrying capacity. The insufficient load capacity could be due to the original design of an older bridge that used lighter design loads, or due to deterioration.

Modern agriculture, with wider and heavy equipment, is putting increased pressure on local bridges.

The I-35W bridge that collapsed into the Mississippi River on August 1 was rated as "structurally deficient" in 2005 according to the U.S. Department of Transportation's National Bridge Inventory database.

LTAP

POLICY

Parking: How much is enough?

Can there be such a thing as too much parking? A growing number of cities and towns around the country are answering yes to this question. They are beginning to recognize that too much parking can be as bad as too little and are taking steps to regulate the demand and the supply of parking. Some cities now mandate a parking maximum and not a minimum as is the norm.

Clearly, too much parking wastes land and carries with it a sizable economic penalty, especially in terms of wasted opportunities. But more important, too much parking often saps the vitality of an area by creating large dead zones where people do not want to be. There is also a growing recognition that it is not just the amount of parking that is important. How it is arranged relative to the buildings, who owns it, and how it is operated, are all factors that affect the extent to which parking will have a positive or adverse effect on the surrounding land uses.

To get a better handle on some of these issues, researchers at the University of Connecticut started a two-year-long study in 2003 of parking at six centers around New England. The primary goal was to compare parking at mixed-use, walkable commercial centers to that at centers with more conventional development patterns (control sites).

The results of the analysis show that the mixed-use sites use much less parking, and use the parking more efficiently, than did the control sites. On average, the peak parking use (generally during the holiday shopping period) at the control sites was about 2.3 spaces per 1000 sq. ft. of building square footage. The mixed-use study site required only 1.8 spaces per 1000 sq. ft., or about

24 percent less than the conventional sites.

In terms of efficiency of use, less than 50 percent of the parking spaces at the control sites were filled during the peak shopping period, versus 80 percent occupancy at the mixed-use study sites. In other words, the amount of parking provided at the control sites was more than twice that required even during the peak shopping period. This is a tremendous waste of land and is also environmentally unsound, as it means that a significant amount of unnecessary impervious surface is found at these developments.

The study sites have a few advantages that allow them to operate smoothly at a much higher occupancy level. One important difference is that the study sites have paid municipal lots and garages that serve the whole center and not individual businesses. This consolidation of parking affords a great deal of efficiency. In contrast, most people at the conventional sites drive from one business to another at the center and thus end up using multiple parking spaces for each visit.

There are a number of reasons why the mixed-use sites are “park once” districts. For one, the act of paying for parking cut down on the tendency to move the car once a person is in the district. These mixed-use districts are also much easier to walk in and provide a more pleasant and more interesting environment.

Based on this study, the researchers suggest the following strategies for reducing the negative impact of parking:

- **Reduce Minimum Parking Requirements:** Most towns could significantly reduce the minimum parking requirements without any noticeable



Many parking lots are unfilled even during peak times, creating unnecessary impervious surfaces.

adverse effect.

- **Encourage Connected, Mixed-Use Development:** The study suggests that mixed-use centers use fewer parking spaces and use the parking provided much more efficiently.

- **Re-institute On-street Parking:** On-street parking is the most valued by customers and often the most convenient. It cuts down on the size of the off-street lot that is needed, thus reducing the amount of impervious surface. On-street parking brings other benefits in that it serves a traffic calming function, making a town center feel safer to pedestrians and more like a real center to drivers and pedestrians alike.

- **Consider Shared Municipal Lots:** Lots shared by different types of businesses are used much more efficiently and do not have as many hours where they sit empty. In addition, consolidated municipal parking promotes a “park once” mindset, which benefits all the businesses in a center. Finally, the parking revenue from municipal parking systems can be used to landscape, beau-

tify, and maintain the streets and other public realms of the center.

The current system of oversupplying parking appears to be wasteful of land and resources, is environmentally unsound, and dampens the economic and social vitality of commercial centers. The good news is that relatively small changes can go a long way in reducing the amount of resources that are devoted to parking and in creating more vibrant centers in our cities and towns.

LTAP

(Written by Norman W. Garrick, Connecticut Transportation Institute, University of Connecticut, and Wesley E. Marshall, Civil and Environmental Engineering, University of Connecticut, wesley.marshall@uconn.edu.)

Reprinted and condensed with permission from Technology Transfer Newsletter, Volume 22, Number 4 – December 2005, Connecticut Transportation Institute’s Technology Transfer Center, University of Connecticut, School of Engineering. Read the full article at www.t2center.uconn.edu/tt_newsletters.html.)

Who really pays for free parking?

Who pays for free parking? “Everyone but the motorist,” said Professor Donald Shoup of the University of California Los Angeles. He made his remarks at the Center for Transportation Studies Fall Luncheon on November 3, 2005.

Americans park for “free” at the end of 99 percent of their trips. The true cost of parking, however, is diffused throughout the economy, embedded in the price of everything from movie tickets to housing. “We don’t pay for parking in our role as motorist,” Shoup said, “but we pay for it...as consumers, investors, workers, residents, and taxpayers.”

This price distortion arises from what Shoup argued are two mistakes in parking policy: it keeps curbside parking free or cheap, and it requires a great deal of off-street parking.

We all bear the cost of this “great planning disaster,” Shoup declared. Parking requirements skew travel

choices, distort urban form, degrade urban design, raise housing costs, impede reuse of older buildings, limit homeownership, damage the urban economy, and harm the environment.

The cost of free parking is staggering. The total subsidy for off-street parking in 2002, Shoup estimated, was between \$127 billion and \$374 billion.

The good news, Shoup said, is that there is “almost an easy way out” of this situation through two reforms in parking policy: charging market rates for curbside parking, and returning the meter revenue to the neighborhoods that generate it.

The success of this approach is evident in Old Pasadena, a 15-block historic district that was a slum 25 years ago. The city of Pasadena lacked funding for public improvements, but merchants had opposed parking meters for fear of losing customers. When the city offered

to return all parking meter revenue to Old Pasadena in 1993, however, merchants and property owners immediately agreed.

Now, 690 meters yield \$1.2 million each year for Old Pasadena. The revenues pay for repaving, increased sidewalk cleaning, and other landscaping amenities. Both businesses and customers support the change.

“The meter money has transformed the public sector...and that has enabled the private sector to do what it can do,” he said.

Today’s modern meters, which allow variable pricing and let motorists pay with their cell phones or credit cards, are a part of the area’s success. Technology also allows communities to monitor the occupancy rate of spaces, reducing the need for meter readers.

Shoup concluded his talk by outlining two future scenarios. In the first, parking policies are unchanged,

costs remain hidden, and transportation choices are distorted. Our cars—parked 95 percent of the time—prevent the valuable land beneath them from being tapped for revenue.

In a “better” future, Shoup envisions communities that charge market-rate prices for curbside parking, use the revenue to improve neighborhoods, and remove off-street parking requirements. The cost of parking becomes unbundled from other transactions, so driving and oil consumption drop and our air is cleaner. “We pay less for the price of everything except parking,” he summarized.

For more about his research, please visit Shoup’s Web site at <http://shoup.bol.ucla.edu>. **LTAP** (Condensed from the December 2005 CTS Report.)

INFORMATION SERVICES

The Shelf

Questions? Contact Arlene Mathison, Minnesota LTAP librarian, 612-624-3646, amathison@cts.umn.edu.

Reports

Application of LRFD Bridge Design Specifications to High-Strength Structural Concrete: Shear Provisions (*Transportation Research Board, 2007, NCHRP Report 579*)

This report contains the findings of research performed to extend the applicability of shear design provisions for reinforced and pre-stressed concrete structures in the AASHTO LRFD Bridge Design Specifications to concrete compressive strengths greater than 10 ksi.

Multiple Corrosion Protection Systems for Reinforced Concrete Bridge Components (*Federal Highway Administration, 2007, FHWA-HRT-07-043*)

Eleven systems combining epoxy-coated reinforcement with another corrosion protection system are evaluated using the rapid macro-cell, Southern Exposure, cracked beam, and linear polarization resistance tests. The results represent the findings obtained during the first half of a five-year study.

Durability of Segmental Retaining Wall Blocks: Final Report (*Federal Highway Administration, 04/00/2007, FHWA-HRT-07-21*)

There have been some reported problems with durability of SRW blocks in cold climates. In response to these concerns, a FHWA-funded research project was initiated to determine

the cause and extent of SRW block distress, to identify and recommend test methods for improving durability of SRW systems, and to recommend specifications for SHAs to ensure long-term durability and performance of SRW systems in highway applications.

Evaluating Air-Entraining Admixtures for Highway Concrete (*Transportation Research Board, 2007, NCHRP Report 578*)

This report presents a recommended procedure for evaluating air-entraining admixtures used in highway concrete.

Freeze-Thaw Resistance of Concrete With Marginal Air Content (*Federal Highway Administration, 2006, HRT-06-117*)

This study evaluated the freeze-thaw resistance of several "marginal" air void mixes, with two different types of air-entraining admixtures (AEA) – a Vinsol resin and a synthetic admixture.

Traffic Detector Handbook: Third Edition: Volume I (*Federal Highway Administration, 10/00/2006, FHWA-HRT-06-108*) and **Volume II** (*Federal Highway Administration, 10/00/2006, FHWA-HRT-06-139*)

The objective of this handbook is to provide a comprehensive resource for selecting, designing, installing, and maintaining traffic sensors for signalized intersections and freeways.

Syntheses

Health and Wellness Programs for Commercial Drivers: A Synthesis of Safety Practice (*Transportation Research Board, 2007, CTBSSP Synthesis 15*)

This synthesis provides a state of the practice of commercial driver health and wellness programs. It describes elements of employee health and wellness programs that could apply to commercial drivers, and offers several case studies of successful employee programs in the truck and motor-bus industries.

The Role of Safety Culture in Preventing Commercial Motor Vehicle Crashes (*Transportation Research Board, 2007, CTBSSP Synthesis 14*)

This synthesis provides information on practices that offer the greatest influence on developing and enhancing a culture of safety among commercial motor vehicle drivers.

State DOT Crash Reconstruction Practices: A Synthesis of Highway Practice (*Transportation Research Board, 2007, NCHRP Synthesis 369*)

This synthesis focuses on crash reconstruction activities conducted by state DOTs, feedback provided from reconstruction activities, and mitigation actions taken as a result.

DVDs

Highway Safety and Trees: The Delicate Balance (*Federal Highway Administration, 2006*)

This DVD stresses that the design of highway projects should be a cooperative effort involving the highway agency, concerned communities, organizations, and individual citizens. It discusses many solutions from roadway relocation to use of guardrail to removal of trees from the most hazardous locations.

CD-ROMs

Application of Ground Anchors and Soil Nails in Roadway Construction (*Federal Highway Administration, 2007, FHWA-WFL/TD-07-002*)

This CD includes five multimedia presentations that describe and explain the principles of science and engineering related to the construction of ground anchors and soil nail systems: www.wfl.fhwa.dot.gov/td/

Road Engineering and Construction Practices for Cold Regions (*Federal Highway Administration, 2007, FHWA-WFL/TD-07-001*)

This CD includes a multimedia presentation that describes and explains the principles of science and engineering related to road engineering and construction for cold regions: www.wfl.fhwa.dot.gov/td/ **LTAP**

TERRA publishes first annual report

The Transportation Engineering and Road Research Alliance (TERRA) published its first annual report in August. The report summarizes the highlights of TERRA efforts and activities during the past fiscal year (July 2006 through June 2007).

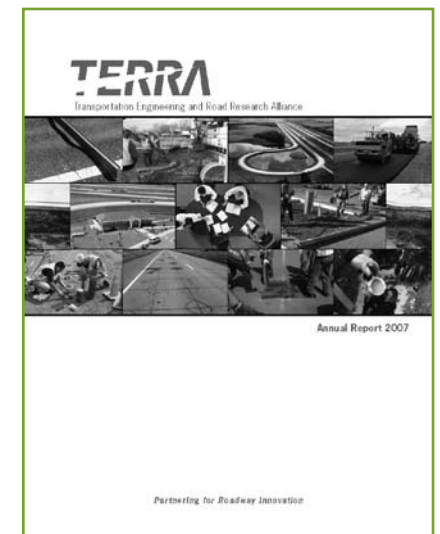
In addition to providing details about TERRA members and how to get involved, the report outlines the research and reconstruction under way at the Minnesota Road Research Project (MnROAD), a pavement

and road research facility operated by the Minnesota Department of Transportation (Mn/DOT). The report also describes TERRA's annual process for collecting project ideas from partners and friends.

TERRA, a research governance structure formed in 2004 to foster a comprehensive road research program, brings together government, industry, and academia in a dynamic partnership to advance innovations in road engineering and construc-

tion. TERRA's partnering efforts reach beyond Minnesota to include transportation organizations in other states and in Europe.

To learn more about TERRA or download a copy of the 2007 TERRA Annual Report, visit www.terraroadalliance.org. **LTAP**



Snow and ice control guidelines

The National Cooperative Highway Research Program (NCHRP) Report 577: *Guidelines for the Selection of Snow and Ice Control Materials to Mitigate Environmental Impacts*, is now available.

The report examines a decision tool for the selection of snow and ice control materials to suit the specific needs of any given highway agency, a purchase specification that can be used by an agency once agency staff have

selected materials for use, and a quality assurance monitoring program that includes procedures and standard test methods to characterize snow and ice control products before their purchase or use.

The report, along with links to download the decision tool software, is at http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_577.pdf. **LTAP**

Local Government Video Catalog published

Minnesota LTAP, in cooperation with the Minnesota Department of Transportation, has published the 2007 edition of the *Local Government Video Catalog*.

The catalog is arranged by subject, with the publisher, date, format,

and length of time. Within a subject area, the videos are listed alphabetically by title. Following the subject index is a listing of videos by title.

More than 700 videos are included on topics such as gravel and low-volume roads, maintenance and opera-

tions, and safety and health.

The catalog is available on the LTAP Web site (www.mnltap.umn.edu/publications).

All the videos listed are available through Minnesota LTAP from Mn/DOT's Library for a three-week loan

period at no charge. To borrow any of the videos or for further information, contact the Mn/DOT Library or Arlene Mathison, Minnesota LTAP Librarian at library@cts.umn.edu.

LTAP

EVENTS & TRAINING

Calendar

If your professional organization meets on a regular basis, let us include the information here. Contact us at mnltp@umn.edu.
For an up-to-date list of events in Minnesota, please see the LTAP workshops and events calendar: www.mnltp.umn.edu/workshops/events.

Date	Event	Location	Contact
November–December			
LTAP Nov. 13	Seal Coat Operations: A Workshop for Practitioners (0.5 cr)	Mankato	Shirley Mueffelman, 612-624-4754, cceconf2@umn.edu
LTAP Nov. 15	Seal Coat Operations: A Workshop for Practitioners (0.5 cr)	Baxter	Shirley Mueffelman, 612-624-4754, cceconf2@umn.edu
LTAP Nov. 16	Seal Coat Operations: A Workshop for Practitioners (0.5 cr)	Duluth	Shirley Mueffelman, 612-624-4754, cceconf2@umn.edu
Nov. 14–16	Minnesota Public Works Association Fall Conference	Brooklyn Center	Heather Dorr, cceconf3@umn.edu
LTAP Nov. 28	Seal Coat Operations: A Workshop for Practitioners (0.5 cr)	Shoreview	Shirley Mueffelman, 612-624-4754, cceconf2@umn.edu
Dec. 5	Minnesota Assoc. of Asphalt Paving Technologists 54th Annual Asphalt Conference	Brooklyn Park	jthomas@mnapa.org , www.asphaltisbest.com
Dec. 6	57th Annual Concrete Conference	St. Paul	Kristi Fischer, 612-625-4265, cceconf4@umn.edu
January–February			
LTAP Jan.–March	Work-Zone Traffic Control (0.5 cr)	TBD	Kim, United Rentals, 612-521-4200, 800-766-5483
Jan. 22–25	Minnesota County Engineers Association Annual Conference	Brainerd	Carrie Alkins, 612-624-3492, cceconf3@umn.edu
Jan. 30-Feb. 1	City Engineers Association of Minnesota Annual Conference (1.0 cr)	Brooklyn Center	Carrie Alkins, 612-624-3492, cceconf3@umn.edu
LTAP Feb. 13	Traffic Engineering Fundamentals (1.0 cr)	St. Cloud	Sonia Piper, 651-604-4876
Feb. 14	12th Annual Minnesota Pavement Conference (1.0 cr)	St. Paul	Shirley Mueffelman, 612-624-4754, cceconf2@umn.edu
March–April			
March 5	52nd Annual Asphalt Contractors' Workshop/MN Quality Initiative Workshop	Brooklyn Center	Jill Thomas, 651-636-4666, www.asphaltisbest.com
March 13-14	Concrete Paving Association of Minnesota 47th Annual Concrete Paving Workshop	Mankato	Deb LaValle, 651-762-0402, www.concreteisbetter.com
March 18-19	NCATSSA "How To" Training Conference (0.5 cr)	Fargo	Rick Shomion, 651-366-3576, www.atssa.com
LTAP March 18	Gravel Road Maintenance and Design (0.5 cr)	Rochester	Shirley Mueffelman, 612-624-4754, cceconf2@umn.edu
LTAP Apr. 1	Gravel Road Maintenance and Design (0.5 cr)	Crookston	Shirley Mueffelman, 612-624-4754, cceconf2@umn.edu
LTAP Apr. 8	Gravel Road Maintenance and Design (0.5 cr)	St. Cloud	Shirley Mueffelman, 612-624-4754, cceconf2@umn.edu
LTAP Apr. 15–16	Spring Maintenance Training Expo (0.5 cr/day)	St. Cloud	Shirley Mueffelman, 612-624-4754, cceconf2@umn.edu

LTAP workshops

LTAP workshops, along with events cosponsored by Minnesota LTAP, are marked with an **LTAP** above. Check the Web for details: www.mnltp.umn.edu/workshops. You may also register online.

Brochures advertising upcoming LTAP workshops are mailed six weeks prior to the first scheduled workshop. Electronic notices are sent as a reminder approximately three weeks later. To be included on our electronic mailing list, please contact Minnesota LTAP at mnltp@umn.edu or call 612-625-1813.

Disability accommodations are provided upon request.

CTAP workshops

If the events above aren't convenient for you, consider scheduling a Circuit Training and Assistance

Program (CTAP) workshop in your neck of the woods. CTAP uses a fully equipped van to provide on-site technical assistance and training. Current CTAP training courses and special presentations are:

- Asphalt Pavement Maintenance and Preservation (0.5 cr)
- Culvert Installation and Maintenance (0.5 cr)
- Gravel Road Maintenance / Dust Control (0.5 cr)
- Roadside Vegetation Management and Erosion Control (0.5 cr)
- Snow and Ice Control Material Application (0.5 cr)
- Truck and Equipment Washing Best Practices (0.5 cr)
- Work-Zone Traffic Control and Flagging Training (0.5 cr)

CTAP workshops are informal and usually hands-on—in fact, many are held in or adjacent to mainte-

nance facilities. Sites with easy access for the van are preferred. CTAP fees are \$250.00 for 8 to 10 participants and \$350.00 for 11 to 40 participants. The fees are for a two- to four-hour CTAP workshop.

To schedule classes, call the CTAP instructor, Kathy Schaefer, at 651-366-3575, or e-mail Kathleen.Schaefer@dot.state.mn.us.

Roads Scholar credit

You can earn credits in Minnesota LTAP's Roads Scholar program by attending LTAP and CTAP workshops and other cosponsored events. (Credits are indicated above.) Required workshops and electives are subject to change. To learn more or enroll in the program, visit www.mnltp.umn.edu/roadscholar. **LTAP**

Roads Scholar credit again offered at 'How to' conference

The Northland Chapter of the American Traffic Safety Services Association (NCATSSA) will hold its 16th annual "How to" safety training conference March 18 and 19, 2008, in Fargo, North Dakota. The conference is open to city, county, state, and federal agencies as well as consulting engineers and contractors.

The conference is intended for field-level installers, supervisors, and designers who work in the areas of work-zone

traffic control, permanent signing, and pavement marking. Tentative topics include:

- Work-zone training—three-part session
- County sign management for townships
- Toward Zero Deaths
- Small sign supports
- Rumble stripes
- Local road safety, low-cost safety solutions

- Pavement marking inspection
 - Risk management for utilities
 - CDL updates
 - FHWA minimums
 - Open forum for government officials
 - Innovative construction
 - Guard rail
 - Lighting and traffic signal maintenance
 - Specification & standards enforcement
- The exhibit hall will feature 45+ displays and representatives for material and equipment suppliers nationwide.

Participants may enroll in the work-zone training and receive half a credit toward Minnesota LTAP's Roads Scholar Program.

Advance registration materials will be mailed out in November, or you can register at www.atssa.com. If you have any questions, please contact "How to" committee member Rick Shomion of Mn/DOT, 651-366-3575, rick.shomion@dot.state.mn.us. **LTAP**

Click, Listen, and Learn schedule set through August 2008

Click, Listen, and Learn is the American Public Works Association (APWA) series of interactive Internet educational programs. (APWA is a partner of the National LTAP Association.) The schedule through August 2008 is now online.

Upcoming topics include emergency preparedness (Dec. 13), trenchless technology (Jan. 10), water, a precious resource (Feb. 21), and innovative funding (Apr. 17).

Each program is led by top experts in the field who convey new ideas, new methods, and new technologies in a fast-paced two-hour time frame.

To participate, all you need is a speaker phone for the audio portion and an Internet connection for the visual portion. If you are hosting or need to train a group of 5 to 25 or more, you will need an LCD projector to hook up to a laptop or PC, a screen, and a separate phone line for the conference phone.

The \$150 connection fee covers one phone connection and one Internet connection. The number of people viewing the program is up to you.

For information, see www.apwa.net/Education/CLL. **LTAP**



Mark your calendars:

2008 Spring Maintenance Training Expo

April 15 and 16
St. Cloud