

MINNESOTA LTAP TECHNOLOGY EXCHANGE

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What makes pavements fail?



Photo courtesy Ervin Dukatz

Types of pavement cracking failures, left to right: longitudinal, thermal or reflective, and fatigue

At the annual TERRA Pavement Conference on February 5, Ervin Dukatz, vice president of materials and research at Mathy Construction Co., discussed less commonly cited causes of pavement rutting, raveling, and cracking. He began with a word of caution: “None of the solutions I’m going to cover will prevent trouble if the pavement foundation is weak.”

Pavement failure *continued on page 4*

Video answers common questions about Minnesota’s gravel roads

Businesses and industries depend on gravel roads, as do the people who travel and live along them. Sometimes, these users have questions: Why is a road gravel instead of paved? Why do conditions vary from one gravel road to another?

A new, five-minute informational video from the Minnesota Local Road Research Board (LRRB) addresses such common questions and concerns. The video is intended to provide a useful tool for county engineers and township supervisors to educate the public about gravel road maintenance.

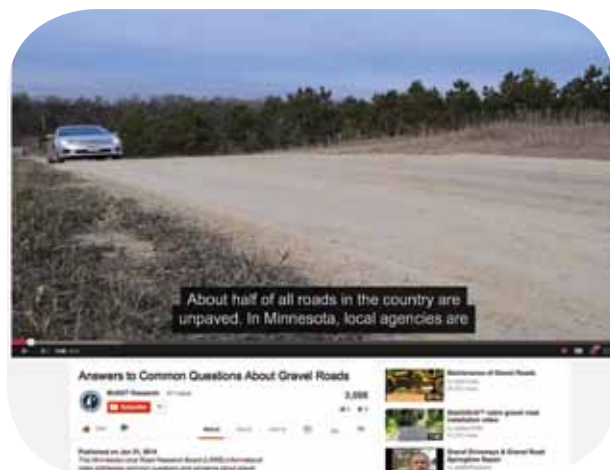
“The idea for this video came from the county engineers in the western side of the state at an LRRB focus group,” said Julie Skallman, Minnesota Department of Transportation (MnDOT) State Aid engineer and chair of the Minnesota LTAP Steering Committee. “They were frequently asked to explain why some of their gravel roads were rough and how they maintain them. The thought was a short video posted on their websites might answer some

of the questions from the public or serve as a good reminder later on.”

The video describes the basic materials and construction of a gravel road, common problems with

gravel roads, and what’s involved in keeping a gravel road in the best condition. In addition, the video provides tips for gravel road users to prevent damage to the road.

A panel of technical advisors guided the content of the video. The panel included representatives from three Minnesota counties, MnDOT, and Minnesota LTAP. The video is available at mnltap.umn.edu/publications.LTAP



Last call for Demo Day!

The Minnesota Roadway Maintenance Training and Demo Day will be held May 15 at the Alexandria Technical and Community College. The event includes classroom sessions and outdoor demonstrations. Attendees will earn a Road Scholars credit. Interested? Visit mnltap.umn.edu/training/roadway for details.

Turfgrass pathology course online, awards Roads Scholar credit

This online course from the University of Minnesota now counts as one elective credit in Minnesota LTAP’s Roads Scholar program. The course is designed for anybody who works with turfgrass, including park supervisors, lawn care providers, land and landscape maintenance employees, and landscapers.

At the conclusion of the course, students will be able to diagnose Upper Midwest turfgrass diseases and then determine control measures for the diseases using both cultural and chemical methods. The course uses a number of interactive instructional tools including audio and video clips, discussion boards, formula calculators, and case studies, along with instructor feedback. Learn more at mnltap.umn.edu/training.LTAP



SAFETY

Tips for successful traffic safety programs

Motor vehicle crashes are the number one cause of on- and off-the-job unintentional deaths in the United States, making an employee's drive to and from work the most dangerous part of his or her day.

To help combat the number of deaths and injuries caused by vehicle crashes on Minnesota roads, Lisa Kons, continuing education coordinator for the Minnesota Safety Council, encourages employers to incorporate traffic safety policies into company procedures.

In November 2013, Kons gave a presentation detailing tips for how employers can adopt these measures at the Minnesota Toward Zero Deaths (TZD) annual conference in St. Cloud. Minnesota TZD is a statewide traffic safety initiative that aims to reduce injuries and deaths caused by crashes by partnering with state agencies and communities to improve traffic safety measures and provide educational outreach.

In the presentation, Kons urged attendees to work with their law enforcement officials and local engineers to enforce company traffic safety policies.

"We're not just doing it to implement another policy," she said. "We're doing it to save lives and minimize risk of life-altering injuries."

According to Kons, 40 percent of lost work hours are due to traffic-related injuries. An on-the-job crash can cost an employer nearly \$30,000; costs can escalate to more than \$125,000 if the crash

results in an injury. If the crash results in a fatality, it can cost a company up to \$1 million. Crashes also result in rising insurance costs, workers' compensation, and damage to company property.

"Traffic safety programs save lives, minimize the risk of life-altering injuries, and protect your most valuable assets—your employees," Kons said.

Some basic traffic safety measures employers can implement include enforcing seat-belt use and preventing impaired or distracted driving. The policies should apply to all employees of a company, fleet or non-fleet.

Kons encouraged employers to partner with local law enforcement officials, businesses, and other safety organizations to engage all employees in traffic safety campaigns, educational training programs, and safety seminars.

After implementing the policies, Kons said it's important to follow up with employees by holding open meetings to evaluate challenges and



Image courtesy Minnesota Safety Council

successes of the program and communicate future goals.

"Changing your behavior behind the wheel is hard, and working with employers is equally as difficult," she said. "But if you keep at it, it's rewarding. If we work together on this, we will start changing behaviors."

The Minnesota Network of Employers for Traffic Safety has brochures, payroll stuffers, fact sheets, and PowerPoint presentations to help employers implement effective traffic safety programs. To view these free materials and other resources, visit minnesotasafetycouncil.org/NETS. **LTAP**

—Lexi Gusso, LTAP intern

Traffic engineering tools for city engineers

It is a typical Monday morning and the voicemail box is stacked up with messages like cars on I-694 during a snow event. For city engineers, fielding questions from concerned citizens, business people, and government officials is part of the job. But finding the right answer to satisfy those concerns is not always easy.

Mike Spack, president of Spack Consulting Group, and Marc Culver, city engineer for the City of Roseville, took on those in-box inquiries in a lively Q and A at the 2014 City Engineers Association of Minnesota (CEAM) annual conference, offering new insights and lists of online resources to help engineers field queries on everything from stop signs and crosswalks to speeding cars and just who has the right of way anyway?

Here are a few of the most common questions along with some helpful resources. Additional resources are linked from the web version of this article.

Can I get a signal?

There are a lot of political traffic signals out there, Culver said. Before saying yes to a signal request, engineers should evaluate alternatives, such as roundabouts and standard two-way controls.

- MnDOT Intersection Control Evaluation Guidelines: dot.state.mn.us/trafficeng/safety/ice/index.html
- Roundabouts in Minnesota: dot.state.mn.us/roundabouts



How can we control traffic around schools to keep kids safe?

According to the Centers for Disease Control and Prevention, Spack said, car crashes are the leading cause of death for kids under age 18. Too often cities assume the school district will take care of traffic issues. But this is an issue that engineers need to pay attention to and take proactive action to ensure a safe environment for students.

- FHWA Safe Routes to School: fhwa.dot.gov/environment/safe_routes_to_school
- MnDOT Safe Routes to School: dot.state.mn.us/saferoutes/index.html
- Traffic Safety Plans for Schools: spackconsulting.com/docs/traffic_safety_plans_for_schools.pdf

Why can't we have a stop sign here? How many people have to die?!

Everybody thinks that stop signs are going to solve all of their problems. Stop signs have some impact on controlling speed—at the point of the stop sign. But they introduce some other issues, Culver said, including compliance and aggressive acceleration after the stop sign. The *Manual on Uniform Traffic Control Devices* (MUTCD), the bible for traffic engineers, regulates what signs can be posted and where. Engineers who go against the guidelines open their cities up to liability.

- For Minnesota regulations: dot.state.mn.us/trafficeng/publ/mutcd
- For other traffic calming techniques: mn-traffic-calming.org **LTAP**

—J. Trout Lowen, LTAP freelancer

Steering committee update

Bruce Hasbargen of Beltrami County has joined the Minnesota LTAP Steering Committee. He replaces Rick West of Otter Tail County.

Welcome, Bruce! **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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OPERA Spotlight: Traffic control response trailer

Project leader: Troy Grossman

Agency: City of Lakeville Streets Division

Problem: The City of Lakeville Streets Division is responsible for traffic control, street closures, and pedestrian safety in all work zones, for emergency response, and at community events. When streets, sidewalks, or trails need to be closed due to storm debris or flooding, the city must react immediately. The city also has community events throughout the year that require the placement of more than 200 barricades to protect pedestrians and control vehicle traffic. The Streets Division currently has to store these barricades and other traffic control devices at its facility to meet any traffic control needs.



Procedure: Staff measured and weighed the barricades to determine space needs so a correctly sized trailer could be purchased. After creating a plan for how the items would best fit, the city was able to order a trailer and purchase steel for fabricating the storage racks. Streets Division staff performed all of the fabrication and obtained quotes from local body shops to prepare and paint the steel racks.

Results: The completed trailer has helped the city to better store its traffic control devices and to improve its response to traffic control and barricade placement needs. Because of the organization of the components, the city only needs one trailer to place traffic control devices for large events. In the past, two trailers were needed because staff could not stack all of the barricades neatly or safely on one trailer. In addition, the response time for delivery and placement of traffic control devices has been cut in half. Labor costs and time have also been reduced by eliminating much of the required handling time for each barricade.

Approximate cost: \$8,757

OPERA funding: \$8,100

Implementation: The traffic control response trailer was used during the summer of 2013 for community events and exceeded the city's expectations. The city has made some changes to the fastener systems to keep the barricades secure on the racks and is now completely confident in the system.

Status: Complete **LTAP**

OPERA annual report shares low-cost innovations

The LRRB's Local Operational Research Assistance Program (Local OPERA) has published two versions of its 2013 annual report. The short version (16 pages) includes the OPERA projects completed in 2013, such as Lakeville's Traffic Control Response Trailer above. Hard copies are available while supplies last; contact mnltap@umn.edu if you are interested. A longer version (44 pages) also includes the entries from the National LTAP Association's Build a Better Mousetrap 2013 competition. Both are available for download on the OPERA website: mnltap.umn.edu/opera. OPERA project fact sheets, along with the full project reports, are posted on the OPERA website as they are completed throughout the year.

AWARDS

Associations announce annual awards

Each year the City Engineers Association of Minnesota (CEAM) and Minnesota County Engineers Association (MCEA) honor outstanding people and projects. The awards are presented at their annual conferences in January. Highlights are below; details are on the association websites.

City Engineers Association of Minnesota CEAM 2013 Engineer of the Year

Two people received the honor this year: Bill Monk, Chaska's city engineer, and Reid Wronski, city engineer and public works director with River Falls, Wisconsin.

2013 Project of the Year

College Drive Reconstruction in Brainerd. Before the project, this corridor experienced significant delays at approaches and excessive crash rates. Project goals included increasing capacity while being sensitive to the environment, improving access and safety at critical locations, and accommodating pedestrian and multimodal facilities. The project included proactive public relations and notifications, such as weekly construction meetings with involved stakeholders. After project completion, crash rates and crash severity have been significantly reduced, and there has been broad community acceptance of the roundabouts that were added.

2013 Honorable Mention Project of the Year

Duluth Lakewalk East Extension. Because of limited access, an active rail line was used to deliver a 180-foot bridge span to the project site; cranes moved the span directly from rail cars to the bridge abutments.

Tower Road Reconstruction and Extension, Fergus Falls. Innovative features include a roundabout and pedestrian plaza overlooks on a bridge over the Otter Tail River.



Design elements in the College Drive Reconstruction in Brainerd included three roundabouts, bridge deck modifications to allow pedestrian and bicycle facilities, and storm sewer improvements.

Photo courtesy WSB & Associates, Inc.

Minnesota County Engineers Association MCEA 2013 Engineer of the Year

Freeborn County Engineer Sue Miller received the honor. Miller previously was named the Rural County Engineer of the Year at the annual National Association of County Engineers conference in April 2012.

Friend of Minnesota Counties Award

Awards were presented to Kandiyohi Commissioner Harlan Madsen and MnDOT State Aid Special Projects Engineer Rick Kjonaas.

County Highway Safety Award Nobles County

Special Project of the Year Award

Dakota County for the CSAH 23 (Cedar Avenue)/ Metro Red Line Transitway Project

County Project of the Year Award

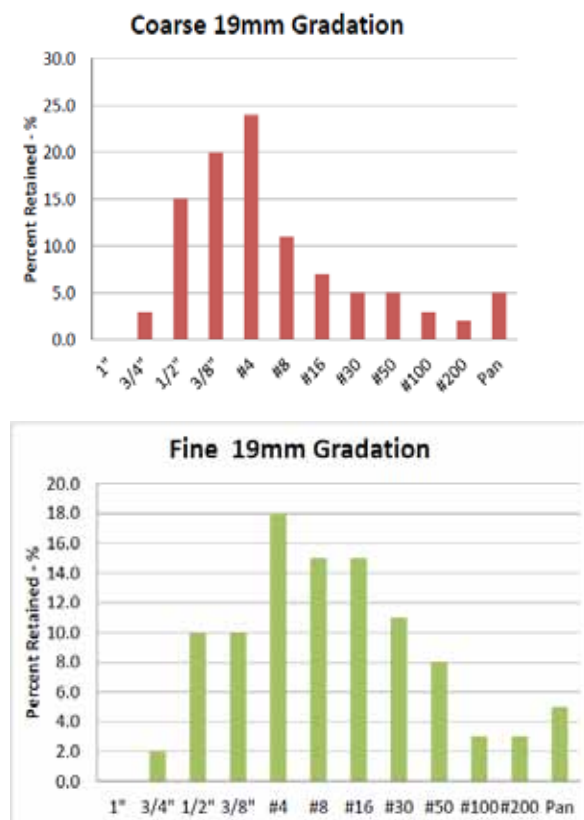
St. Louis County for its CSAH 91 (Haines Road) project **LTAP**

PAVEMENTS

Pavement failure from page 1

Rutting

Dukatatz said incorrect gradation is an important cause of rutting. "Usually we use the 0.45-power graph with the maximum density line plotted to show the mix gradation—but that's not the only way to characterize gradation," he added. As alternatives, he showed these Individual Percent Retained graphs (Figs. 1 and 2) and said they represent stable gradations:



Figs. 1 and 2: Individual Percent Retained graphs representing stable gradations

"If you need more air voids in a coarse-graded mix, you remove fine aggregate—whereas in a fine-graded mix, you add fine aggregate to increase air voids," he commented. "These are steps that move the gradation curve further away from the maximum density line on the 0.45 gradation graph."

Dukatatz said what *won't* work is a "double-humped" gradation (Fig. 3):

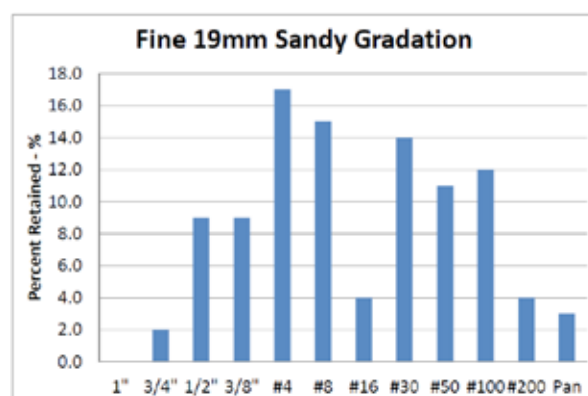


Fig. 3: "Double-humped" gradation

"The high proportion of sand-sized particles (No. 30 – No. 50) tends to lubricate the mix so it ruts."

How the rock is processed to make sand will affect the amount of angularity in the finished product. "More angular is more rut resistant," he explained. "The type of crushing can create either angular or rounded particle shapes. A single pass through the crusher results in angular sand good for asphalt mixes, while multiple passes create rounded sand particles useful for workability in PCC. If the gradation has a double hump, the second hump in the sand sizes will tend to make the mix tender and rut-susceptible. In that case, the mix tenderness occurs regardless of particle shape. So, 100% crushed will not solve tenderness/rutting if the mix has a gradation with a double hump."

Dukatatz stated rules of thumb for the relationship between changes in gradation and changes in air voids:

- 1% change in minus 200 = 1% change in air voids
- 3% change in minus 8 = 1% change in air voids



Photo courtesy Ervin Dukatatz

Inadequate moisture control in the mix can lead to rutting.

- 5% change in minus 1/2 inch = 1% change in air voids

Quality control issues at the quarry

Dukatatz said poor quality control of aggregate stockpiles is another common cause of volumetric problems that can lead to low air voids and rutting. "You need to manage the aggregate piles so you get uniform feed into the plant. Unexpected changes in gradation due to mixed stockpiles result in unexpected mix volumetric changes. In turn, these changes then result in mix problems such as low air voids and rutting or high air voids and raveling."

He said absorption of asphalt by aggregate is another problem that, if not managed, can lead to pavement problems such as rutting. He showed a comparison of two cores with the same aggregate. One made as WMA had little visible absorption of asphalt into the particles. But the other made as HMA showed considerable absorption of asphalt into the particles. "This changes the amount of effective asphalt in the mix," said Dukatatz, "which is the asphalt holding the aggregate together. So, depending on how hot the mix was produced and tested, the same mix could have high, low, or the correct air void content." He added that the amount of asphalt absorption also depends on the source of the aggregate.

Too much or too little moisture in the aggregate

Dukatatz discussed how inadequate moisture control in the mix can lead to rutting. "Plants weigh the

aggregate as it goes into the mix. But if you don't account for the aggregate moisture, the plant controls will add enough asphalt for equivalent weight of dry aggregate and you end up with too much asphalt in the mix. If the plant is run too fast and hot, it removes moisture from the surface of the aggregate but doesn't get the moisture out from the interior of the aggregate. Then in the field, that moisture will make its way to the surface, leading to bleeding."

Raveling

Raveling can result from some of the same problems Dukatatz had discussed with regard to rutting: incorrect mix design and production issues. On the latter topic, he commented on how segregation can occur in stockpiles and other places: "You might have good aggregate storage bins with big concrete dividers to prevent stockpile mixing, but you still have to contend with gravity. Any time you make a pile of materials with different particle sizes, the particles with the most mass are going to roll the farthest. The result is segregation in the stockpile, the paver, or the road."

Cracking

With regard to cracking, Dukatatz focused on improper paver operation. He said it's important to avoid segregation in the hopper: "You need to maintain a consistent head of material in the paver hopper all day as well as consistent mix temperature and a consistent paving speed. It's also important to maintain proper adjustment of the flow gates,

Pavement failure continued on page 6

Richard Ingberg receives Rohrbach Award

This year's Gerald Rohrbach Distinguished Service Award was presented at the TERRA Pavement Conference to Richard C. Ingberg. Ingberg is best known as the innovator of the "Minnesota Heat-Transfer Method" for recycling bituminous material.

After receiving a bachelor's degree in civil engineering from North Dakota State University, Ingberg served in the Air Force as an armament electronics maintenance officer. He was instrumental in improving equipment readiness on planes that carried hydrogen bombs during the Cold War.

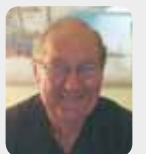
"My military experience showed me how to get things done," he says. "I think that helped when we figured out how to recycle bituminous pavements. A lot of people said our method wouldn't work. Everyone was trying to do it in the dryers used for making the mix. But they would get a lot of smoke, which was unacceptable to the Pollution Control Agency. My experience in the military taught me how to work with people to reach a goal."

Ingberg began his work on asphalt recycling in the 1970s.

"I was working in the MnDOT materials lab. One day, we were talking about how we could make recycling work. I mentioned a class I had taken at NDSU on heat transfer. I said, 'How about if we heat the virgin aggregate hotter than normal and bring the salvaged material together with the virgin material outside the dryer? The heat will be transferred from the hot gravel to the salvaged asphalt material.' So they tried that out in the lab and it worked."

For developing that method, Ingberg received an award from the National Asphalt Pavement Association. His method is the basis for all pavement recycling, worldwide. "After all the meetings and demonstrations we went to," Ingberg says, "when the right idea came along, I thought, 'Well, why didn't I think of that in the first place?!'" **LTAP**

—Richard L. Kronick, LTAP freelancer



Colored concrete pavements: Are they here to stay?

At the TERRA Pavement Conference, MnDOT senior road research engineer Tom Burnham reported on his investigation of early distress in colored concrete pavements. He said colored concrete is growing in popularity and showed several examples where it was used as streetscaping or to delineate paths (Figs. 4 and 5).

Burnham said distress in colored concrete has shown up as early as a few years after placement, and is more common around joints. Figure 6 is a typical example.

Construction practices and core analysis

Burnham reported on his observations of construction methods and concluded that they are probably not the main cause of distress in colored concrete. He also showed core samples taken from several sites in the metro area and pointed out that the cracking found in the cores goes all the way to the bottom of the pavement. He listed the following results from analysis of the cores:

- Most samples had good air void systems—but they were filled up with ettringite crystals, which negates freeze-thaw resistance.
- There were indications of alkali-silica reaction (ASR), which is rare for the typical aggregates used to make concrete in Minnesota.
- Most samples showed concrete with high porosity due to high water-to-cement (w/cm) ratios—up to 0.50.

Pigment analysis

Scanning Electron Microscopy (SEM) and Energy Dispersive X-Ray Spectrometry (EDX) were done on select cores. “Whether the pigment is red or yellow,” Burnham said, “it’s mostly ferric oxide or ferric hydroxide—essentially rust.” One key SEM finding was that magnesium particles, shown as green in Fig. 7, were present throughout the paste.

Burnham said he assumes the magnesium is from magnesium chloride deicer. He showed that the magnesium was dissolving fine aggregate particles and paste.

Laboratory studies

“We tried some mixes to investigate the effects of pigment volume and w/cm ratio on durability—and to see if we could replicate the ASR,” Burnham said. He concluded that w/cm ratios up to 0.43 worked well. “Using the ASTM C666 test [relative dynamic modulus], we didn’t see a lot of degradation,” he added. “So durability isn’t really being affected by the amount of pigment.”



Figs. 4 and 5: Colored concrete for aesthetic purposes and to delineate a path



Fig. 6: Early distress in colored concrete in Centerville, MN

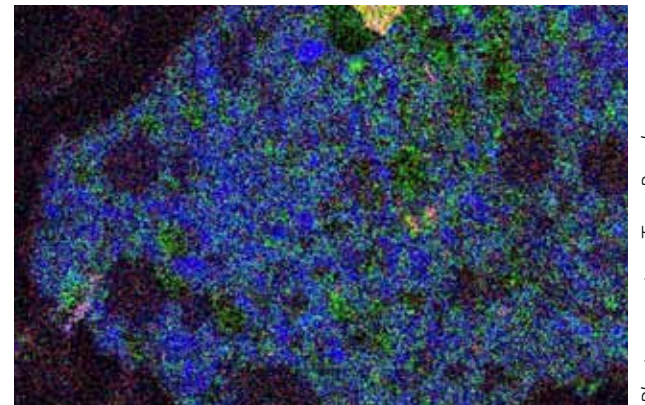


Fig. 7: Magnesium particles (blue) are present throughout the paste, in close approximation to the ferric particles (green).

Photos courtesy Tom Burnham

The ASR testing showed that coarse aggregate was not greatly affected by changing the amount of pigment. “But where it really shows up is in the fine aggregate,” Burnham said. “As soon as you have pigment involved, the expansion of mortar cubes with small aggregate takes off.” He warned, however, that much more testing is needed before conclusions can be drawn about the cause of ASR in colored concrete in Minnesota.

Thermal expansion

Burnham showed examples in which thermal expansion apparently had caused cracking of either the colored concrete or adjacent uncolored concrete. To quantify thermal expansion, he created sidewalk slabs at MnROAD with different amounts of color and instrumented the slabs for temperature and expansion. He found that a light red slab averaged 5% warmer than an uncolored slab but that a dark red slab averaged 35% warmer than the uncolored slab. He cautioned designers to be aware of the

potential for thermal incompatibilities when colored and non-colored concrete are adjacent.

Recommendations

In conclusion, Burnham recommended:

- Limiting use of magnesium-based deicers on colored concrete
- Constructing mixes with w/cm ratios up to 0.43
- Investigating how ASR can be mitigated—perhaps by adding more fly ash into the mixes
- Considering alternatives to full-depth colored concrete:
 - Surface staining
 - Pavement surface marking
 - Colored concrete paving blocks

Burnham’s final report, which will recommend construction specifications, repair techniques, and alternative coloring methods, is planned for release in June 2014. **LTAP**

—Richard L. Kronick, LTAP freelancer

When is the best time to do preventive maintenance on asphalt pavements?

At the February 5 TERRA Pavement Conference, MnDOT research project supervisor Tom Wood discussed a study conducted jointly by MnDOT and the Asphalt Institute (AI). The study’s objective was to determine the best time for preventive maintenance (chip seal) to minimize damage caused by asphalt aging.

The study was begun in 1999 on a section of MN TH 56 between I-90 and Leroy, a two-lane rural highway with about 2,000 ADT. Two end-to-end sections of the highway had been repaved. One was done with cold-in-place recycling and an overlay in 1995. The other was done with mill-and-overlay in 1999.

“Our idea was to chip seal one-mile sections of each of these pavements, one year at a time, and then look at data 15 years after the pavements had been constructed to determine when had been the best time to chip seal,” Wood said. The annual chip seals were placed from 2000 through 2004. One section of the 1995 pavement was left un-chip-sealed as a control.

To assess the results of the preventive maintenance, cores were collected in 2011 from the 1999

sections that were then 12 years old. For each core, the chip seal was removed. Then the top 1 inch and the second 1 inch of the core were sliced off and tested for fracture resistance. In the following graph (Fig. 8), the blue columns represent fracture resistance in the top 1 inch of each core and the red columns represent fracture resistance in the next 1 inch of the same core:

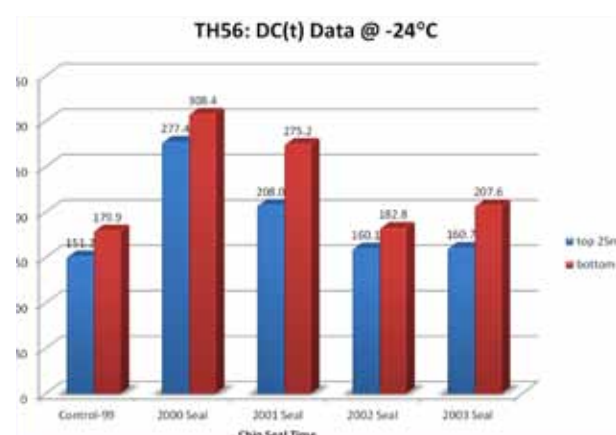


Fig. 8: Fracture resistance in the top 1 and 2 inches of a core

“The section chip-sealed in the first year resisted cracking much better than the control section,” Wood pointed out. “The section that was chip sealed the second year was better than the control, but not as much. The sections that were chip sealed in years 3 and 4 were just barely better. We [MnDOT and AI] conclude that it’s best to do the chip seal the first year. If you wait three or more years to chip seal, there’s very little advantage.”

Wood also showed IRI ride quality measurements of the sections taken from 2004 through 2012. “For the 1995 section, we found that the chip-sealed sections had significantly higher ride quality that equals two to four years longer pavement life than the control (un-chip sealed) section,” he said. “For the 1999 section, we found that the chip-sealed sections had significantly higher ride quality, which equals five to six years longer pavement life than the control section.” **LTAP**

—Richard L. Kronick, LTAP freelancer

COMMUNICATIONS

Social media: It's here to stay

Social media—use it or avoid it? That is a question many project managers are asking these days. Twitter and other social media tools can be effective for communicating with residents and others before, during, and after a project, but social media has some pitfalls as well, according to three panelists participating in a social media session at the 2014 City Engineers Association of Minnesota (CEAM) annual conference.

@169

The City of Minnetonka explored using Twitter on two recent projects, the expansion of the interchange at Highway 169 and Bren Avenue (@169) in the summer of 2011, and a residential road reconstruction project (@MtkaSparrowRd) in 2013.

Minnetonka has had its own Twitter feed since 2008, but @169 was the first time the city had tried integrating Twitter into project management, said Jacqueline Larson, Minnetonka's community relations officer. Overall, the results were positive, but there was a learning curve.

The Hwy. 169 interchange expansion had a lot of challenges, Larson said. About 100,000 vehicles pass through the corridor each day. And the area is home to the offices of some major corporate stakeholders. "We really wanted to keep commuters and private partners happy," she said.

@169 helped keep commuters updated on developments in real time, but it was just one piece of the city's communication strategy. Information was also posted on the city's web page, including contact information for project and city officials, maps, plans, and schedules.

Garnering 1,500 page views, a video of the overpass demolition proved to be one of the most popular items. "I think it's still the best-viewed video of anything on our city website," Larson said.

Although the @169 Twitter feed netted only about 200 followers, the city took lessons learned from that project and applied them to the Sparrow Road reconstruction last summer.

@MtkaSparrowRd

The rebuild of Sparrow Road had all of the challenges inherent in any residential road reconstruction and one more. The 185 households living on the road had just two entrances/exits.

"It was a very disruptive project," Larson said. "We felt it was really critical to give them timely updates."

The city put the project coordinator, who was on site daily, in charge of the Twitter feed. @MtkaSparrowRd netted 81 followers and was an effective tool for fielding residents' questions, cutting down time spent responding to phone calls and on-site inquiries, Larson said. But Twitter couldn't reach everyone, and it was clear the city needed to use multiple communication strategies, including print, web, and e-mail to keep residents informed.

Larson offered some other lessons learned:

- Be consistent. Provide updates regularly.
- Stay current. Busy days require more tweets, even if you're busy too.



"We make sure we've got engaging pictures and then weave in educational information in the captions of those pictures."

—Jessica Wiens

- Always, *always* make sure the information you're sending out is correct.
- Don't be a robot. Inject your personality and a little humor into your tweets.
- Respond quickly to questions.
- Use common sense. Your organization's brand is at stake.
- Tweets are forever.

@stcroixcrossing

Replacement of the Stillwater lift bridge over the St. Croix River is the "perfect storm" for testing the success of social media, said Jessica Wiens, public affairs coordinator for the MnDOT project.

Long before the actual work began, the highly publicized bridge replacement was already a hot topic of conversation, Wiens said, and there are a number of interested audiences, including local residents, commuters, area businesses, and weekend vacationers. Bridge building also offers a lot of good visuals, she said, which is key to getting and keeping followers.

Construction runs through 2016, but in terms of social media, a few trends have already emerged, Wiens said. For example, different social media tools attract different audiences. Community members turn to Facebook. The news media prefers the immediacy of Twitter. Pictures really are worth a thousand words. "We make sure we've got engaging pictures and then weave in education information in the captions of those pictures," Wiens said.

Wiens offered some other tips for keeping followers engaged:

- Post user-generated frequently asked questions with answers.
- Post timely information written in everyday language. (Engineers may need help from communications staff.)

- Provide unique access to the project. People love seeing pictures of things they can't see on their own.

Things that do not work:

- Posts with no pictures—*boring*.
- Photos that show employees doing something wrong. (One photo posted on Facebook showed an employee doing something that did not comply with OSHA safety guidelines.)

In addition to practical concerns, Laura Kushner, director of human resources at the League of Minnesota Cities, said using social media also raises some legal concerns for employees and employers.

- Employees who overshare. One young woman lost her job after posting news on Facebook about a new job offer.
- Release of private data. The League has gotten a number of calls about volunteer EMTs, firefighters, and police posting about calls on Facebook. While not technically a release of private data, many of these posts have required policing.
- Productivity and morale. Even untrue rumors about layoffs or other work-related issues can cause a lot of damage.
- Legal protections. Employees do have some Constitutional rights associated with free speech. In order to be protected speech, however, the employee has to be speaking as a private citizen on a matter of public concern. The employee's interest as a citizen has to outweigh the city's interest in delivering efficient government services. **LTAP**

—J. Trout Lowen, LTAP freelancer

Pavement failure from page 4

auger load, and auger height to prevent thermal segregation."

Then he discussed problems with RAP and RAS. He showed research illustrating considerable variability in the high and low true temperature grades of RAP and RAS samples taken from different regions of Wisconsin. He summarized studies conducted on the aging characteristics of binders that include RAS. "They found that it's important to watch the RAS/RAP ratio and the mix results after aging. An unaged mix made with PG 52-34 asphalt, 5.4% RAS, and 5% rejuvenating oil tested the best of several samples in the Texas Overlay tester for cracking resistance. But the same mix with the rejuvenator, after five days of aging, performed as poorly as any of the other

RAS combinations tested. All the RAS combination mixes produced poorer results—fewer cycles to failure—than the aged and unaged virgin mixes and the mixes made with RAP. They also tested cores taken from I-94 for shear modulus. Samples with a higher proportion of RAS to RAP tested significantly stiffer than the samples with a lower proportion. Correspondingly, the pavement with the higher percentage of RAS exhibited significantly more cracking than the sections with lower percentages." **LTAP**

—Richard L. Kronick,
LTAP freelancer

SNEAK PEEK:

We'll have more articles from the pavement conference and the Dust Control Institute's pre-conference workshop in our next Exchange.

Conference materials online

Presentation slides and selected videos are available from the Transportation Engineering and Road Research Alliance (TERRA) Pavement Conference at terreroadalliance.org.

TERRA sponsored the conference in cooperation with CTS, the U of M Department of Civil Engineering, the Minnesota Local Road Research Board, the City Engineers Association of Minnesota, the Minnesota County Engineers Association, MnDOT, Minnesota LTAP, the Minnesota chapter of the American Public Works Association, and the Minnesota Street Superintendents Association. **LTAP**

THE SHELF

Links to these publications and many more are on the LTAP website. Questions? Contact Marilee Tuite, Minnesota LTAP librarian, 612-626-8753, ctslib@umn.edu.

Culvert Repair Best Practices, Specifications and Special Provisions (MnDOT)

These guidelines will help engineers make better decisions on culvert repairs, including replacement and rehabilitation.

Implementation of TONN 2010 (MnDOT)

This report describes the implementation of the TONN 2010 analysis method for estimating spring load capacity of roads using pavement structure and traffic data, and results from the falling weight deflectometer. The resulting tool is a spreadsheet that combines the work of two other research projects, the FWD Viewer Tool and the TONN 2010 analysis.

Implications of Modifying State Aid Standards: Urban Construction or Reconstruction to Accommodate Various Roadway Users (MnDOT)

This report focuses on developing guidance for design decisions to best balance the competing needs and accommodate all expected roadway users as non-motorized modes of transportation increase.

Evaluation of Winter Pothole Patching Methods (Ohio DOT)

This report evaluates the performance and

cost-effectiveness of the tow-behind combination infrared asphalt heater/reclaimer patching method and compares it to the throw-and-roll and spray-injection methods.

Self-Consolidating Concrete: A Synthesis of Research Findings and Best Practices (Connecticut DOT)

This report discusses specifications of self-consolidating concrete.

Effect of Flaggers and Spotters in Directing Work Zone Traffic for Illinois Expressways and Freeways (Illinois Center for Transportation at the University of Illinois)

This report focuses on assessing the effectiveness and role of flaggers and spotters in directing traffic in work zones that have a speed limit greater than 40 mph.

Coordinated Pre-Preemption of Traffic Signals to Enhance Railroad Grade Crossing Safety in Urban Areas and Estimation of Train Impacts to Arterial Travel Time Delay (Florida DOT)

This report investigates the potential for using advanced features of traffic signal system software platforms as a way to alleviate problems at highway-railroad at-grade crossings and adjacent arterials.

Comprehensive Study to Reduce Pedestrian Crashes in Florida (Florida DOT)

This report explores pedestrian safety on Florida's state roads by identifying crash patterns and contributing factors, and then proposing potential countermeasures to reduce pedestrian crashes.

Effects of Various Asphalt Binder Additives/Modifiers on Moisture-Susceptible Asphaltic Mixtures (University of Illinois Center for Transportation)

This report investigates effects of additives and modifiers such as liquid anti-strip and hydrated lime on the moisture susceptibility of asphalt concrete.

Misinformation Contributing to Safety Issues in Vehicle Restraints for Children: A Rural/Urban Comparison (Mountain-Plains Consortium, part of the Upper Great Plains Transportation Institute at North Dakota State University, Fargo)

This report explores health care providers' knowledge of child passenger safety issues.

Search me

The Minnesota LTAP website features custom search engines to help you find information. You can search:

- LTAP & TTAP Centers
 - State DOTs
 - Transit agencies
 - University transportation centers
- Bookmark www.mnltap.umn.edu/publications/library.

Another great resource is MnDOT Library's catalog, which includes resources from CTS.

Bookmark dot.state.mn.us/library.LTAP

Safety Performance Functions for Freeway Merge Zones (Colorado DOT)

This report documents the safety performance function development for ramp-freeway merge zones categorized as isolated, non-isolated, and weave. **LTAP**

Roundabouts: new fact sheets

Several new fact sheets are available about roundabouts:

- *Safety and Risk in Modern Urban Roundabouts* (January 2014) is a four-page research brief from the Center for Transportation Studies. It describes findings from two University of Minnesota research studies—one on bike and pedestrian risks at roundabouts, and the other about the effects of signing and striping. Available at cts.umn.edu.
- *Accommodating Trucks in Roundabouts* (TERRA, 2013) provides an overview of a roundabout truck study sponsored by the Wisconsin Department of Transportation and the Minnesota Department of Transportation. The study looked at current design practices, gathered feedback from the trucking industry, and developed guidance and recommendations for accommodating trucks at multilane roundabouts. Available at terreroadalliance.org.
- *EDC Intersection Interchange Fact Sheet 21st Century Solutions*, from the Federal Highway Administration's Every Day Counts initiative



Photo courtesy Nicola Harger

(2013), describes several proven techniques to improve the safety of intersections by strategically eliminating or relocating left-turn conflicts: roundabouts, diverging diamond interchanges, displaced left-turn intersections, and u-turn intersections. Available at fhwa.dot.gov/everydaycounts. **LTAP**

MnDOT updates field manual for temporary traffic control

MnDOT has updated the *Temporary Traffic Control Zone Layouts Field Manual*. The revised edition contains typical traffic control layouts that all state, county, and city roadway operations staff should use. Although the field manual is contained in the *Minnesota Manual on Uniform Traffic Control Devices*, a separate printed document is available. You can download the complete manual or view/print by section at dot.state.mn.us/trafficeng/publ/fieldmanual. **LTAP**

Clear Roads publishes toolkit, toxicity report



Several new materials are available from the Clear Roads pooled-fund project: clearroads.org. This ongoing research program, currently led by MnDOT, has 26 member states and is funding practical, usable winter maintenance research.

- *Cost-Benefit Toolkit*. This web-based toolkit takes the guesswork out of evaluating winter maintenance investments. It facilitates cost-benefit analysis for 21 different winter maintenance materials, equipment, and methods. A user's manual and training videos help you get started.
- *Results from Determining the Toxicity of Deicing Materials*. This research project evaluated and ranked the toxicity of several deicing chemicals. The final report, a two-page summary, and a video of the final presentation webinar are all available. **LTAP**

Complete Streets guidebook offers insights for implementation

To help Minnesota practitioners implement Complete Streets in their communities, University of Minnesota researchers have published a guidebook filled with practical insights and best practices. The guidebook—*Complete Streets from Policy to Project: The Planning and Implementation of Complete Streets at Multiple Scales*—explores what it takes to successfully move Complete Streets from concept to implementation.

The guidebook is based on research funded by the Minnesota Department of Transportation and the LRRB. The guidebook explores policy, process, design, maintenance, and funding approaches. It includes six best practice areas that range from project delivery to promotion and education. The guidebook also presents key examples in each best practice category.

The guidebook is available at cts.umn.edu. **LTAP**



Photo courtesy Carissa Schively Slotterback

WORKSHOPS & TRAINING

Calendar

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

Gravel Road Maintenance and Design

(1 RS required credit) **LTAP**

Apr. 24, Brainerd
Apr. 28, Hutchinson

American Public Works Association—Minnesota (APWA-MN) Chapter Spring Workshop

May 7–9, Nisswa

AirTAP Wildlife Control Workshop

May 14, Minneapolis

Concrete Pavement Rehabilitation for Local Streets and Roads (2 RS elective credits) **LTAP**

May 14–15, Arden Hills

Minnesota Roadway Maintenance Training and Demo Day (1 RS elective credit) **LTAP**

May 15, Alexandria

Underground Utilities Construction Inspector School (APWA-MN)

May 20, Richfield

25th Annual CTS Transportation Research Conference

May 21–22, St. Paul

Truck-Weight Compliance Training

(1 RS elective credit) **LTAP**

Starting again in fall

Toward Zero Deaths Annual Conference

Nov. 13–14, Duluth

APWA-MN Fall Workshop (1 RS elective credit) **LTAP**

Nov. TBD

From Line to Leadership: Transitioning from Operations to Supervision (1 RS required credit) **LTAP**

Fall TBD

Snowplow Simulator Training (0.5 cr) **LTAP**

Fall TBD

ONLINE TRAINING

Gravel Road Maintenance and Design

(1 RS required credit) **LTAP**

Work-Zone Safety Tutorial **LTAP**

Turfgrass Pathology (1 RS elective credit) **LTAP**

Archived webinars:

- **Gravel Roads: Drainage Maintenance and Design (1 RS elective credit) **LTAP****
- **Local Concrete Flatwork Specifications (1 RS elective credit) **LTAP****
- **ADA Transition Plan Requirements: A Model Plan for Local Agencies (1 RS elective credit) **LTAP****

Roads Scholar credit

You can earn credits in Minnesota LTAP's Roads Scholar (RS) program by attending LTAP and CTAP workshops and other cosponsored events. To learn more or enroll in the program, visit mnltp.umn.edu/roadsscholar.

LTAP workshops

LTAP workshops, along with events cosponsored by Minnesota LTAP, are marked with an **LTAP** at left. Check the web for details and to register online: mnltp.umn.edu/training. To be added to our print or electronic mailing lists, e-mail mnltp@umn.edu or call 612-625-1813.

CTAP workshops

Circuit Training and Assistance Program (CTAP) workshops bring LTAP services to your neck of the woods. CTAP uses a fully equipped van to provide on-site technical assistance and training. Each CTAP workshop earns **0.5 RS elective credit**. Current CTAP training courses and special presentations are:

- Asphalt Pavement Maintenance and Preservation
- Culvert Installation and Maintenance
- Gravel Road Maintenance / Dust Control
- Roadside Vegetation Management and Erosion Control
- Snow and Ice Control Material Application
- Snowplow Controller Hands-on Workshop
- Work-Zone Traffic Control and Flagger Training

For more information or to schedule classes, call the CTAP instructor, Kathy Schaefer, at 651-366-3575, or e-mail Kathleen.Schaefer@state.mn.us. **LTAP**

Monitoring the condition of gravel roads

Various tools and systems are available for monitoring pavement conditions. Some of these same tools—such as ground-penetrating radar (GPR)—are also being used to assess the condition of gravel roads. David Rettner, senior vice president and principal engineer with American Engineering Testing, Inc. (AET), gives us some background.

What is AET's experience with gravel road assessment?

"Our primary work has involved roadway assessments in areas where wind farms are under construction. AET has been performing this type of work throughout the country for about five years. However, what we do is also applicable for any agency that has a gravel road system to manage. For example, agencies can use the information to compare the performance of different surfacing or maintenance methods."

How are developments such as wind farms affecting gravel roads?

"With wind farm development, heavy truck traffic is very concentrated for a relatively short period of time, about four to eight months. Low-volume gravel roads are not constructed to withstand that type of traffic, so a significant amount of rutting can occur, both in the gravel surface and in the subgrade. Subgrade failures mean pronounced potholes. Repairing them is much more involved than just putting down gravel—you have to remove 1 to 3 feet of subgrade."

What assessment services can AET provide?

"Evaluation could include condition surveys, falling weight deflectometer (FWD) testing, GPR, and soil borings. Costs range from \$500 to \$1,000/mile depending on project size."

How does AET work with counties and townships?

"We work with the wind farm developers, and then we share information with local agencies, primarily counties and townships. We've worked on a number of projects in southwest Minnesota, including ones in Jackson, Martin, and Rock Counties."

What rating systems do you use?

"Several, depending on the project. The Pavement Condition Index (PCI) is one. PCI is based on a visual survey of a pavement, and the resulting analysis gives a numerical value between 0 and 100. The Pavement Surface Evaluation and Rating (PASER) system uses a 1 to 10 scale and is simpler, faster, and a little less expensive. We use whatever a county is comfortable with. The data can be converted."

What new tools are on tap?

"We're looking at more automation using accelerometers and lasers. These tools are more expensive, however, so before investing in them, we want to take a hard look. Development can be spotty, depending on the financial incentives for wind farms."

For more information

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