Chains, blades, and fire have been among the most common and useful tools for centuries, especially for building and maintaining roads. But even with today’s improvements, use of such tools can be ineffective or, at worst, turn deadly in a heartbeat without adequate training.

One place for local transportation agency personnel to get this important training is the Minnesota Roadway Maintenance Training and Demo Day, an annual offering from Minnesota LTAP.

### By your, boomers...Is your organization ready?

Half of the current workforce is or will become eligible for retirement over the next 10 years. Who will replace them? Has your organization been thinking about workforce recruitment, training, and retention?

Leaders from across the country developed a cohesive strategic framework for addressing these challenges at the National Transportation Workforce Summit held last year. A summary of the summit identifies four critical issues:

- **Demographic changes:** Baby boomers are retiring and taking specialized knowledge and historical perspective with them.
- **Career awareness and training:** Students often make decisions about which careers they will pursue before they learn about transportation.
- **Career transition and training:** Health and safety are high priorities.
- **Career development and training:**"Morning is the best time to plant a tree. Afternoon was the best time to plant a forest."  

### Long live concrete pavements!

“We can achieve the goal of pavements that last 40 years or more,” said Shiraz Tayabji, a featured speaker at this year’s TERRA Pavement Conference in February.

“The technology already exists,” Tayabji said. “The challenge is to apply what we know consistently in design, materials, construction, maintenance, and rehabilitation. Pavements should not exhibit premature failures or materials-related distress. We should be able to maintain desirable ride and surface texture characteristics with minimal intervention; we shouldn’t need to reseal joints every six or seven years. Pavement failure should result from traffic loading.”

Tayabji, a senior consultant for Fugro Consultants, Inc. of Columbia, Maryland, and a member of FHWA’s Advanced Concrete Pavement Technology Products Program team, outlined strategies for achieving long-life concrete pavements. He prescribed the more detailed goals for concrete pavements shown in Table 1.

### Table 1: Goals for concrete pavements of 40+ years

<table>
<thead>
<tr>
<th>Distress</th>
<th>Desired Value Near End of 40+ Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cracked slabs</td>
<td>Maximum 10 to 15%</td>
</tr>
<tr>
<td>Faulting</td>
<td>0.25 inch or less (some agencies now specify 0.15 inch, max.)</td>
</tr>
<tr>
<td>Smoothness</td>
<td>IRI of 150 to 180</td>
</tr>
<tr>
<td>Spalling</td>
<td>Minimal</td>
</tr>
<tr>
<td>Materials-related distress</td>
<td>None</td>
</tr>
</tbody>
</table>

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**Boomers continued on page 4**

**Long live concrete pavements continued on page 6**
Getting smart about ITS

Intelligent transportation systems (ITS) — broadly defined, the application of technology to the transportation environment — are helping communities improve traffic safety, increase mobility, and boost efficiency, and at significantly lower costs than rebuilding or replacing transportation infrastructure, according to presenters at the annual meeting of the City Engineers Association of Minnesota in January. From crosswalk enhancements to surveillance cameras to traffic signals and traffic detectors, intelligent transportation systems are helping to reduce the number and severity of crashes and capturing traffic data to keep systems flowing smoothly and safely, said Eric Minge, vice president of ITS Minnesota and a principal at SRF Consulting Group, Inc.

But the systems now in operation in Minnesota and elsewhere are just the beginning, Minge continued. On the near horizon, he said, will be vehicles that communicate in real time with the vehicles around them, vehicles that drive themselves, adaptive traffic signals, and coordinated management of multimodal travel that will empower users to take the most efficient route to a destination, regardless of mode.

Already, ITS technologies are improving safety on Minnesota highways and in local communities, Minge said. Intersection collision warning systems (ICWS) and deer detection systems are reducing collisions in rural areas, and dynamic curve warning systems are providing a wake-up call for drivers.

Intersection collision warning systems have proven effective at reducing crashes at several high-crash intersections around the state, Minge said. A variety of ICWS systems are already in use at more than a dozen intersections. The electronic signs operate in real time, monitoring oncoming traffic and alerting drivers when it is safe to turn onto or cross the highway. Under a MnDOT program, at least 20 and up to 50 additional rural intersections will be equipped with warning systems in the next several years.

Deer detection warning systems are replacing some of the familiar yellow, diamond-shaped deer crossing signs on the state’s rural roads. The warning systems use motion sensors to detect the presence of deer in roadside ditches; flashing beacons then alert drivers of approaching animals. MnDOT installed the first warning system six years ago just outside of the City of Marshall near Camden State Park, in an area with a high population of deer. The department reported a 57 percent drop in deer vehicle collisions in 2008, and a 33 percent reduction in 2008, Minge said.

On other roads, dynamic curve warning systems use radar to determine vehicle speeds; flashing chevrons then get drivers’ attention, reducing red lights and rollovers. These solar-powered systems offer a relatively low-cost way to improve safety in high-crash areas, Minge said.

Pedestrians in several Twin Cities suburbs are getting a little extra protection thanks to in-pavement LED lights and radar-activated stop signs at crosswalks. The communities of St. Anthony and Bloomington are using the technology to improve crosswalk safety near schools.

Janelle Borgen of WSB Associates worked with the village of St. Anthony to install LED lights at a mid-block crosswalk used by middle and high school students. State law requires drivers to stop for pedestrian in crosswalks, but many drivers fail to stop, especially for mid-block crossings, Borgen said. A traffic count at a mid-block crosswalk near the schools found as many as 49 percent of vehicles failed to stop.

To improve compliance, the city installed directional LED lights in the pavement at the crosswalk, much like lights in use at airports, along with a radar-activated blinking stop sign. The flashing yellow lights on the blinking stop sign are clearly visible in daylight and at night, Borgen said. Although no follow-up study has yet been done, anecdotal evidence suggests the lights are making a difference, she added.

In a similar situation, the City of Bloomington augmented pedestrian crossings with rectangular rapid flashing beacons (RRFBs) at two locations, near a high school and at a mid-block crossing used by middle and elementary school students near the I-35W corridor. The RRFBs are activated by a curbside push button that alerts drivers to the presence of pedestrians in the crosswalk. Studies by the Federal Highway Administration and the Texas Transportation Institute show RRFBs can boost driver compliance at crosswalks to more than 90 percent, said Amy Marohn, traffic engineer for Bloomington.

“It’s a very vivid notification to drivers that there is a pedestrian there right now,” she added.

For additional ITS resources, visit these websites:

• USDOT’s Research and Innovative Technology Association: rita.dot.gov
• Intelligent Transportation Society of America: itsa.org
• U of Minnesota ITS Institute: its.umn.edu
• Minnesota GuideStar: dot.state.mn.us/guidestar

LTAP

—J. Troun Lowen, LTAP freelancer

Intersection collision warning systems have reduced crashes at several high-crash intersections around the state.

LTAP welcomes new Steering Committee member

Rich Sanders, the county engineer in Polk County, has joined the Minnesota LTAP Steering Committee, replacing Doug Grindall (see article on page 4 for Doug’s words of wisdom). Welcome, Rich, and thank you, Doug!

Technology Exchange

The Minnesota Local Technical Assistance Program (LTAP) is a component of the Federal Highway Administration’s Local Technical Assistance Program (LTAP) program, funded with federal and state funds for state and local governments. LTAP programs are administered by the University of Minnesota’s Center for Transportation Studies. The Minnesota LTAP program is funded by the MnDOT and the University of Minnesota’s MnROAD Research Road and the Minnesota Department of Transportation.

The University of Minnesota is committed to the policy that all persons shall have equal access to its programs, facilities, and employ-

ing without regard to race, color, creed, religion, national origin, sex, age, marital status, or disability. LTAP welcomes applicants or employees with disabilities. LTAP is a member of the Minnesota Higher Education Partnership and is part of Minnesota LTA P, a network of nearly 75 local technical assistance programs, including Minnesota’s 25 LTAP programs. LTAP is a member of the Minnesota LTA P Steering Committee.

Rich Sanders, county engineer in Polk County, has joined the Minnesota LTAP Steering Committee, replacing Doug Grindall. Welcome, Rich, and thank you, Doug!
OPERA Spotlight: Skid Loader Bituminous Screed

Project leader: Lonn Jackels
Agency: Murray County Highway Department

Problem: Murray County was disappointed with the quality of its bituminous patching over large areas. Often, the patches had poor ride quality and uneven lane thickness. In addition, maintenance crews had to move large quantities of bituminous mix by hand when working on large patches. The county needed a better way to handle large, lane-width patching operations that would also improve the resulting ride quality.

Solution: The county built a wide-screed skid loader attachment to bridge the patch over a wider area. The screed slides on hydraulically maneuverable skids that can be raised or lowered depending on the desired thickness of the patching material.

Procedure: The screed attachment is used after the hot mix has been placed in the area to be patched. Murray County uses the attachment to level the patch area—first by making a few passes back and forth to rough out the bituminous mix and then completing a final pass to leave the area just high enough to compact. To achieve the desired thickness for each side of the screed attachment, separate operators independently control the hydraulic skids. The skid loader operator maintains the proper angle for the attachment as well as speed and direction.

Approximate cost: $6,340
OPERA funding: $4,000
Implementation: Murray County used the screed attachment effectively for a few large patches in the fall of 2012, and it expects proficiency to increase with additional time and use.

Status: Complete
Agency: Murray County Highway Department

LTAP

Fact sheets online
The Exchange regularly highlights projects completed under the LRRB’s Local Operational Research Assistance Program (Local OPERA). Project fact sheets, along with the full project reports, are posted on the OPERA website as they are completed throughout the year. All are available at mnltap.umn.edu/opera.

New LRRB video showcases stormwater management techniques
The LRRB has released a new video: Choosing Stormwater Management Practices: A Decision Tree for Minnesota Cities and Counties. It introduces seven management practices that local government agencies may use to meet state and federal stormwater regulations. Based on an LRRB guide to stormwater best management practices, the 14-minute video shows examples of various BMPs as local engineers explain how they have used them to keep stormwater pollutants out of Minnesota lakes and streams.

More resources:
- Decision Tree for Stormwater BMPs guide (2011RIC01CO), two-page technical summary (2011RIC01TS), and PowerPoint (2011RIC01PP)

Correction: CEAM Award
The spring 2013 Exchange article titled “Associations Announce Annual Awards” incorrectly cited the participating partners for the City Engineers Association of Minnesota (CEAM) Project of the Year Award. The correct information is:
City of Maple Grove’s 2012 Bass Lake Road Reconstruction Project from CSAH 101 to Vicksburg Lane. Maple Grove was the lead agency and contracting authority throughout the project, while Hennepin County partnered in funding the project. In addition, SRF Consulting Group, Inc. prepared preliminary and final design plans and construction administration services.

We regret the error.

Slagle receives NACE award
Cory Slagle, Washington County’s engineering and construction manager, has been awarded the National Association of County Engineers (NACE) 2012 Project Manager of the Year Award. The award was announced April 24 at NACE’s Annual Meeting and Management and Technical Conference in Des Moines, Iowa.

Slagle received the award in recognition of his work on the Broadway Avenue reconstruction in Forest Lake. The complex three-year project, which improved safety and mobility, was the largest ever undertaken in county history. Features include a new crossing over Interstate 35, two pedestrian bridges, and a roundabout.

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Career advice from a Minnesota retiree

One local example of the wave of retirees is long-time Koochiching County Highway Engineer Doug Grindall, who retired in March. In the position for 36 years, Grindall was one of the longest-serving county engineers in the state. He is now working as a sales engineer for a consulting firm.

Grindall also served on Minnesota LTAP’s Steering Committee since 1995. He often livened up meetings with humorous tales of his experiences. Below he shares some advice for potential county engineers:

Why would I encourage young engineers to consider a career as a county engineer?

• “You can basically pick any place to live in Minnesota if an opening occurs and you are the most qualified.
• You have the satisfaction of guiding the improvement of the transportation system within a county (with the approval of the county board). Seeing a project reconstructed after years of planning is always a great feeling of satisfaction.
• There is so much variety in the job that time goes by very quickly. I can remember coming in the office in the morning with my "to do" list and finding that many, if not most of the items, didn’t get completed or even started by the end of the day due to other issues coming up.
• You get to be outside as much as you can fit into your work schedule.
• You will have the opportunity to meet many great engineers during your career. You can count on them to keep you from reinventing the wheel, as many of them have been there done that. Many of them will become your very close friends whom you will not only work with on committees, but you will also get together after hours for recreational activities with them and their families. The bond becomes almost as great as family. I cannot say enough good things about my fellow county engineers and their assistants, and I am pleased with the group that will take over the reins as us older engineers retire. They are generally more computer savvy than us old dinosaurs.
• You will have the opportunity to meet the community leaders in your county.”

How can students/young professionals prepare to be a county engineer?

• “You have to enjoy math and science classes in high school. Next, get a good foundation in college with classes in soils, bituminous, concrete, hydraulics, hydrology, structures, etc.
• Passing the registration exam is mandatory for anyone serving the public.
• Paying your dues by working many years as an assistant engineer would definitely help. An option would be working for a consulting firm that does work for counties and/or cities. Also starting out in a state highway department and taking advantage of the opportunity to rotate through several divisions is a great way to gain experience. Initially you may not become a county engineer in an area you truly love until you have the years of experience to become the most qualified for the position.
• Communication skills, both oral and written, are mandatory.
• Get used to the fact that not everyone is going to agree with your point of view, and be willing to compromise when necessary. Keep in mind that the county board may not always be right, but they are always the boss. Plan on updating your resume when you can no longer accept that fact.
• There will be peaks and valleys during your career, as there are with any jobs. Learn to roll with the punches. Some days you will be the dog, some days you will be the hydrant.
• If you don’t like dealing with the public, you should continue searching for a job you really like.”

Read more of Grindall’s wit and wisdom—including what he found most rewarding about his job and how the job changed over the years—in the web version of this article. He also shares some humorous stories. “Every county engineer has similar stories that would make a good book for publishing if they were all put together,” he says. LTAP

Boomers from page 1

• New technologies: More technologically savvy systems operators and managers are needed.
• Rising demand on transportation agencies: Broader responsibilities require a workforce with a wider range of technical and non-technical experience.
• Because the transportation workforce requires a range of skills and abilities, a single approach to recruitment, training, and retention is not sufficient, the report says. For example, change management, interpersonal, and collaboration skills are a higher priority for workers in supervisory roles, while specific technical training is necessary for specialty occupations. Similarly, tactics for attracting single parents, immigrants, and the Generation Y workforce to transportation careers may vary from traditional recruitment campaigns.
• Summit participants created a framework for action and set overarching goals for workforce development, including:
  • Reaching out to the future transportation workforce.
  • Increasing interest and training for secondary careers in transportation.
  • Increasing transportation degree, credit, and skill portability.
  • Expanding transportation workforce access to post-secondary education.
  • Improving student readiness for the transportation workforce.
  • Increasing transportation workforce retention in underserved populations.
  • Accommodating an aging and multi-generational transportation workforce.
  • Adapting to the constant technological advances in the transportation industry.
• Leaders also recommended that the current workforce mentor students and new employees—not only to teach them valuable skills, but also to welcome them into the industry.

The 28-page summary is available at cutcworkforce.com/about. LTAP

Capturing boomers’ knowledge

Not only are baby boomers leaving the workforce: they’re taking their knowledge with them.

An August 5, 2011, article in BusinessWeek—“Intelligence Lost: The Boomers are Exiting”—encourages leaders to ensure that all that experience and intellectual capital doesn’t leave along with retirees.

The article gives tips for extracting and archiving key information from older workers, such as:

• Setting up a database for collecting information.
• Encouraging interaction between the generations.
• Hosting formal and informal events to bring people together.
• Using social media and online tools.

LTAP

Minnesota LTAP is offering a “From Line to Leadership: Transitioning from Operations to Supervision” workshop with Hennepin Technical College this fall. Stay tuned to mntap.umn.edu for news.

50% of the current workforce is or will become ELIGIBLE FOR RETIREMENT OVER THE NEXT 10 YEARS.
R o a d s  S c h o l a r s  h o n o r e d  a t  g r a d u a t i o n  c e r e m o n y

The latest graduates of the Roads Scholar program received a certificate of achievement during a ceremony at the 2013 Minnesota Roadway Maintenance Training and Demo Day in Rochester. “We value and appreciate the time and energy they’ve invested,” said Jim Grothaus, Minnesota LTAP’s director. “Today we honor students who have recognized the value and benefit of sharing transportation knowledge, improving skills, and putting research and new technology into practice.”

Comments from our new Roads Scholars:

“I used ideas from the Roads Scholar program for storm pods. We were able to bring these ideas to our bosses and lay it out there for them. The ideas we got from this program were the most helpful for me. Because of this program, we also started using geo-linking fabric that we never used before.”
—Keith Raines, City of Shakopee

“I was able to take away a lot of things from the program to use in my work life. I really liked the GPS class, for trucking. It was very practical. I’d highly recommend the program. There were many different classes, and the program covered a lot of topics.”
—Todd Majerus, Goodhue County

“The blacktop classes helped me the most. They were relatable to what I do. It’s a good program, and a lot of information is in the classes.”
—Jamison Thes, City of Shakopee

The Roads Scholar Program

The Roads Scholar Program combines a range of training options into a structured curriculum. To become a Roads Scholar, participants must earn eight credits within five years from a combination of required and elective courses. Training options include LTAP workshops, Circuit Training and Assistance Program workshops, and other events. For more information, contact Mindy Carlson, Minnesota LTAP program manager, at 612-625-1813, mnltap@umn.edu, or visit mnltap.umn.edu/RoadsScholar.

ROADS SCHOLAR GRADUATES FROM 2005 TO 2013:

| NUMBER OF STUDENTS NOW ENROLLED: | 90 |
| NUMBER OF STUDENTS NOW ENROLLED: | 2,276 |

VIEW VIDEO AND MORE PHOTO HIGHLIGHTS FROM THE DEMO DAY:

mnltap.umn.edu/training/roadway/2013

THANKS TO OUR HOST!

A big thank-you to Mike Sheehan and his staff at the Olmsted County Highway Department for providing the venue and helping plan and staff the event. “We are so grateful to everyone who helped with the Training and Demo Day,” says Mindy Carlson, Minnesota LTAP training manager. “Mike’s crew worked with us for many weeks to make the event a success.”

—Michael McCarthy, LTAP editor
He then discussed how these goals can be achieved through coordinated efforts in design, construction, maintenance, and rehabilitation.

**Design**

“We are done with the previous AASHTO Design Guide and its nomographs and charts,” Tayabji declared. It is his view that designers adopt the NCHRP-developed Mechanistic Empirical Pavement Design Guide (MEPDG) in order to integrate the effects of all design elements. The MEPDG-associated software, Pavement ME Design, is available from AASHTO.

One of the most important changes that should occur to achieve sustainable 40-plus-year pavements is to reduce the overall volume of concrete in our pavements. “One way to achieve this without compromising performance is to reduce slab thickness. And to do that, you need to improve the pavement base support,” he said. Europeans replace native materials with high-quality base materials, so “they need just 10 to 11 inches of concrete for the most heavily loaded highways. You can’t go back and rework the base, so you need to address the foundation and drainage first.”

Tayabji added that drainage must be a high priority and recommended daylight permeable bases. He does not trust edge drainage systems because they tend to become clogged and damaged. He said these changes will reduce slab stress, deflection, and truck rolling resistance. Finally, he recommended treated base materials on roads that see high-volume truck traffic, adding that untreated granular bases should be reserved for lower-volume roads.

Another strategy that will help in the construction of sustainable pavements is the use of composite pavements “with PPC- for the upper 3 inches and PPC+ for the lower 7 to 9 inches,” Tayabji said. He explained that “PPC- is not marginal concrete; it is good concrete and is not made with locally available marginal or recycled aggregate.” He also recommended continuously reinforced concrete pavement, and noted that Georgia and California are reevaluating that idea.

**Better dowel bar design**

Tayabji also advocated wider lanes and shorter joint spacing—15 feet maximum—for most highway applications: “With a 12-foot-wide lane, if you have a 10,000-pound axle load, you are transferring 5,000 pounds at each wheel set as the vehicle crosses the joint. Of that, almost 3,000 pounds are being handled by the dowel bar at the edge (dowel bar #13 in Figure 1 above). But if you widen the lane, you reduce the load to a maximum of about 1,200 pounds. So now you can reduce the dowel bar structural requirements. You can use smaller dowel bars and actually eliminate some of the interior dowel bars altogether—from 12 per lane down to 8 or 10—because they’re only handling 200 or 300 pounds.”

Tayabji added that the elimination of some dowel bars in each lane will allow agencies to afford the cost of more durable and innovative dowel bar materials.

“We should be using non-corrosive dowel bars,” he said. “We have tried epoxy-coated dowel bars, but in some cases they have not delivered the performance we wanted. So we need to try other alternatives such as zinc-clad steel, stainless steel, micro-composite steel, and fiber-reinforced polymer.” However, he said research results have been mixed on the performance of fiber-reinforced polymer dowel bars.

For a truck-loaded highway with a slab thickness equal to or greater than 8 inches for a pavement that will endure more than 5 million ESALs, Tayabji said designers should specify dowel bars at least 1.25 inches in diameter. He also advocated round dowels, saying they will meet our needs and are more economical. Finally, he said load transfer efficiency at joints should be greater than 70 percent over the pavement’s service life. If these changes are made, he said there should be no need for retrofitting dowel bars over the 40-plus-year life of a concrete pavement.

**Better paving materials**

Tayabji said the goals for paving materials must be durability and sustainability. “We don’t want the materials to fail before they reach their expected service life because we cannot fix materials problems easily without reconstructing or resurfacing,” he added. “We can fix structural problems, such as joint cracking and faulting.” To achieve this objective, he said we must use:

- Dense, well-graded aggregates—three or more sizes.
- Less cement and more supplemental cementing materials such as fly ash and slag.
- A two-lift paving process—together with the previously mentioned composite pavement concept (PC+) /PC-).

**Construction**

To achieve high quality, Tayabji emphasized, construction requirements must be well-defined and measurable: “No contractor is going to give you more than you specify!” He also quoted from Ray Rollings, a retired engineer with the Army Corps of Engineers: “A poorly designed pavement but well constructed will outlast a well-designed pavement but poorly constructed.”

**Concrete management—from plant to joint sawing**

Tayabji recommended the following specifications for concrete:

- Flexural strength ~750 psi for 10- to 11-inch-thick slabs (using improved base/support).
- Minimum compressive strength ~4,000 psi.
- Maximum water/cement ratio <0.50 (<0.45 in freeze areas).
- Well-graded aggregates (3+ bins) and larger maximum aggregate size.
- Advanced admixtures.
- Smart vibrator systems on the paver and more cores to check for proper consolidation.
- Timely curing—especially during hot weather.

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- Advanced admixtures.
- Smart vibrator systems on the paver and more cores to check for proper consolidation.
- Timely curing—especially during hot weather.

Concrete continued on page 7
Performance Analysis of Centerline and Shoulder Rumble Strips Installed in Combination in Washington State (Washington State DOT, April 2013)

This report examines the combined effects of centerline and shoulder rumble strips and compares installation scenarios with shoulder and centerline rumble strip installation.

Traffic Enforcement Strategies for Work Zones (TRB, 2013)

This report presents guidance for the safe and effective deployment of traffic enforcement strategies in work zones on high-speed highways (those with speed limits of 45 mph or greater). The report discusses the planning, design, and operation of traffic enforcement strategies, as well as administrative issues that should be considered.

Minimizing Traffic-Related Work Zone Crashes in Illinois (Illinois Center of Transportation, April 2013)

This report presents findings that may help to minimize work zone crashes in Illinois, including an analysis of the frequency of work zone crashes and an evaluation of temporary rumble strips in work zones.

Concrete from page 6

Use less paste

He also advocated a reduction in paste content: “When we smooth the surface, we are bringing the paste to the surface—and paste is the weakest part of concrete. Most concrete durability concerns are due to paste issues. Paste is necessary, but we should minimize it—especially at the surface. The surface does not have to be super smooth.” He also said designers should:

• Consider end product specifications.
• Use blended cements (ASTM C595).
• Use performance-based cements (ASTM C1157), including portland lime-stone cement.

Contractor process control

Tayabji said careful process control will limit or eliminate placement of marginal concrete and the use of marginal construction processes: “We accept that problems develop during construction, but it cannot be all day long, every day. The engineer in the field should not let the contractor proceed if material or process specifications are not being met. There should be acceptance testing, and it has to be statistically based because we cannot test every square yard of concrete. Ideally we should be testing behind the paver.” He said production should be stopped if aggregate gradation or concrete requirements are not met, and added that “they should also stop the paving process if there are edge slump or consolidation issues.”

Tayabji also commented on a variety of construction issues:

• Jointing—“Most agencies are moving to single-cut joints. There is no need for double cutting. The question is: if you go to single cut, should you seal the joint or not? There’s a lot of discussion on this at the national and DOT levels.”
• Dowel bar alignment testing and specification—“Better equipment is available for determining dowel bar alignment reliably, we see that projects are not meeting the current specifications. So what do we do? Our specs are not ‘performance related’ and I don’t think we are at the performance-related stage yet.”


This report explores highway maintenance operations that occur within 15 minutes or less, and examines risk factors that maintenance workers may face while carrying out these operations.

Evaluation of Dynamic Message Signs and Their Potential Impact on Traffic Flow (Maryland DOT, April 2013)

This report explores the potential impact that dynamic message signs have on traffic flow as well as their accuracy, timeliness, relevance, and usefulness.

Developing Safety Performance Measures for Roundabout Applications in the State of Oregon (Oregon DOT, April 2013)

This report documents efforts to quantify the safety performance functions of roundabouts in order to evaluate the safety performance of single-lane, four-leg roundabouts.

Identification and Laboratory Assessment of Best Practices to Protect DOT

Equipment from the Corrosive Effect of Chloride Decree on Winter Application Equipment and Vehicles

Development of an Economical, Thin, Quiet, Long-Lasting, and High Friction Surface Layer: Volume 1—Mix Design and Lab (Illinois Center of Transportation, March 2013)

This report considers four new asphalt concrete mixtures that use locally available aggregates as a way to use a cost-effective mixture that also improves pavement performance.

Slope Failure Investigation Management System (Maryland DOT, March 2013)

This report presents a framework for developing a system that tracks, records, evaluates, analyzes, and reviews soil slope failure and remediation data by using a GIS database and a collective overlay of maps.

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Bridge Deck Reinforcement and PCP Cracking: Final Report (Center for Transportation Research, April 2013)

This report discusses optimizing reinforcement in the cast-in-place concrete placed on bridge decks and identifying ways of controlling cracking in precast, prestressed bridge deck panels.

“The engineer in the field should not let the contractor proceed if material or process specifications are not being met.”

—Shiraz Tayabji

• Proactive contractor process control—“If we see problems occurring, we need to respond right away during construction.”
• Stringless paving—“Stringless paving is the way of the future and is available now. It should result in a faster and well-controlled paving process.”
• Performance-related specifications—“We are not yet at the point where we can use performance-related specifications, but at least we know how to specify the end results and can let the contractor do his job without telling him how to do it.”
• Proactive contractor process control—“We’re seeing more and more of this. If we see marginal construction, we stop and correct it.”

Repair and rehabilitation

To improve rehabilitation of concrete pavements, Tayabji recommended:

• Timely maintenance and repair/restoration activities to extend the service life of existing pavements.
• Accelerated rehabilitation projects using full closures rather than night and/or weekend closures to ensure a quality end product.
• Thinner (5- to 7-inch-thick) concrete overlays with a 6-foot by 6-foot joint spacing over deteriorated concrete pavements that can still provide good support.
• Precast pavements for accelerated repair and rehabilitation; he noted that MnDOT has constructed a precast pavement test section.

Joint rot issue

On some projects, joints are deteriorating sooner than they should be. Tayabji suggested that paste saturation during freeze/thaw cycles may be the main culprit, as has been shown in recent studies. He said recommendations being proposed to overcome this problem include:

• Better quality concrete with water-to-cement ratios below 0.40
• Good in-situ air system
• Dense concrete
• Well-drained pavements, especially at the joint

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Conference materials online

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

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Gravel road know-how online: webinar and course

Minnesota LTAP offered a webinar on May 29 about gravel road drainage, maintenance, and design. Three gravel road experts shared their knowledge of and experience with properly designing and maintaining a gravel road for effective drainage. The webinar, cosponsored by the LRRB, is archived online for viewing.

In addition, Minnesota LTAP continues to offer an online course—Gravel Road Maintenance and Design. It provides a high-quality training option at a low cost, and it counts as one required credit in the Roads Scholar Program. Minnesota LTAP developed the course in partnership with the LRRB.

One satisfied customer of the online course is Mary J. Andrist, New Haven township supervisor (Olmsted County). “Gravel Road Maintenance and Design is a very interesting and informative course,” she said. “I enjoyed taking it online.”

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He also advocated for timely and proper joint sawing: “This is not an issue for transverse sawing, but delay in longitudinal sawing can result in premature cracking. We continue to see problems with this because some contractors don’t understand that you need to do longitudinal joint sawing as soon as you do transverse joint sawing. This means they need to have enough sawing equipment available. If they wait to do longitudinal sawing after transverse sawing, it can be too late, and premature longitudinal cracking can result.”

Well-developed specs with end-product emphasis

Tayabji concluded by reemphasizing the importance of specifications: “Good specs lead to good construction!” He said the purpose of the specification is to:

• Minimize contractor’s risk of rejecting an acceptable product.
• Minimize owner’s risk of accepting a marginal product.
• Identify and minimize variability in the concrete pavement construction process.
• Deliver an end product that is durable.
• Minimize risk of premature failures.
• Minimize owner’s risk of accepting a marginal product.
• Minimize contractor’s risk of rejecting an acceptable product.

The industry, Tayabji said, needs to move away from prescriptive specifications: “The future is end-product specifications. Whether for profile, thickness, or strength, end-product specifications enable clear definition of critical paving processes. We don’t tell the contractor how to do those things. By giving the contractor a freer hand, we should obtain greater innovation in the process. Results must be objectively definable and measurable—not arbitrary!”

As a resource for specifiers, he recommended the Guide Specification for Highway Concrete Pavements, published in 2012 by Iowa State University’s National Concrete Pavement Technology Center. LTAP

—Richard Kronick, LTAP freelancer

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