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### Iowa Local Technical Assistance Program

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IOWA STATE UNIVERSITY  
Institute for Transportation

## New procedures offer guidance for using bonded whitetopping on asphalt pavements

Researchers Peter Taylor from Iowa State University and Dale Harrington from Synder and Associates, Inc., along with Minnesota Department of Transportation's (MnDOT's) Tim Andersen and Dan Warzala, have developed procedures for selecting distressed asphalt pavements for bonded whitetopping based on site examination and lab testing. Now, while test results do not offer definitive indications of how overlaid asphalts will perform, procedures offer critical recommendations on pre-overlay pavement treatment, testing protocols, and bonded whitetopping design considerations.

### What was the need?

Many counties throughout Minnesota have used bonded concrete overlays to rehabilitate asphalt pavement. Although not widely used by MnDOT, a bonded concrete overlay, or whitetopping, normally involves milling a few inches of asphalt off the damaged surface and placing 4 to 6 in. of concrete over the asphalt pavement. A well-bonded overlay can add 20 years to a pavement's service life.

Bonded whitetopping performance has not been carefully tracked, and correlation of its performance with the underlying pavement condition is not well understood. Before MnDOT can expand its use of bonded whitetopping, materials engineers wanted to better understand what asphalt pavement conditions are best suited to this type of overlay, how asphalt behavior influences the concrete top layer, and what underlying pavement characteristics affect the expected lifetime and performance of bonded whitetopping.

### What was the goal?

This project sought to develop an integrated selection procedure for analyzing existing, distressed asphalt pavement to identify good candidates for bonded whitetopping and establish design considerations for a site-specific, effective concrete overlay. By testing pavement core samples in the lab, researchers wanted to identify asphalt pavement properties that correlate with distresses in

*Whitetopping continued on page 3*



Well done whitetopping of asphalt pavement (left) vs. rutted and otherwise damaged pavement (right).

## Acronyms and Abbreviations in *Technology News*

AASHTO	American Association of State Highway and Transportation Officials
APWA	American Public Works Association
FHWA	Federal Highway Administration
IHRB	Iowa Highway Research Board
InTrans	Institute for Transportation (at ISU)
Iowa DOT	Iowa Department of Transportation
ISU	Iowa State University
LTAP	Local Technical Assistance Program
MUTCD	Manual on Uniform Traffic Control Devices
NACE	National Association of County Engineers
TRB	Transportation Research Board



U.S. Department of Transportation  
Federal Highway Administration



### About LTAP

LTAP is a national program of the FHWA. Iowa LTAP, which produces *Technology News*, is financed by the FHWA and the Iowa DOT and administered by the Institute for Transportation at Iowa State University:

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## From the director: LTAP diversity and gratitude

The FHWA recently asked LTAPs and similar organizations around the country to send out a survey that they will use to define the training and technical assistance needs of local agencies throughout the United States. Here in Iowa, in my opinion, we had a respectable response, in fact, it was higher than our typical in-state needs assessment, which will be coming out soon. I'd like to thank those that took the 20 minutes or so to respond to the pretty detailed questions they asked. The only input I received was a question about why they needed some of the information they were asking for if the focus was on training and technical assistance.

The results of this survey, we have been told, will be used to guide the development of a national strategic plan for LTAPs. This strategic plan will impact the work plan that LTAPs use to receive their federal and subsequent state funding. FHWA has indicated in previous communications with the LTAPs that they understand the need for flexibility in how this new guidance should be implemented. I believe that this flexibility is essential for the LTAPs to serve the needs of local agencies within the context of each state. I have indicated more than once that I believe the greatest strength of LTAPs is their diversity. If LTAPs listen to their local transportation agencies, they can serve their technical needs while staying within their budget and resources, while not duplicating efforts already being done by others. I personally believe that LTAPs are one of the most effective uses of federal/state partnering programs that exists for local transportation agencies. But, of course, there is a range of LTAPs that are at a different stage of "maturity," and this growth can go in cycles (e.g., changes in director or location, what other agencies are doing, state funding, etc.)

Luckily, we have it pretty great here in Iowa—with partners that work well together to get the job done—whether it's in training, technical assistance, roadway safety, winter maintenance, or many other areas.

For all of this, and for all of you, I am deeply grateful. I can't imagine what things would be like without all the hard work done by local transportation agencies and their staff.

And now for my typical wrap up. Please don't forget to register for the InTrans Innovation Demonstration and Training Day (MUTCD Signing Review) on April 17. This is the first time InTrans has held this effort and it would be great to do it every year. Come over and visit InTrans, view some great tools, get some training if you want, and have lunch. It's a small way for us to toot our horn and also say "thank you" to everyone that supports us. Of course, our bridge inspection workshops have also been advertised and we will be doing our MUTCD sign training throughout the state in May (these will be advertised soon). In June, we are also planning a Local Street Bridge Innovation and Demonstration Day in Independence, and you are all invited to register when that advertisement comes out. Representatives from Minnesota and possibly Wisconsin are also expected to be in attendance.

With respect, dignity, and a bowed head... ■

Keith

*Whitotopping continued from page 1*

concrete overlays that are 6 in. or less. They also sought specific recommendations for managing transverse cracking in asphalt to avoid reflective cracking into concrete overlays.

### What did they do?

Researchers began with a literature review of approaches to selecting pavements for bonded whitotopping. The results of this review were used to develop testing procedures to identify the volumetric properties of existing asphalt pavements. They then applied these procedures to 22 pavement cores from six concrete overlay sites in Iowa, Michigan, Minnesota, and Missouri. Selected projects entailed 4 to 6 in. overlays in fair to good condition that were built from 1994 through 2009. Data about mix design, asphalt condition, pavement thickness, overlay thickness, site conditions, and other details were available for each site.

The research team compared roadway data with falling weight deflectometer measurements from pavement cores to evaluate field performance and design recommendations suggested by the selection procedure. To refine the procedures, the researchers evaluated volumetric asphalt characteristics for their potential influence on premature overlay cracking due to stripping, slab migration, and reflective cracking. Finally, the team developed a detailed selection process that included steps to identify and test asphalt pavements with the potential for bonded whitotopping, repair asphalt before overlays,

and established design considerations for overlays based on the test results from the selected asphalt pavement.

### What was learned?

The selection procedure, which is based on recommended practices from the National Concrete Pavement Technology Center, has six steps:

- Perform a desk review of available site data, including design, repair, and environmental conditions
- Obtain pavement core samples
- Conduct site visits to examine existing conditions
- Obtain additional core samples for testing, when necessary
- Prepare preliminary cost and materials estimates, if practical
- Provide design recommendations

Researchers tested pavement cores for air voids, density, stiffness, fatigue, aging, stripping potential and other distress parameters. Results were inconclusive in terms of identifying asphalt properties that lead to specific bonded concrete overlay failures or to long-term performance of bonded whitotopping projects. The pavement cores showed wide variation in material properties, but few of these distresses. Recommendations were framed for testing volumetric properties in the format of MnDOT's *Pavement Design Manual*, giving the agency an easily adopt-

able core testing protocol.

The selection procedures included information about the impact of transverse cracking, rutting, longitudinal cracking, and other distresses on concrete overlays, and provided recommendations for treating various distresses before whitotopping. Design considerations for whitotopping were also provided based on site conditions and the results of core, ground penetrating radar and falling weight deflectometer testing.

### What's next?

Tested overlay sections should be evaluated over time to determine if life expectancy is met or if asphalt stripping, slab migration, or reflective cracking has decreased overlay life. Because volumetric tests failed to provide conclusive relationships between asphalt properties and overlay distress, further research is needed to identify mechanistic or field tests that could correlate asphalt properties with concrete overlay performance. Once this additional research is completed, the selection procedures identified could be refined and placed in the design guide. A lifecycle cost analysis of overlays would also be useful for decision-makers considering bonded concrete overlays of asphalt.

This technical summary pertains to Report 2017-24, *MnDOT Thin Whitotopping Selection Procedures*, published June 2017. The full report can be assessed at [www.dot.state.mn.us/research/reports/2017/201724.pdf](http://www.dot.state.mn.us/research/reports/2017/201724.pdf). ■

*“This research established a procedure for testing pavement cores. However, more performance data on whitotopping is needed to correlate pavement performance and asphalt properties.”*

*—Tim Andersen, Pavement Design Engineer, MnDOT*

*“These procedures address collecting field data and testing pavement core samples in the lab. They also provide useful guidance for pavement repair and design considerations for overlays.”*

*—Dale Harrington, Principal Engineer, Snyder and Associates, Inc.*

## Iowa LTAP Mission

To foster a safe, efficient, and environmentally sound transportation system by improving skills and knowledge of local transportation providers through training, technical assistance, and technology transfer, thus improving the quality of life for Iowans.

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# Math proves the savings in pavement preservation strategies

Pavement preservation strategies can save money in maintaining an agency's highway network. Today, instead of individual projects and pavements, the focus is on sustaining infrastructure through whole-life investments and quantifying risks. Pavement preservation plays a key role in managing pavement systems in these whole-life programs.

Agencies have gained experience with preservation treatments and can tabulate the costs and expected impacts from using them. Each agency also can predict the need for preservation treatments from the age, condition, usage, climate, and other factors unique to sections of the pavement network. The Every Day Counts round four (EDC-4) pavement preservation initiative helps agencies pull together the information for their networks and identify strategies that take whole-life costs into consideration.

For example, from 2007 to 2012, the Kentucky Transportation Cabinet embarked on a process of diamond grinding—a treatment that corrects surface imperfections in pavements—for all 536 state-maintained lane miles of concrete pavement. The program reduced the average International Roughness Index (IRI) value—a method used to measure ride quality or comfort—from 112.1 to 74.5 over the five-year program. The cost of the program was about \$100 million, but the comparable cost of non-preservation treatments to achieve the same IRI values would have been in excess of \$1 billion.

The North Carolina Department of Transportation (NCDOT) has a long-standing chip seal program and has invested heavily in measuring performance, improving specifications, and training the workforce. Of NCDOT's 60,000 miles of paved secondary roads, about 44 percent have been treated with a chip seal, a surface treatment that combines layers of

asphalt binder and aggregate.

The average cost of a chip seal treatment is \$25,000 per lane mile, compared to \$100,000 per lane mile for a traditional 1.5 in. mill-and-overlay project. By ensuring proper construction techniques and materials are used on chip seal projects, NCDOT is able to treat significantly more lane miles of paved roadways in a year than it could with a traditional mill-and-pave program.

The Washington State Department of Transportation (WSDOT) has a strategic maintenance policy under which \$13 million applied to 3,500 lane miles between 2009 and 2015 resulted in \$15 million in annual savings by delaying major resurfacing projects. In 2014, WSDOT implemented a policy that requires at least one maintenance treatment before a capital rehabilitation or resurfacing project can be programmed.

WSDOT found that when a chip seal is applied at the right time, the cost is 20 percent of the cost of asphalt resurfacing and 30 to 40 percent of the lifecycle cost of asphalt resurfacing. Because of that, WSDOT applied 1,500 lane miles of chip seal conversion between 2010 and 2015. The agency plans to convert at least 1,500 lane miles more over the next 10 years.

WSDOT estimates that applying preservation strategies to its network will save the agency \$80 million a year through 2025. That comes from an estimated difference between \$324 million as an average annual network cost baseline and a \$244 million average annual network cost with preservation strategies applied.

Article condensed from the September/October 2017 (Issue 62) of the *FHWA Innovator* (FHWA-17-CAI-012). ■

Every Day Counts is the FHWA's initiative to advance a culture of innovation in the transportation community in partnership with public and private stakeholders. Every two years, FHWA works with state departments of transportation, local governments, tribes, private industry, and other stakeholders to identify a new set of innovative technologies and practices that merit widespread deployment through EDC. EDC-4 (2017–2018) builds on the progress of earlier rounds. ■

# From the Safety Desk: Iowa DOT, InTrans facilitate collaborative road safety discussions

*“We get everybody in the room together and during the presentations and breaks there’s discussion and you get a cross-pollination of ideas.”*

The Local Technical Assistance Program at Iowa State University’s Institute for Transportation understands that creating a collaborative environment at workshops and other events can be a meaningful way to come up with solutions to complicated transportation and safety issues.

Bringing together transportation and road safety professionals, including engineers, law enforcement, and planners, creates a unique discussion, said David Veneziano, LTAP Safety Circuit Rider.

“You get people talking and they’re outside their silos. You get engineers talking to law enforcement. We get everybody in the room together and during the presentations and breaks there’s discussion and you get a cross-pollination of ideas,” Veneziano said, adding that side discussion has been a catalyst for getting important safety information out to the public.

For example, a discussion based around the dangers of uncontrolled intersections ultimately led the Iowa DOT, Governor’s Traffic Safety Bureau (GTSB), and Iowa’s county engineers to put out an informative safety pamphlet about uncontrolled intersections

in Iowa. The pamphlet is now handed out at driver’s license stations and through other avenues as part of Iowa’s “Zero Fatalities” campaign.

“That’s the kind of information—the kind of thing that springs up—as a result of these workshops,” Veneziano said.

These events and workshops held by LTAP ultimately aim to improve safety, education, and engineering at a local level. Some workshops that aim to strengthen and expand local safety programs may provide resources of information to participants, like links to safety funding programs or important contacts at the Iowa DOT or GTSB.

One such workshop is the Local Road Safety Workshops, organized by LTAP and held annually throughout Iowa. The workshops are organized and intended to reach city or county employees directly, by bringing the discussion to convenient locations throughout the state like in Cedar Rapids or Ottumwa, so professionals can be a part of the discussion without traveling far to do so, Veneziano said.

Local Road Safety Workshops cover presentation and discussion topics that originate from

issues in law enforcement and engineering, or other transportation and safety-related subjects across the board. Topics in the past have been low-cost treatments, incident management, and distracted driving. Many topics are based on feedback and evaluations from previous years.

“They learn from the discussion, and we learn from their perspective,” Veneziano said.

Events to improve safety efforts in the state are held throughout the year by LTAP and other groups within InTrans. Other planning and presentations for the workshop are provided by the Iowa DOT Systems Planning and Local Systems offices, the Iowa Division of the FHWA, GTSB, and LTAP.

Article written by Hannah Postlewait, Institute for Transportation student staff, in collaboration with David Veneziano.

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## Success of 2018 Iowa Work Zone Safety Workshops

During February and March 2018, work zone traffic control and safety training was offered at several Iowa venues so that workers across the state could participate conveniently. Each one-day workshop covered current revisions in the 2009 Manual on Uniform Traffic Control Devices (MUTCD), particularly Part 6. It’s not too early to put it on the calendar for next year! ■

**Zero Fatalities**<sup>®</sup>  
A Goal We Can All Live With



**IOWA DOT**

# 5 Questions with Gordon Smith concerning the National Concrete Pavement Technology Center

Gordon Smith is the associate director for the National CP Tech Center at Iowa State's Institute for Transportation. He has been associated with the Center since its founding in the 1990s, holding various roles, so joining the team as associate director in August 2017 seemed like a natural next step. At the CP Tech Center, he will continue years of work focused on the advancement of concrete pavement technology and educational outreach to agencies and practitioners.

## 1. Why was now the right time to join the CP Tech Center as its associate director?

The opportunity to join was a true blessing that allows me to continue work in my long-standing commitment to the design, construction, and advancement of concrete pavements. After working as a paving contractor in Iowa for 14 years, followed by 31 years of leadership for the Iowa Concrete Paving Association and Iowa Ready Mixed Concrete Association, I realized that I wasn't quite ready to retire when the calendar said it could be done.

The National CP Tech Center provides a perfect appointment that allows me to continue to make a difference in my chosen field of interest and expertise. Through the Center, I am now afforded the forum to help make that difference, not only in Iowa, but around the country and beyond. There are always new challenges and opportunities in our vocation, and I am pleased that I can contribute to progressive solutions through research, technology transfer, and timely

implementation in the coming years.

## 2. What's your favorite part of the job?

In my role, the greatest satisfaction comes from continued relationships with agency and industry leaders and friends as well as the outstanding InTrans staff. These connections are an essential element to my satisfaction, allowing me to work with many to collaborate in research initiatives and technology transfer ventures that advance the application and performance of durable concrete pavements.

## National Concrete Pavement Technology Center



## 3. What are the challenges currently in the concrete industry, and how does CP Tech Center work to address them?

The challenges currently facing the concrete paving industry include topics related to concrete pavement durability in an ever-changing environment, extending the life of older pavements to provide suitable service, and further development of concrete overlay technology. Through FHWA cooperative agreements, IDIQ (indefinite delivery, indefinite quantity) contracts, and Transportation Pooled Fund and IHRB projects, the National CP Tech Center is working diligently with many partners to develop the science and practice for Performance

Engineered Concrete Mixtures or PEMs, to provide vital guidance for the care and life extension of our aging pavements guided by new initiatives in asset management and to share, nationally, the Iowa success story in the history and utilization of concrete overlays.

## 4. How did you get interested in your field of study?

I have a strong family background in construction trades, engineering, and education, so it was natural for me to pursue a career in civil engineering and highway construction. A passion for building pavements, followed by a strong interest in research and education, served as the cornerstone of my long journey in this exciting world of concrete.

## 5. What do you like to do outside of work?

When I can find the time, I enjoy traveling with my family to cities and countries near and far, working at our acreage at home and laboring at a family farm in southwest Iowa. I am also a longtime member of the Des Moines Choral Society and am passionate about sharing the joy of choral music performance with others. And yes, I have sung at Carnegie Hall!

## Contact

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### About the National CP Tech Center

The National Concrete Pavement Technology Center is a national hub for concrete pavement research and technology transfer. The CP Tech Center was founded in 2000 and has been instrumental in developing and helping to advance the nation's strategic plan for concrete pavement research, The CP Road Map. With a focus on serving the needs of the concrete pavement stakeholder community, its mission is threefold:

- Help street and road agencies find answers to their concrete pavement-related questions
- Identify critical concrete pavement research needs and discover sustainable solutions
- Help agencies, industry, and businesses incorporate advanced, sustainable solutions, and new technologies into their day-to-day practices

More information about the Center and its research can be found at [www.cptechcenter.org/](http://www.cptechcenter.org/). ■

# Workshop and conference calendar

Date	Event Name	Location	Contact
<b>April 2018</b>			
5-6	2018 APWA Iowa Chapter Spring Conference	West Des Moines	Peggy Englehart
17	InTrans Innovation Demonstration and Training Day (MUTCD Signing Review)	Ames	David Veneziano
22-26	National Association of County Engineers Conference	Wisconsin Dells, WI	Keith Knapp
23-4	NHI Course 130055, Safety Inspection of In-Service Bridges	Ames	Paul Albritton
<b>May 2018</b>			
1	Motor Grader Operator Safety Training	Calmar	Paul Albritton
1	MUTCD Sign Training	Atlantic	David Veneziano
2	MUTCD Sign Training	Cherokee	David Veneziano
3	Accessible Sidewalks and Curb Ramps: Design to Installation	Ames	Keith Knapp
8	Motor Grader Operator Safety Training	Iowa City	Paul Albritton
8-10	NHI Course 135095, Two-Dimensional Hydraulic Modeling of Rivers at Highway Encroachments	Ames	Paul Albritton
8	MUTCD Sign Training	Independence	David Veneziano
9	MUTCD Sign Training	Davenport	David Veneziano
15	Motor Grader Operator Safety Training	Storm Lake	Paul Albritton
22	Motor Grader Operator Safety Training	Atlantic	Paul Albritton
30	Motor Grader Operator Safety Training	Ames	Paul Albritton
<b>June 2018</b>			
12-14	NHI Course 130053, Bridge Inspection Refresher Training	Ames	Paul Albritton

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## Event details and online registration

Watch for details and online registration information, by specific dates and events, on the Iowa LTAP Workshops page, [www.iowaltap.iastate.edu/workshops/ltap-workshops/](http://www.iowaltap.iastate.edu/workshops/ltap-workshops/). ■

## Iowa LTAP Tech Corner—Indiana LTAP Field Quantities Calculator

### What is it?

The Indiana Local Technical Assistance Program, located in West Lafayette, Indiana, created this app, which contains several calculators for determining field quantities associated with road and bridge operations. It provides calculators for areas, volumes, and material stockpiles. Lengths or distances can be measured by using your phone's GPS feature. Accuracy is dependent on the GPS signal and phone capabilities.

### How does it work?

With an ease-of-use menu screen, users can choose between a variety of materials, such as asphalt, tack seal coat, sidewalk, concrete deck sealer, chip seal, and even stockpile. The rest is as simple as inputting a number of measurements and then clicking the “calculate” button.

For example, for chip seal field calculations, users would input the walk distance (length and width) in feet, the emulsion application rate in gallons/yards<sup>2</sup>, and aggregate application rate in lbs/yards<sup>2</sup>. The calculation will yield an area size with an estimated emulsion amount. And this is just one calculator example of many.

### Where can I get it?

Currently, the calculator is available on Google Play under “Indiana LTAP Calculator” and can be installed on a computer or Android phone, Version 4.3 and up.

Visit [play.google.com/store/apps/details?id=edu.a3id.ltapcalculatorapp&hl=en](http://play.google.com/store/apps/details?id=edu.a3id.ltapcalculatorapp&hl=en) to use the free tool today. ■

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