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Iowa Local Technical  
Assistance Program

2711 S. Loop Drive, Suite 4700  
Ames, IA 50010-8664

Phone: 515-294-8103  
FAX: 515-294-0467

[iowaltap.iastate.edu](http://iowaltap.iastate.edu)

IOWA STATE UNIVERSITY  
Institute for Transportation

## CP Tech Center publishes final report on PEM pooled fund

The National Concrete Pavement Technology Center (CP Tech Center) has published the final report on a 5-year project to improve the long-term performance of concrete pavements, conducted under Transportation Pooled Fund (TPF-5(368)) as a joint venture between Oregon State University (Jason Weiss), Oklahoma State University (Tyler Ley) and Iowa State University (Peter Taylor). As recent developments in concrete testing technologies have produced methods that better measure pavement reliability, this project sought to identify key testing technologies that are needed to incorporate these developments into concrete pavements.

“The aim of the program was to help states develop better specifications by focusing on the properties that matter and implementing approaches to evaluate those properties using appropriate test methods,” said Peter Taylor, CP Tech Center director. “The goal was to reduce the risk of accepting concrete that would not survive as intended, while also reducing the dependence on old methods that are no longer ideal. We also sought to help contractors consistently produce mixtures that would comply with these needs.”

### Accomplishments of Performance-Engineered Mixtures (PEM)

FHWA; 19 state transportation agencies; 7 paving chapters from Minnesota, Pennsylvania, Michigan, Wisconsin, Iowa, Oklahoma/Arkansas, and the Southeast; and 4 national associations (American Concrete Pavement Association, Portland Cement Association, Ready Mixed Concrete Research and Education Foundation, and Slag Cement Association) joined to fund this project. Study participants were supported in implementing improved specifications for mixtures within their states, gathering field performance data, and using available measurement technologies to design and control concrete pavement mixtures around key engineering properties. Activities included the following:

- Formal test training was provided in 12 of the 19 pooled fund member states.
- Shadow projects supported state agencies in implementing PEM and using new testing methods. When possible, open houses were held during shadow projects to provide education on the program and demonstrate new PEM tests.

*PEM continued on page 3*



Iowa PEM shadow project (left) and PEM workshop at the Georgia Department of Transportation (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
ICEA	Iowa County Engineers Association
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

## 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:

Institute for Transportation  
ISU Research Park  
2711 S. Loop Drive, Suite 4700  
Ames, Iowa 50010-8664  
Telephone: 515-294-8103  
Fax: 515-294-0467  
[intrans.iastate.edu](mailto:intrans.iastate.edu)

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# From the Director: Scooby-DOOs, what are you?

Like the title? Hopefully a few of you will get it. It's always worth a try, I think. The benefits of smiling and laughing are pretty well established. So, whether you laugh at the joke or at my lame and dated attempt at a joke, I'm hopeful some of the benefits will sink into your core and impact the next interactive connection you make with this world's bits and pieces. Maybe the tendrils of that joy will reach others.

Scooby-Doo and his crew were always entering the world of the unknown and ultimately labeled "meddling kids" by forces choosing to deceive. Appearances were often not reality in their stories until they worked together to draw the mask aside. And here you thought "Scooby-Doo!" was just a cartoon and not a lesson in the existential truths of life.

I think this life, however you define it, is full of doors of opportunity (DOOs). Sometimes these doors have to be forced open, and sometimes they swing easily. But, at any particular time, the weight of the door may just be too heavy, or the hinges so full of rust due to darkening skies and storms, that a person just can't do it. It may also make sense, when it's not the right time, to sometimes step past a DOO. Community can and does assist at either of these times with a hand, a hug, or simply some kind words. Without any expectations of return.

DOOs, small and large, are a never-ending stream. Another will present itself. Recognizing them can be a practice, and it may not always be immediate. Opening some DOOs can be deeply connected to desirable expectations or overcoming a fear of expectations. These are temporary. What is on the other side, however, despite our thinking, is rarely within our control.

The opportunities that arise over the many thresholds of this stream might be predicted, but many more in my experience are unforeseen. Embracing these unknown results, whenever they reach your heart, is pretty great. Just be kind to yourself in the process and open to what might happen. It's something I try to do, not always with success.

Opening DOOs may not always feel enjoyable. In fact, some may be related to the hardest parts of our lives. They can also be the fruit of life. We hope the DOOs that Iowa LTAP creates and offers are not difficult. Summer is our slower time, but we'll be putting out a few monthly "biweeklies," announcing our Iowa Build a Better Mousetrap Competition winners, and helping with the ICEA Mid-Year Conference on July 13. Motor Grader Operator (MoGO) field days in August will also be announced soon. In addition, the International Low Volume Roads Conference starts July 23 (LTAP will have a table there), and the Iowa Streets and Roads Workshop and Conference is scheduled for September 19 to 21. Lastly, we'll soon be sending out the "training needs" survey we do online every other year.

With all my gratitude.

Keith ■




PEM continued from page 1

- 82 workshops, meetings, and webinars facilitated technology transfer for PEM across the country.
- A PEM webpage was created.
- A PEM database included data collected by state agencies during the shadow test projects.
- Several test methods in the areas of strength, shrinkage, freeze-thaw durability, transport, aggregate stability, and workability were studied in the PEM effort. Because each state agency is unique in the way they specify concrete pavements, Table 2 in AASHTO R 101 gives the agency choices on select PEM properties and their standard test methods.

Surveys of pooled fund member states were conducted in 2019 and 2021

to better understand their pavement specifications and whether their specifications had changed based on what they had learned from the PEM program. Results showed that agencies had started incorporating PEM in their specifications or were considering a change.

“It is notable that at least 17 states have adopted at least one of the recommendations developed and implemented under the program,” Taylor said. “Work will continue to help states continue to improve their specifications.”

### Continuing with PEM

A new pooled fund, Performance-Centered Concrete Construction (P3C), focuses on construction operations after a mixture leaves the batch plant, including the use of the appropriate amount of vibration for

consolidation as well as effective finishing, curing, saw-cutting, and sealing operations.

“The P3C program will seek to adopt a similar mindset of monitoring the concrete as it is transported, placed, and finished to ensure that the concrete in its final position achieves the promises of the batched material,” Taylor said.

Successful completion of the project will involve the development of specifications and guidance tools for technology transfer, including videos, written documents, and training programs.

For more on the PEM program, see the project page at <https://intrans.iastate.edu/research/completed/performance-engineered-concrete-paving-mixtures/>.

Article written by Zane Charter, a communication specialist with InTrans. ■

## Low Volume Roads Conference: Register today for July 23–26 event

### Registration also open for supplementary events

The 13th TRB International Conference on Low Volume Roads is a “once or twice in a lifetime” event that is fast approaching. Registration is open for this special opportunity for Iowa professionals.

The event will be held July 23–26, 2023, in Cedar Rapids. The conference is convened by the TRB and is a global forum to examine new technologies and new techniques in planning, design, construction, operation, maintenance, and administration of low volume roads.

Registration information and a preliminary agenda are available here: <https://trb.secure-platform.com/a/page/lowvolumeroads>. Note that registration rates will increase after June 23.

The event will feature workshops, plenary sessions, break-out lectern sessions, poster sessions, and exhibits. Additionally, the conference includes a field trip to see



Ben Hull

low volume road bridge and pavement innovations in surrounding Linn and Johnson counties. The half-day tour is being organized by the ICEA and includes stops to see five different innovations.

Low Volume Road Conference attendees are also invited to the Iowa Night on the evening of July 24. The event is hosted by the ICEA and is expected to be a great evening of good old Iowa friendliness, food, and fun. It is provided at no additional cost, and transportation will be provided, but is limited to those who are registered for the conference.

There is also a bridge site bus tour and workshop that will be held on July 27

provided by Buchanan County and the Short Span Steel Bridge Alliance.

More details and separate registrations are available for both the Iowa Night and bridge site tour/workshop events, which are not sponsored by TRB but do not conflict with other conference agenda items, at the above link under “Offsite Events.”

The Low Volume Road Conference has been held every four years since 1975 and was last held in Cedar Rapids in 1979, for the 2nd International Low Volume Roads Conference. The event typically draws between 200 and 300 practitioners and researchers from more than 20 countries. ■

## 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.

### Staff

Keith Knapp  
Director of Iowa LTAP  
[kknapp@iastate.edu](mailto:kknapp@iastate.edu)

Paul Albritton  
Technical Training Coordinator  
[palbritt@iastate.edu](mailto:palbritt@iastate.edu)

Kori Mahieu  
Education & Activity Administrator  
[korim@iastate.edu](mailto:korim@iastate.edu)

Christinia Crippes  
Technology News Editor  
[ccrippes@iastate.edu](mailto:ccrippes@iastate.edu)

Theresa Litteral  
Statewide MDST Facilitator  
[litteral@iastate.edu](mailto:litteral@iastate.edu)

David Veneziano  
Safety Circuit Rider  
[dvenez@iastate.edu](mailto:dvenez@iastate.edu)

### Advisory Board

Tyler Christian  
Marion County Engineer  
641-828-2225  
[tchristian@co.marion.ia.us](mailto:tchristian@co.marion.ia.us)

Matt Greiner  
Public Works Director, City of Johnston  
515-278-0822  
[mgreiner@cityofjohnston.com](mailto:mgreiner@cityofjohnston.com)

Tim Herrstrom – Chair  
Road Foreman, Boone County  
515-795-2825  
[bctjh@iowatelecom.net](mailto:bctjh@iowatelecom.net)

Ron Knoche  
City Engineer, City of Iowa City  
319-356-5138  
[ron-knoche@iowa-city.org](mailto:ron-knoche@iowa-city.org)

Corey Mellies  
Operations Manager, City of Ames Public Works  
515-239-5276  
[cmellies@cityames.ia.us](mailto:cmellies@cityames.ia.us)

Nicole Moore  
Iowa DOT, Office of Local Systems  
515-239-1506  
[nicole.moore@iowadot.us](mailto:nicole.moore@iowadot.us)

Brad Skinner  
Appanoose County Engineer  
641-856-6193  
[bskinner@appanoosecounty.net](mailto:bskinner@appanoosecounty.net)

Steve Struble  
Harrison County Engineer  
712-644-3140  
[sstruble@harrisoncountyaia.org](mailto:sstruble@harrisoncountyaia.org)

Wade Weiss  
Greene County Engineer  
515-386-5650  
[wweiss@co.greene.ia.us](mailto:wweiss@co.greene.ia.us)

Andrew Zimmerman  
Transportation Engineer, FHWA - Iowa  
515-233-7334  
[andrew.zimmerman@dot.gov](mailto:andrew.zimmerman@dot.gov)

# CTRE project tackles trail management

The Center for Transportation Research and Education (CTRE) has long overseen a robust pavement management program to support local agencies with their roadways. Now, its researchers are turning that expertise to aid local jurisdictions in Central Iowa with pavement management of a different sort.

As Iowa local agencies are responsible for more than 600 miles of paved bike and pedestrian trails that connect the central-state region—a network that is starting to show its age—they have a need for pavement condition data to determine maintenance needs.

“As the network of paved trails grows, local governments will need to redirect their spending toward preserving and maintaining the existing trails,” said Inya Nlenanya, CTRE research scientist and principal investigator (PI) on the project to help establish a trail management program for Central Iowa.

The role of CTRE, a center within InTrans, is to use the data collected by the Iowa Data Bike as the basis for the development of the trail management program for all paved trails within Central Iowa for the use of the Des Moines Area Metropolitan Planning Organization (MPO) and its member cities and counties, as well as partner organizations. The overall goal of the program is to help inform a long-term maintenance strategy for Central Iowa’s trail network.

The CTRE project will develop a crack detection and automated distress calculation methodology, a roughness index calculator, and a trails pavement condition index for the trail pavement data collected by the MPO’s Iowa Data Bike.

In addition to pavement condition data, the bike data will be used for other purposes to benefit the local agencies and users of the trail system, including Google Street View images and geocoded imagery.



InTrans doctoral student Zia Zihan collects pavement data on a paved trail in Central Iowa

InTrans doctoral students Yazan Alatoom and Zia Zihan are assisting Nlenanya with the project. Zihan is assisting with the data collection and image detection, and Alatoom is helping to develop the algorithm for measuring the pavement roughness.

“Regular pavement condition data collection occurs for street networks, but no such data had been collected for paved trail networks until the Iowa Data Bike. This was because prior to the Iowa Data Bike, there was no equipment available for collecting trail pavement condition data, as the equipment used for roadways is too big and requires speeds that are not suitable for usage on the trails,” said Nlenanya.

The project also represents a new area of study for the center and expands InTrans’ role in working with local agencies in the state.

The project, which began in the spring of 2022, is expected to wrap up in summer 2023 with a plan to extend it beyond Central Iowa. More details about the project are here: <https://intrans.iastate.edu/research/in-progress/development-of-a-trail-management-program/>. ■

# New soil testing device developed at InTrans

A newly developed soil testing device will allow users to measure the cyclic behavior of soils in the ground rather than in a laboratory, saving time and money and delivering more accurate measurements.

The Cyclic Borehole Shear Test (CBST) device was developed as part of an Institute for Transportation (InTrans) project sponsored by the National Cooperative Highway Research Program (NCHRP) Innovations Deserving Exploratory Analysis (IDEA) program. The project developed a prototype device and software control program, and a future research project is expected to further develop and commercialize the CBST product.

“The device has the potential to help advance the safety and sustainability of transportation infrastructure by improving the speed, reliability, and accuracy with which daily foundation design inputs and liquefaction susceptibility of soils are assessed,” said Jeramy Ashlock, principal investigator on the project and InTrans faculty affiliate.

The CBST is unique in its ability to measure the parameters in the soil’s natural setting, under cyclic loading, in a matter of minutes. The current most commonly used tests can require up to several weeks and occur in a laboratory setting for which the collection of samples requires extraction, transportation, preparation, and trimming of soil specimens.

“By testing the soil in situ, the device will not only save time but also reduce or avoid effects of soil sample disturbance, which can significantly affect laboratory



CBST device in borehole ready for test in Ames, Iowa

test results,” said Ashlock, who is also an associate professor at Iowa State University’s Department of Civil, Construction, and Environmental Engineering.

The results from the test device are typical required inputs for the safe design of foundations and earth retaining structures for virtually all transportation infrastructure. The measurements are also important for infrastructure design in areas where natural disasters such as earthquakes and landslides are more likely to occur.

The CBST will enable engineers to measure the in situ soil response under cyclic loading as occurs in earthquakes and soil residual strengths that occur at large deformations in landslides. It may also prove useful for other geotechnical problems such as pavement subgrades and foundations of offshore structures, wind turbines, bridges, and marine retaining walls, among others.

“With further research, the device also has the potential to fundamentally transform

the presently empirical techniques used in practice for assessment of soil liquefaction resistance, into a more mechanistic physics-based framework,” said Ashlock. “This is because the device directly or indirectly measures the actual physical mechanisms responsible for liquefaction; namely stress, strain, and pore water pressure.”

The three-year project developed and further refined the device through field tests that occurred in five states that included a variety of soil types: Iowa, South Carolina, Maryland, Virginia, and Oregon. The field test results were compared to the typical conventional laboratory tests, which demonstrated that the CBST can measure meaningful cyclic behavior of soil in situ.

The CBST employs two serrated shear plates to engage the soil in shearing just beyond the borehole wall. The device first applies a normal stress to the borehole wall, and then after a consolidation delay time, applies a cyclic vertical shear stress to the borehole wall. It requires only a single borehole and can be performed at specific targeted depths with controlled stresses and measurements of pore pressure and shear displacement.

More information about the research project and the developed CBST device can be found at <https://intrans.iastate.edu/research/completed/development-of-in-situ-cyclic-borehole-shear-soil-test-device/>, which will also include a link to future phases of the project once they are underway. ■

*“The CBST device has the potential to help advance the safety and sustainability of transportation infrastructure by improving the speed, reliability, and accuracy with which daily foundation design inputs and liquefaction susceptibility of soils are assessed.”*

*—Jeramy Ashlock, principal investigator on the CBST project*

# Tips to stay safe in the summer heat

As temperatures and humidity levels rise with the arrival of summer, workers exposed to the elements are at risk of heat-related illnesses.

A heat-related illness occurs when there is an increase in the worker's core body temperature above healthy levels. There are a variety of heat-related illnesses that include heat stroke, heat exhaustion, heat cramps, heat syncope, and heat rash.

While these illnesses can be a matter of life and death, they are preventable.

The Iowa LTAP has a number of resources available to managers and workers alike to prepare for and prevent heat-related illnesses.

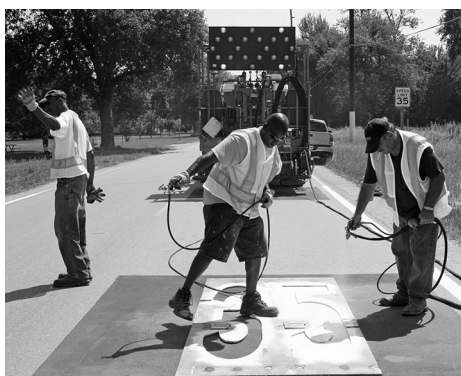
Through its Worker Safety Training Resources for Public Agencies web page, available under the Resources dropdown menu on the Iowa LTAP home page, the Iowa LTAP has collected a several tools for agencies to conduct heat illness safety training.

These include several Occupational Safety and Health Administration (OSHA) and other similar resources, such as details about OSHA's "water, rest, shade" campaign and a video that covers preparing to work in hot environments and how to treat heat-related illnesses.

While OSHA does not have a specific standard that covers working in hot environments, employers have a duty to protect workers from recognized serious hazards in the workplace that includes heat-related hazards.



The Bridge Preservation Open House held in July 2021 gave attendees access to the Jesup maintenance shop to keep cool between demonstration events



Pavement marking work, for example, could potentially lead to heat-related illnesses without proper care and caution



To access this and other safety resources, visit <https://iowaltap.iastate.edu/safety-resources-main-face/>. The Iowa LTAP asks that you provide basic information initially during login to use these resources, in an effort to track who is using the materials, but the trainings are offered free of charge.

The Heat Illness Safety Training available through the Iowa LTAP website is just one of nearly two dozen safety training topics curated to specifically assist local public works and county secondary roads

departments with their safety training for employees. Each training can be made applicable for your particular agency and its unique needs.

Additional details about how to use the safety resources pages are available in the October–December 2020 Technology News available at <https://iowaltap.iastate.edu/technology-news-new/>. For other questions or more specific information about the Worker Safety Training Resources, contact Paul Albritton. ■

In addition to the Worker Safety Training Resources, Iowa LTAP has available three heat-related Tailgate Talks from the National LTAP, also accessible through Iowa LTAP's Resources dropdown menu, or to access directly, visit <https://nltapa.org/information-exchange/nltapa-tailgate-talks/>. ■

# Workshop and conference calendar

[Information current as of June 22, 2023] Iowa LTAP will continue holding both virtual and in-person events and trainings throughout the summer. For the most up-to-date information about in-person attendance requirements and additional upcoming virtual events, please check regularly at <https://iowaltap.iastate.edu/events/> and consider subscribing to our mail list at <https://iowaltap.iastate.edu/> for email updates.

2023	Event Name	Location	Contact
<b>July</b>			
13	ICEA Mid-Year Conference	Ames	Keith Knapp
23–26	TRB Low Volume Roads (LVR) Conference	Cedar Rapids	Keith Knapp
24	Iowa Night at TRB LVR Conference	Atkins	Keith Knapp
<b>August</b>			
23–25	ICEA Affiliate Meeting at ISAC Annual Conference	Des Moines	Keith Knapp
<b>September</b>			
13–14	MINK Conference	St. Joseph, MO	David Veneziano
19–21	Iowa Streets and Roads Workshop and Conference	Ames	Keith Knapp

## Contact information

Keith Knapp, 515-294-8817, [kknapp@iastate.edu](mailto:kknapp@iastate.edu)  
David Veneziano, 515-294-5480, [dvenez@iastate.edu](mailto:dvenez@iastate.edu) ■

## Event details and online registration

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

## In brief: Lasting LTAP impacts

The Iowa LTAP is committed to providing technical and management assistance to Iowa’s local governments, which includes providing resources for funding and training opportunities.

The Infrastructure Investment and Jobs Act (IIJA), also known as the Bipartisan Infrastructure Law (BIL), was signed into law by President Joe Biden on November 15, 2021. The law provides \$550 billion over fiscal years 2022 through 2026 in new federal funds for infrastructure, with half of that funding going to transportation.

The Iowa LTAP has created a resource page with links and details that are aimed at providing comprehensive information about the programs and opportunities available with the IIJA/BIL.

Some primary resources include (1) the Iowa DOT’s IIJA, which includes IIJA implementation policies, federal-aid conversion information, and presentations introducing the legislation; (2) the FHWA’s BIL, which includes fact sheets, local support information, and recently updated information; (3) the U.S.DOT’s BIL, which contains funding opportunities, technical assistance resources, and an overview of projects that have already been funded; and (4) the White House’s Build.gov page, which contains a guidebook on the law and information about funding specifically addressing transportation needs, environmental issues, etc.

“We hope that our local governments find this resource page helpful when searching for answers about the IIJA and

when looking for funding opportunities for their agency,” said Paul Albritton, LTAP Technical Training Coordinator. “We know how hard it can be to find the right information when it’s most needed.”

If interested, check out the full resource page here: <https://iowaltap.iastate.edu/iija-bil-resources/>, and don’t forget to share your impact story with us! If you need further information or have questions about the links, reach out to the Iowa DOT’s Local Systems Bureau here: [https://iowadot.gov/local\\_systems/contact-us](https://iowadot.gov/local_systems/contact-us), or contact the Iowa LTAP Director Keith Knapp at [kknapp@iastate.edu](mailto:kknapp@iastate.edu) or 515-294-8817.

Article written by Brandy Haenlein, a communication specialist with InTrans. ■

Institute for Transportation  
Iowa State University  
ISU Research Park  
2711 S. Loop Drive, Suite 4700  
Ames, IA 50010-8664

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