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IOWA STATE UNIVERSITY  
Institute for Transportation

## New traffic signal design developed at InTrans reduces wind-induced vibration, and costs

Project led by BEC Researcher Alipour now in implementation phase

A recently funded project led by Bridge Engineering Center (BEC) Researcher Alice Alipour will be implementing a recently developed traffic light signal that has proven to effectively mitigate vibration in traffic signal structures.

The modified traffic light design increases aerodynamic damping and reduces vibration of the traffic signal structure. The proof-of-concept was developed as part of the National Cooperative xHighway Research Program (NCHRP) Innovations Deserving Exploratory Analysis (IDEA) program that explores the feasibility of unproven technical concepts. Now, as part of a follow-up NCHRP IDEA project, Alipour will test and try the developed idea on a full-size traffic signal structure.

“In the initial project, we introduced the first known effort to use the geometric characteristics of the signal light itself to mitigate the problem,” said Alipour, who is also an associate professor at Iowa State University. “In the recently funded follow up project, we get to expand the concept from the laboratory to a real-world environment by implementing it on a real-life structure.”

“Another unique aspect about this innovation is that by increasing the wind speed, the respective aerodynamic damping also increases, which results in more degradation of amplitude

of vibrations,” said Partha Sarkar, who collaborated on the project and is an Iowa State professor. Alipour added, “In other words, it effectively uses wind itself to mitigate wind excitations in traffic signal structures.”

The novel solution is much needed given the wide usage of cantilevered traffic signal structures throughout the US that have experienced many instances of failure, typically attributed to the large amplitude vibrations caused by wind. Additionally, it adapts the signals themselves rather than the structures, meaning the solution is less costly.

Alipour is especially thankful for the support from two main collaborators: the Iowa DOT and the City of Ames. She said, “They have been supporting this project from the very first day.”

“The economic implications of this approach are huge considering the millions of these structures that are being maintained by cities and state DOTs,” said Alipour. “This new strategy can be used as a mitigation technique for the existing structures, and by implementing it for new structures, it can help with savings on the structural system.”

Learn more about the project at: <https://intrans.iastate.edu/research/completed/development-of-a-novel-aerodynamic-solution-to-mitigate-large-vibrations-in-traffic-signal-structures/>. ■



Alice Alipour, right, with City of Ames and Iowa State University staff at the test signal installation

## 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:

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# From the Director: Artificial intelligence (AI) – enough already!!!

Column disclaimer: I certify that the content below has been created by my limited individual brain structure and life experience. While I interact with AI every day and could have used it in part or in full to “create” this column, the words and errors are truly my own (if not referenced) with the assistance of my editor and friend. Thank you, CC.

I’m guessing, unless you’ve been hiding somewhere, that you’ve been pulled into, whether voluntarily or simply because we are all “connected,” the media tornado that is the discussion around AI. I put the word “connected” in quotes here, because my personal definition of this word is not based on technological capabilities. But, that is not the subject of this column, and I’ll set that aside as the type of meaningful discussion that should occur—perhaps, my friends—when we are together and can share our thoughts and firing mirror neurons with respectful agreement or disagreement.

As many of you know by this time, I tend to float within two different communities on a regular basis: the informational analytic and the heart- and nature-inspired creative. These worlds are not as far apart as they might seem and are often impossible to separate. AI—these “devices” or “programs” that now appear to search out information, “create,” improve (dare I say “learn”), and “create” again—is one subject of commonality. A subject area about which I’ve even heard the creators admit they don’t understand how the AI has come to its offered solution. Think about that. The “creator” doesn’t know how the “created” will act on a worldwide stage. This discussion can lead down several paths of significance.

The commonality between my two communities on this subject, however, is not how AI might be used, what it might “create,” or whether it’s the solution or destroyer of our future. It is, in my opinion, how uncomfortable it makes everyone feel, deep inside, for a variety of reasons. During the last few months, I’ve been in discussions about AI-related job losses; the monetization of AI-created essays, music, and art; and whether people will begin

to form a “connection” with these self-learning devices/programs (or whatever they should be called). Generally, everything that many people use to define their lives and believe they have control over. All the while, during these discussions, there is a recognition that what is produced by AI may currently have major factual errors in it and that what we are reading, hearing, and seeing will have never have been penned, played, or painted by human hands. What is the “truth” here, and how is it identified? The uncomfortableness in this is our commonality and not unexpected.

I offered the disclaimer above to, hopefully, provide some level of comfort to my friends that a human is typing at this keyboard to create what you are seeing. Did it help, and is there enough trust here for you to believe it? That there is, truly, a human heart and soul behind these words? That these words are the “truth” as I understand them and that I own the errors in it? That there is no need to type anything into WOPR (a WarGames movie reference that I confirmed through an online non-open ended subject search mechanism) for a discussion? Now, expand these questions worldwide. You know, even WOPR came to the conclusion that sometimes the best option in a game is to not play at all. So, just give me a call if you want to discuss this column—human to human.

Coming up this quarter, here are the courses LTAP will be offering to humans by humans: sidewalk/curb ramp design, excavation safety, motor grader operation, and the MUTCD. We’re also hoping to have one or two one-hour webinars on leadership and one three-hour workshop on grant writing. And, events with our involvement include the county engineers research focus group in May and the ICEA Mid-Year Conference in July (registration opens in May). Registration also remains open for the TRB International Low Volume Roads Conference in Cedar Rapids (July 23–26).

Want to play a game?

Keith ■

# LTAP offers resources to navigate infrastructure law

In little more than a year after President Joe Biden signed the Infrastructure Investment and Jobs Act (IIJA), also known as the Bipartisan Infrastructure Law (BIL), more than 20,000 projects across the US have already been awarded funding. The projects include more than \$2 billion in projects awarded in Iowa.

However, those projects and funds are just a drop in the bucket of the \$550 billion that will be allocated in the US through 2026. Half of those new federal funds will go toward transportation.

Finding the available funding opportunities and navigating the grant application process may be difficult for agencies with limited resources and time.

To help local agencies with their efforts, the Iowa LTAP has developed a one-stop web page that aims to collect current and impending funding announcements, resources for submitting grant applications, and general background details about the law.

The web page can be found at <https://iowaltap.iastate.edu/iija-bil-resources/>, or under the Resources tab at the Iowa LTAP website.

The page is being updated regularly to keep up with the most current information and provide new resources as they become available. However, please reach out if there's more information or specific resources we can provide. ■

## 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>. Early-bird rates have ended, but prices will increase again 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.

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# BEC concludes two FHWA projects

BEC researchers recently wrapped up two projects sponsored by the FHWA to support its Office of Infrastructure program.

The *Guide for Orthotropic Steel Deck (OSD) Level 1 Design* and *Advancing Bridge Load Rating: State of Practice and Frameworks* both concluded in December and are part of the Infrastructure Research and Technology Deployment Program.

Though the projects do not set national standards for their respective topics, they both aim to further standardize and simplify the processes in their respective areas.

“OSDs are durable, redundant, and lightweight, making them a popular option for both new design and the rehabilitation of signature structures. However, the complexity of design, sophisticated analysis requirements, large fabrication costs, and the possibility of owner-mandated experimental testing generally makes OSDs prohibitive for use with commonplace bridges,” said BEC Acting Director Justin Dahlberg, who served as principal investigator (PI) on the OSD guide project.

Dahlberg added that the intention of the guide is to further develop details of Level 1 design—using proven OSD solutions without the need for analysis—and to encourage the implementation of OSD systems.

Similarly, the bridge load rating project helps address the need for improved processes and consistency in standards via the identification and development of state of practice and future frameworks.

“Due to the vast bridge inventory in the US, establishing an efficient framework for the load rating, posting, and overweight permitting of bridges may be of great benefit to state agencies by providing consistency and by helping to optimize technological advancement capabilities,” said Bridge Research Engineer Brent Phares, who served as PI on the bridge load rating project.

Phares added that the technological advancements should improve the efficiency of decision-making while taking advantage of better load rating tools, which could also improve management of rehabilitation and replacement budgets.

Learn more about the OSD guide at: <https://intrans.iastate.edu/research/completed/guide-for-orthotropic-steel-deck-level-1-design/>, and learn more about the advancing bridge load rating project at: <https://intrans.iastate.edu/research/completed/advancing-bridge-load-rating-best-practices-and-model-frameworks/>. ■



A long-span orthotropic bridge, the Poplar Street Bridge over the Mississippi River

# Safety performance functions offer new insights into intersection crashes

It takes a significant effort to develop a new scientific method to predict the safety performance of roadways. The task of implementing the novel approach to understanding intersection crashes is no less vast.

The research developed at InTrans under its Center for Transportation Research and Education (CTRE) led by researchers Zachary Hans and Hossein Naraghi is now being implemented at the Iowa DOT and led by Naraghi.

“It takes a lot of effort to change the thought process of safety practitioners to convince them of the robustness of the new method and be able to answer tons of questions they have about the new approach,” said Naraghi, who had the unique experience of being on both sides of research development and implementation.

He added, “All in all, I think my experience of being involved in development side tremendously helped me to break the huge road blocks on the implementation side.”

## What is the research?

The CTRE project first developed an intersection database—identifying all intersections in the state—and then the intersections were assigned to categories based on similar traffic control, cross section, speed limits, and traffic volumes. From there, project members determined the number of crashes at the intersections using five years’ worth of data.



A rural stop-controlled intersection

Finally, they developed and refined the safety performance functions (SPFs), or models, to account for the randomness of crashes and to determine the difference between the actual crash experience and what number of crashes would be expected at similarly defined intersections and roadway segments.

An SPF is an equation used to predict the average number of crashes per year at a location as a function of exposure and, in some cases, roadway or intersection characteristics. The SPFs were developed for 11 categories of paved intersections (defined as having at least one paved approach) and for 8 categories of primary road segments. The models were also developed for all crashes and severe crash categories.

“There’s a lot can we can learn from having a better understanding of how a location is actually performing compared to how we’d expect it to perform, based on these models,” said Hans, who was the principal investigator on the SPFs research

project and is a research engineer with CTRE. “Additionally, the network may be screened for possible opportunities for improvement.”

The sites where the observed number of crashes, corrected for randomness, is higher than predicted crashes offer a potential for crash reduction and thus may warrant additional study to determine whether there are countermeasures that can be implemented to improve the safety at those locations.

## How is the research being implemented?

Naraghi, who now works as a safety data analyst at the Iowa DOT, said each of the crash sites are ranked with high, medium, and negligible potential for crash reduction, and the ranking tiers are utilized by the Iowa DOT and other transportation agencies to identify and prioritize their safety projects.

“The SPFs are an integral part of road safety management activities and enable safety practitioners at the DOT and other agencies to utilize the models’ results to allocate the limited resources to the sites with highest potential for crash reduction,” said Naraghi.

More information about the project and its implementation is available from the Iowa DOT: <https://www.transportationmatters.iowadot.gov/2022/07/new-tool-evaluates-similar-intersections-for-safety.html>. ■

*“There’s a lot can we can learn from having a better understanding of how a location is actually performing compared to how we’d expect it to perform, based on these models.”*

*—Zachary Hans, principal investigator on SPFs research project*

## In brief: Lasting LTAP impacts

The Iowa LTAP continues to expand its Equipment Loan Program. Two cellular signal boosters have been added to the collection of items available for free loans.

Purchased by the Iowa DOT for use in e-ticketing efforts by cities and counties, these devices strengthen cellular signals in locations where signal strength may be weak. Iowa LTAP is facilitating the free loan of these two units to local agencies.

The Iowa DOT implemented its new e-ticketing system in 2020. E-ticketing is an electronic means of producing individual scale tickets and providing material haul summaries for construction companies. The system helps ensure employees are safe at the jobsite. Instead of having a traditional ticket taker—whether it's the “dump man” or field tester/inspector—in the way and often not in view of the truck driver, e-ticketing allows users to (electronically and safely) view tickets, capture proof of delivery, and add test results directly from their mobile device (such as a cell phone or tablet).



Ultimately, the cellular signal boosters enhance cellular signal strength, quality, and data transfer speeds, thus allowing users to access the Iowa DOT's system in locations where a mobile device may not necessarily have a reliable connection. The unit is easy to use. Just press the power button and connect to the booster via Wi-Fi while at the jobsite.

“The continued use of the different equipment available through the LTAP loan program has assisted local agencies in Iowa to improve the safety of their roadways, alongside the safety of their employees,” said David Veneziano, LTAP Safety Circuit Rider. “We understand the value of access in the field, which is why we are pleased to be able to provide that with these new booster units for our local agencies for use on their projects.”

If interested, fill out the form here to request the equipment: <https://iowaltap.iastate.edu/cell-booster/>. As always, the entire collection is available to loan, free-of-charge. Check out all the currently available equipment available here: <https://iowaltap.iastate.edu/equipment-loan-program/>, and don't forget to share your impact story with us!

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

*“The continued use of the different equipment available through the LTAP loan program has assisted local agencies in Iowa to improve the safety of their roadways, alongside the safety of their employees.”*

*—David Veneziano, LTAP Safety Circuit Rider*

## Iowa LTAP now accepting applications for Mousetrap contest

### Competition deadline is May 5

It is the people on the front lines who often discover the latest and best practices, whether through new gadgets that improve the quality and safety of a project or innovative processes that reduce costs and improve efficiency.

Each year, Iowa LTAP sponsors a statewide Build a Better Mousetrap (BABM) Competition that provides a great opportunity for local agencies to share their new ideas with others.

We are looking for submissions from Iowa's local public agencies (e.g., cities

and counties) that have created new solutions to problems or found ways to work more effectively. The top three winners are recognized statewide and are offered free workshop registrations.

*BABM competition continued on page 7*

# Workshop and conference calendar

[Information current as of March 20, 2023] Iowa LTAP will continue holding both virtual and in-person events and trainings throughout the spring and 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>April</b>			
4	Excavation Safety Workshops	Storm Lake	Paul Albritton
5	Excavation Safety Workshops	Clarion	Paul Albritton
6	Excavation Safety Workshops	Independence	Paul Albritton
6	Accessible Sidewalks and Curb Ramps: Design to Installation	Ames	Keith Knapp
11	Excavation Safety Workshops	Corning	Paul Albritton
12	Excavation Safety Workshops	Indianola	Paul Albritton
13	Excavation Safety Workshops	Sigourney	Paul Albritton
<b>May</b>			
4	County Engineers Research Focus Group	Ames	Keith Knapp
9	MUTCD Signing Review	Ames	David Veneziano
10	MUTCD Signing Review	Atlantic	David Veneziano
11	MUTCD Signing Review	Cherokee	David Veneziano
16	MUTCD Signing Review	Cedar Rapids	David Veneziano
17	MUTCD Signing Review	Waverly	David Veneziano
18	MUTCD Signing Review	Fairfield	David Veneziano
<b>July</b>			
23–26	TRB Low Volume Roads (LVR) Conference	Cedar Rapids	Keith Knapp
24	Iowa Night at TRB LVR Conference	Atkins	Keith Knapp

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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, [iowaltap.iastate.edu/workshops/](https://iowaltap.iastate.edu/workshops/). ■

### *BABM competition continued from page 6*

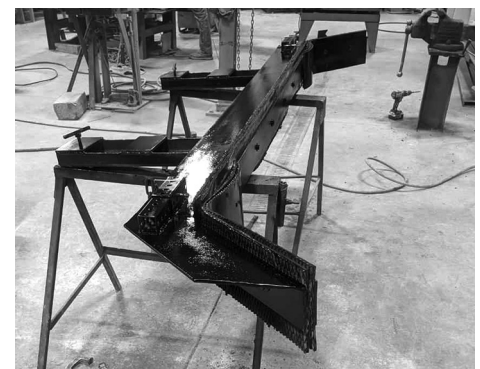
Local agency employees can learn more about the competition and submit an entry at <https://iowaltap.iastate.edu/iowa-babm-competition/>. The deadline to submit an innovation is May 5, 2023.

Entrants must provide a photo of their invention, details on its cost and savings/benefits to the community, and offer background as to why and how the solution was developed. Videos of the

equipment or innovation are strongly encouraged. The entries will be judged on cost savings/benefits to the community, ingenuity, ease of transferability, effectiveness, and video demonstrations.

Madison County won the 2022 Iowa competition for its inventive shop clean-up squeegee.

More details about previous Iowa winners are available here: <https://iowaltap.iastate.edu/iowa-innovations/>. ■



Madison County's shop clean-up squeegee

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