Technology NEWS

Providing transportation technology transfer for Iowa's cities and counties

Iowa LTAP
Local Technical Assistance Program

Inside this issue

Iowa Local Technical Assistance Program

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Iowa State University
Institute for Transportation

Work Zone Safety Sign Package Program winners

About

The Iowa Work Zone Safety Workshops have provided an opportunity for operations personnel from various cities in Iowa to improve their work zone safety and setups when conducting routine street maintenance. Many of the participants have been from cities with a population of less than 10,000 residents. Small city budgets for this type of work can sometimes lead to diminished funding for temporary traffic control devices and the use of signs, barricades, cones, and vests that are deteriorated and may be out of compliance with the 2009 MUTCD.

This project was developed to assist smaller cities with the introduction or upgrade of their temporary traffic control devices to meet current standards for compliance.

The process

Each application submitted to the program was reviewed and evaluated. Factors such as the city's population, staff size, demonstrated need, signing condition, and commitment to work zone safety was taken into account, as well as their demonstrated participation in the Iowa Work Zone Safety Workshops.

Winners

A total of 10 cities from across Iowa were chosen as winners, each receiving a package that included $2,500–3,000 worth of signs, vests, and materials.

"I think it was a success. Now, 10 more Iowa cities are fully outfitted with everything they need to keep their work zones safer," said Paul Albritton, Iowa LTAP technical training coordinator and co-organizer of the program.

Each package included the following materials:

- One Lane Road Ahead signs
- Road Work Ahead signs
- Be Prepared to Stop signs
- Type III barricades
- 28 in. traffic cones
- Class 2 safety vests
- Sign stands
- 42 in. channelizers with bases

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From left to right: A look inside the package and winners from Solon, Iowa.

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

IOWA DOT

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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Printed with soy ink

From the director:

National strategic planning and its impact on the Iowa LTAP

As some of you may already know, the Local Technical Assistance Program is financially supported in part through the federal transportation bill. The national program was officially established in 1991, but a number of state LTAPs—including the one here in Iowa—have been around since the early 1980s (also thanks to the federal transportation bill at the time).

From this federal seed money and non-federal match funds, and over the decades, the LTAPs within each state have adjusted and morphed to best meet the needs of their local agencies. However, last year, the FHWA reorganized and shifted the LTAP into the Office of Innovative Program Delivery: Center for Local Aid Support. This is a new center at the FHWA that is just now beginning the process of developing its new strategic plan for LTAP. Their plan will include providing federal guidance to state LTAPs on what focus areas they should address—a type of guidance that has always existed in some manner in the past.

FHWA held an initial LTAP strategic planning meeting from May 9 to 10 in Lakewood, Colorado. In attendance were FHWA representatives, two state LTAP directors, a Tribal Technical Assistance Program director, as well as a number of others from the National Association of County Engineers (NACE), American Public Works Association, American Association of State Highway and Transportation Officials, and localities. In fact, our own Brian Keierleber, a Buchanan County engineer and the NACE president, was one of those in attendance.

One of the key outcomes that appears to have come from the meeting is the need for a national local needs assessment to guide the LTAP strategic plan. This assessment survey should be distributed through state LTAPs and their partners sometime in 2017. The group also concluded that training and technical assistance done by LTAPs should be coordinated with all our LTAP partners in an effort to avoid duplication. Additionally, there was discussion on training and technical assistance needs, including the promotion of proven, market-ready innovations and serving the fundamental training needs of localities. The group also had a good discussion about allowing LTAPs the flexibility to adapt national goals and focus areas to each states' unique local environment.

My feelings on these conclusions are that they are already typical of Iowa LTAP activities. In my seven years as Director of the Iowa LTAP, changes from the FHWA to our focus areas has happened once before. And we already do serve the traditional fundamental needs of our clients and customers while balancing it with national directives. However, it is important to keep the level of effort in these tasks in proportion to the source of funding provided. For example, we currently get more non-federal than federal funds. The Iowa LTAP also has always promoted innovations that are relevant to the local experience here in Iowa and worked with our county, city, state, federal, and contractor partners. Not collaborating and cooperating with our partners can result in duplicating efforts, and it wastes time and money that none of us have to waste.

So, what does all this mean? Well, we will keep doing our traditional training and reevaluate all the workshops for possible duplication. In addition, you'll be hearing more about innovations, as there will be more innovation-focused activities offered here in Iowa. For example, we already assisted with a Ultra-high Performance Concrete Workshop and completed Road Diet Training in March. In June, we assisted with four Self-cleaning Culvert Workshops and are organizing steel mill and galvanizing plant tours. And besides reintroducing the statewide "Build a Better Mousetrap" competition, I'm working on something called a Local Agency Bridge Innovation Day. .

Until next time. Thanks for all that you do.■

Keith

New technology for backup alarms: Eliminate noise nuisance complaints and improve safety

By Renée Railsback, Colorado LTAP Director

Technologies that could mitigate problems from backup beepers have existed for over two decades. Nonetheless, the conventional single-tone backup alarm still dominates road construction and maintenance sites. If annoyance level is an indication, backup beepers may be one of the most harmful noises. In a 2010 report titled *Technology for a Quieter America*, the National Academy of Engineering cited backup beepers as one of the six top noise sources people associate with behavioral and emotional consequences (Holzman 2011).

During Boston's Big Dig project, which rerouted much of the traffic through the heart of the city, people lodged more complaints about noise than about any other annoyance factor and far more complaints about backup beepers than any other noise source (FHWA 2017).

Similarly, 20 state departments of transportation identified them as a major problem in generating nighttime construction noise. From a safety perspective, an investigation by the federal Occupational Safety and Health Administration (OSHA) found that an original equipment manufacturer backup alarm failed to prevent two-thirds of backover accidents analyzed (Purswell and Purswell 2011).

One alternative technology to the traditional backup beeper is the broadband beeper. This type of device has the same cadence as the conventional beeper but broadcasts a "white-noise," whooshing sound.

According to the *Health and Safety Executive*, one quarter of all workplace vehicle accidents are caused by reversing vehicles and, as such, reversing alarms are one of the most important and cost effective devices you can fit (Brigade Electronics 2017).

Reverse in safety

Reversing "beep-beep" alarms were first introduced to Europe in the 1970s. At the time, they provided a vital step forward in safety, but have been shown to have a number of inherent problems; specifically concerning their environmental impact, but also in terms of compliance and safety. Advances in technology mean there is a new alternative: the BBS-Tek® White Noise Reversing Alarm manufactured by Brigade Electronics.

In contrast to the beeping sound of the old-fashioned, high-pitched pure tone alarm, the BBS-Tek® backup alarm uses broadband sound, also known as "white sound." It is easier on the ears, yet equally as effective as a conventional alarm, even five decibels (dB) quieter. Additionally, because broadband sound dissipates at twice the rate of a pure tone sound, it doesn't cause noise nuisance to neighboring residents or other workers on-site. This multi-frequency device operates by emitting sound at multiple frequencies attenuated above 4000 hertz so that the sound is perceived to dissipate more quickly.

The science behind it

The way we react to a broadband sound is part of our survival system. Deep inside both human and animal brains is the superior colliculus, which alerts us when it hears certain noises. The noises it reacts to are not narrow-band sounds with their tighter frequency range, but rather broadband (white noise) sounds that give away their direction and make our heads turn towards them.

The "white" description derives from white light, which is composed of all the colors in the spectrum. Similarly, white sound is composed of all frequencies in the audio spectrum. White sound has the unique characteristic of its source being instantly locatable. White sound does not have to rely on high sound pressure (decibels) in order to be heard, because in being multi-frequency, competing single frequencies cannot mask it (Iveco n.d.)

At their lowest setting of ~92–95 dB, these alarms are about three-quarters as loud as standard backup beepers. Quite literally, you only hear the white noise reversing alarm if you're in a danger zone.

Safety impact

The white noise reversing alarm is also considered safer, because, unlike conventional alarms whose noise can be heard all around the work site, broadband is localized. This means the sound is directed only into the hazard zone and not everywhere else, which increases response to the alarm and diminishes the chance of it being ignored. In a busy working or urban environment, anyone in the danger zone can recognize that the sound is coming directly from the reversing vehicle near them. Even in areas where the background noise levels vary considerably, the smart auto-adjusting models automatically monitor and set the warning sound level to between 5 and 10 decibels above an ambient level to ensure optimum safety.

Instantly locatable, it enables pedestrians to discern exactly which vehicle is moving and in which direction, allowing them to move to safety. This also makes them a safer option for the visually impaired, as they may not be able to see the vehicle reversing but will hear the direction it is reversing in. Because of the wide spectrum of frequencies created, the hearing impaired are often able to detect some noise, unlike with narrowband single tone alarms (Beacons and Lightbars n.d.)

Approved for use in construction vehicles in all areas of New York City, and implemented on the equipment in Snowmass Village, Colorado, white noise reversing alarms are proving to be an optimal choice for many municipalities and local authorities wishing to minimize noise pollution and increase pedestrian safety in confined or densely populated work areas.

Reprinted with permission from Summer/Fall 2016 edition of the Colorado LTAP newsletter.

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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.

FHWA releases flexible roadway design key to safer streets

"At the Federal Highway Administration, we know that a multi-modal transportation network is key to getting people where they need to go, whether they make the trip by car, on foot, on a bicycle, or all of the above," said former FHWA administrator Greg Nadeau.

But when it comes to designing highways and other roads, it is also imperative to keep in mind the safety of all road users, including bicyclists, pedestrians, and transit riders.

In an effort to help states, local governments, transit agencies, and others make the most of their road infrastructure and remain "flexible," the FHWA published their guide in August 2016—*Achieving Multimodal Networks: Applying Design Flexibility and Reducing Conflicts*.

Groups like AASHTO and the National Association of City Transportation Officials (NACTO) have already produced similar guides, which encourage a flexible, holistic design approach that many states, counties, and cities have embraced nationwide.

However, the FHWA guide builds upon their work through the reinforcement of federal guidelines, which involves considering vulnerable road users when designing roadways.

Part 1 of *Achieving Multimodal Networks* makes clear that flexibility is not only allowed but encouraged under existing guidelines, pointing to FHWA's own guidance on the subject as well as references to works from AASHTO, NACTO, and others in the field.

Part 2 provides specific, practical guidance as to how to achieve multimodal design in real-world scenarios.

"By taking a comprehensive approach to road design, vulnerable populations like seniors, people with disabilities, and children on the way to and from school all benefit from 'complete streets' that help keep them out of harm's way," said Nadeau.

The guide notes that this approach is better for motorists, too, as flexible road designs produce a driving environment that is more coherent, predictable, and less likely to result in conflict with other road users.

Achieving Multimodal Networks is available for download on the FHWA Office of Planning, Environment & Realty (HEP) website: www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/multimodal_networks/.

Information reprinted from online post by Greg Nadeau, former FHWA administrator.■

MoGO in Ames

On May 16, Chris Archer (left), an operator from Pocahontas County, co-leads the classroom session with Craig Davis at the Motor Grader Operator Training in Ames, Iowa.

From the Safety Desk: To pave or not to pave

By John Shaw, Iowa LTAP Safety Liaison

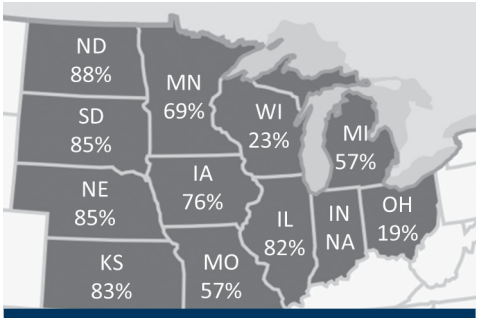
Did you know that about three-quarters of Iowa's secondary roads are unpaved?

Nearly all major highways in the United States are paved, but decisions about whether to pave secondary roads are complex. Issues such as dust control, drivability, and the ability to accommodate seasonal loads are important to residents, agricultural producers, industry, and other road users. County and city governments also need to consider the budgetary impacts of building and maintaining various surfacing types, which often involve trade-offs between long-term and short-term costs. In turn, these issues are affected by factors such as traffic volume, terrain, subgrade conditions, and the quality of locally available road building materials.

The percentage of unpaved secondary roads varies greatly across the Midwest. In Ohio and Wisconsin, only about 20% of secondary roads are unpaved, while in Kansas, Nebraska, and the Dakotas more than 80% are unpaved. Within Iowa, the percentage of unpaved secondary roads ranges from 23% in Polk County and 40% in Dubuque County to more than 90% in Adair, Clarke, Lucas, and Monroe Counties. Overall, about three-quarters of Iowa's secondary roads are unpaved, and some budget-conscious Iowa counties have considered converting low-volume paved roads to granular (gravel) surfacing as a cost-saving measure.

A large portion of Iowa's fatal and serious injury crashes occur on secondary roads, so safety is an important consideration in decisions involving the secondary system. A 2010 study conducted at InTrans found that among all types of low-volume roads, unpaved roads with traffic volumes between 100 and 400 vehicles per day had the highest crash rates. In this volume range, the number of crashes per vehicle-mile-traveled was twice as high on unpaved secondary roads as it was on their paved counterparts (Souleyrette et al. 2010).

Creating a safe roadway system requires managing the interaction of vehicles, roads and roadsides, road user behavior, and traffic speeds (OECD 2008). If any of the four elements fails and the other three are robust enough to prevent a fatality or serious injury, a roadway can be considered a Safe System. Feasible engineering interventions are strongly influenced by the type of surfacing. On hard-surface roadways, markings such as centerlines and edge lines are versatile tools to influence road user behavior and reduce inappropriate maneuvers. Pavement markings also help manage conflicts at intersections, and when motor vehicles share the road with bicycles or other low-speed traffic (such as horse-drawn vehicles in Iowa's Amish and Mennonite communities). Advanced safety treatments for paved rural roads include centerline and edge rumble strips and high-friction surface treatments, which have been shown to reduce wet-weather collisions at intersections and sharp curves.



Available percentages of rural major collectors, minor collectors, and local roads that are unpaved.

Source: Federal Highway Administration, Office of Highway Policy Information, Highway Statistics 2015, Table HM-51

Although the menu of engineering treatments suitable for granular roads is limited, examples include post-mounted delineators to mark the roadway edge, chevron signs to guide drivers through curves, and lighting to draw attention to intersections and major driveways. Signage serves an important function on all roadways, but it is doubly important on unpaved roads since pavement markings are not available to cue drivers about changing conditions.

While the choice of roadway surfacing is of considerable interest to the public, the characteristics of roadsides play a less visible (but highly important) role in road user safety. For example, good drainage is essential for all roadways, but some Iowa roads have ditches that are deeper or steeper than they need to be (perhaps due to erosion or overzealous cleaning). In such situations, mundane driving mistakes such as momentary inattention can have severe consequences—especially if the shoulders are narrow. Gentle side slopes are one way to make roadways more forgiving of driver errors and unexpected loss-of- control during wet or wintry conditions. Side slope improvements sometimes require major earthwork, but there are also sites that can be considerably improved as part of ordinary roadway maintenance. Little by little, the improvements made through day-to-day actions can add up to safer city streets and county roads all across Iowa.

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Pavement preservation (when, where, and how)

By Thomas Van, Steve Gaj, and James Gray, FHWA Office of Infrastructure

Applying a pavement preservation treatment at the right time (when), on the right project (where), with quality materials and construction (how) is a critical investment strategy for optimizing infrastructure performance.

Whether a highway pavement is constructed using asphalt, concrete, or a composite system, traffic loads and environmental elements will contribute to its deterioration over time. Pavement preservation treatments can slow this structural decline. When the right treatment is applied at the right time with quality materials and construction, these practices offer a proven, cost-effective approach to extending the overall service life of pavements and achieving smoother, safer roads with fewer costly repairs.

What is preservation?

Preservation includes work that is planned and performed to improve or sustain the condition of the transportation facility in a state of good repair. Preservation activities generally do not add capacity or structural value, but do restore the transportation facility's overall condition.

Just as pavements differ, so do pavement preservation treatments. There is an array of different analyses, treatments, and construction methods that can help infrastructure owners achieve and sustain a desired state of good repair for their transportation facilities—despite tight budgets.

The When and Where component of this innovation, as part of the fourth round of Every Day Counts (EDC-4), supports preserving highway investments by managing transportation pavements proactively. The How component promotes quality construction and materials practices, including treatment options that apply to both flexible and rigid pavements.

The "when" and "where"

Historically, pavement preservation programs have focused on applying specific project treatments at specific locations. These projects demonstrated that the proper application of a treatment could extend the life of a pavement at a relatively low cost. However, not all projects were successful due to poor timing, inappropriate treatments, substandard materials, and inexperienced construction crews. As a result, the policy in many agencies today is to allow pavements to deteriorate until reconstruction is the only option, resulting in higher costs and more pavements in poor condition.

The mantra, "Right Road, Right Treatment, at the Right Time" was promoted from 1995–2005 to address these issues. Extensive training by the asphalt and concrete pavement industries and by the FHWA at the time helped eliminate many of the construction issues and improper uses for temporary fixes. While these practices were valuable to demonstrate the viability of preservation projects, they did not link to pavement management or other strategic processes.

This EDC-4 effort supports moving the preservation concept significantly forward. The focus today in transportation is on sustaining infrastructure through "whole-life" investments and quantifying the risks. Pavement preservation has a key role in managing pavements in these whole-life programs.

For example, a class of pavements with an expected life of 30 years will have several construct/operate/preserve/repair/restore alternatives and schedules over the expected lifecycle. Selection of a comprehensive strategy that includes preservation programs not only meets the performance expectations of the owners and users, but does so at a cost that is predictable and affordable. Making this evaluation a key part of pavement policy is an innovative approach to sustaining pavements in the future.

The "how"

Pavements deteriorate as a result of many different forces, but the predominant factors affecting pavement performance are the vehicle loads and environmental elements they are exposed to over their lifetime. Today, most highway agencies accept that an effective pavement preservation program will slow down the rate of pavement deterioration, while also providing a safer, smoother ride to the traveling public. Pavement preservation programs are based on the 3Rs—right treatment, right pavement, and right time.

One obstacle to successful pavement preservation is the impact that treatment failures can have on an entire program. Whether it is a failed patch, stone flying off a chip seal, or a microsurfacing that peels off because it did not set, even a single failure and the associated damages can set back an agency's program for many years. However, most early failures can be attributed to a breakdown in some part of the construction process, such as the materials, site preparation, or placement practices, and as such are avoidable.

EDC-4 is promoting quality construction and materials practices that apply to both flexible and rigid pavements. For flexible pavements these include using improved specifications for thin asphalt surfacings such as chip seals, scrub seals, slurry seals, microsurfacing, and ultrathin bonded wearing courses; following improved construction practices; and using the right equipment to place these treatments. Rigid pavement strategies include the rapid retrofitting of dowel bars to reduce future faulting; the use of new, fast-setting partial- and full-depth patching materials to create a long-lasting surface; advanced pavement removal techniques to accelerate patching construction times; and advancements in diamond grinding that contribute to smoother and quieter pavement surfaces with enhanced friction.

Far too often, the past response to a construction failure has been to introduce bans or moratoriums on using treatments that have otherwise been proven effective. By following the best practices for materials selection and construction practices, pavement preservation will be less disruptive and safer while also eliminating much of the "fix-the-fix" problems endemic to many conventional pavement repair and rehabilitation techniques. Improved construction practices and the associated reduction in construction-related failures allow agencies to continue to use treatments that are proven to be effective, enabling them to realize the benefits of these techniques.

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Conference calendar

Date	Event Name	Location	Contact
July 2017			
13	Annual ICEA Mid-Year Conference	Ames	Keith Knapp
August 2017			
16-17	2017 Mid-Continent Transportation Research Symposium	Ames	Judy Thomas
24-25	ICEA Affiliate Meeting at ISAC Annual Conference	Des Moines	Keith Knapp
September 2017			
20-21	MINK Local Roads Meeting	St. Joseph, MO	David Veneziano
6	Iowa Statewide Traffic Incident Management Conference	Ames	John Wilson
October 2017			
5-6	2017 APWA Iowa Chapter Fall Conference	Dubuque	Jon Dienst

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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/.■

Iowa LTAP Tech Corner—PaveCool mobile app

What is it?

One of the biggest problems in Minnesota's bituminous pavements is a lack of in-place density due to late season paving practices. When bituminous materials are placed in cool weather, they are difficult to compact properly because the asphalt stiffens too rapidly. In response, the Minnesota Department of Transportation (MnDOT) developed the PaveCool app to assist asphalt contractors, inspectors, and engineers when making rapid decisions regarding cool-weather paving.

How does it work?

The PaveCool mobile app includes many important and useful features:

1. Users enter the time of day, the date, and the latitude of the paving job. Next, the type of mixture is entered along with the type of surface being paved.
2. The surface temperature, air temperature, wind speed, lift thickness, and the mixture delivery temperature are then entered. The final input is the amount of cloud cover.

A heat flow model is used to compute the temperature drop and the time it takes for the asphalt mix to cool from its delivery temperature to 175°F or 80°C.

If the user feels that there is an inadequate amount of time available to compact the mixture, options can be explored to extend the time. For instance, increasing the lift thickness or mix temperature will increase the window of time for effective compaction of the pavement.

Versions 2.4 and later also enable the user to specify starting and stopping compaction temperatures according to agency or manufacture specifications.

Where can I get it?

Currently, the app is available for Apple and Android mobile devices.

Use the QR code here or visit the MnDOT website at www.dot.state.mn.us/app/pavecool/ to download the free app today.■

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