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BETTER ROADS SAFER ROADS

LIMITING GLARE IN WORK ZONES

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The Local Technical Assistance Program (LTAP) is a nationwide effort financed by the Federal Highway Administration and individual state departments of transportation. Its purpose is to translate into understandable terms the best available technology for roadways, bridges, bicycle and pedestrian facilities, and public transportation for city and county roadway and transportation personnel. The TxLTAP, operated by the University of Texas at Arlington, is sponsored by the Texas Department of Transportation (TxDOT) and the Federal Highway Administration. This newsletter is designed to keep you informed about new publications, techniques, and training opportunities that may be helpful to you and your community.

WORK ZONE FATALITIES IN TEXAS ON THE RISE WITH MAJORITY BEING MOTORISTS

As part of its recognition of National Work Zone Awareness Week in April 2018, the Texas Department of Transportation reminded drivers that every day requires caution when driving through work zones. In 2017, work zone fatalities in Texas increased 9 percent over the previous year, resulting in 199 deaths and 813 serious injuries. With 4 percent of those fatalities being road crew workers, the remaining 96 percent was comprised of motorists, pedestrians and bicyclists.

"We always urge drivers to exercise great caution and obey traffic laws, especially in work zones," said TxDOT Executive Director James Bass. "Doing so helps ensure everyone – motorists and work crews – gets home safely to their loved ones."

As the state's population continues to boom, the price of progress can mean more than 2,500 active TxDOT work zones at any given time. In 2017, there were 27,148 work zone crashes in Texas, an increase of 5 percent over 2016. The leading causes of statewide work zone crashes – speeding and driver inattention – are entirely preventable. Fines in work zones double when workers are present and can cost up to $2,000.

"Roadside crews often work only a few feet from fast-moving traffic," Bass said. "Driver vigilance is paramount to ensuring the safety of everyone in the work zone. We urge anyone driving through a work zone to minimize distractions, give their full attention to the road and be prepared to slow down or stop on short notice."

As part of its ongoing Work Zone Awareness campaign, TxDOT also reminds drivers of the Move Over/Slow Down law, which requires drivers to move over or slow down when approaching TxDOT crews, law enforcement, emergency vehicles or tow trucks stopped on the roadside or shoulder with flashing blue or amber lights. Failure to do so can result in fines up to $2,000.

To further help raise awareness about the need for driver responsibility in work zones, TxDOT has partnered with Austin-based Texas Mutual Insurance Company to spread the campaign message around the state. An integral part of Texas Mutual's mission – helping employers prevent workplace incidents and minimizing their consequences – aligns with TxDOT's Work Zone Awareness efforts.

For media inquiries, contact TxDOT Media Relations at MediaRelations@txdot.gov or (512) 463-8700.

10 CITIES LEAD NATIONAL EFFORT TO ELIMINATE TRAFFIC FATALITIES

by Stephanie Johnston, Public Works Magazine, Editor-In-Chief

A pedestrian is injured every eight minutes and killed every other hour in traffic-related incidents. With more people choosing to walk or bicycle instead of driving, the Vision Zero Network was launched in spring 2015 to promote an approach to transportation design and management that challenges the inevitability of such deaths.

In early 2016, 10 Vision Zero Focus Cities began contributing to this goal by working to develop a model other cities can replicate: Austin, Texas; Boston; Chicago; Fort Lauderdale, Fla.; Los Angeles; New York City; Portland, Ore.; San Francisco; Seattle; and Washington, D.C. Each city's team includes representatives from the mayor's office and departments of police, public health, and transportation. The Vision Zero Network facilitates peer-to-peer exchange of ideas and strategies and data sharing and partnered with the National Association of City Transportation Officials (NACTO) to support the local transportation leaders.

"Our shared goals to stop traffic deaths are ambitious and urgent," said Seleta Reynolds, Los Angeles DOT general manager and NACTO president. "We'll get there faster by learning from one another."

The network also launched an Emerging Cities program for communities that've begun the Vision Zero process. They include San Jose, Calif.; San Antonio, Texas; and Eugene; Ore.

"Traffic fatalities and serious injuries aren't normal, unavoidable consequences of modern life," said San Antonio City Councilwoman Shirley Gonzales. "They are the result of public policy that prioritizes mobility over safety."

The network is partly supported by Kaiser Permanente, the nation's largest integrated healthcare system. "These are great examples of engaging diverse stakeholders in the critical work of ensuring healthy environments for all community members," said Tyler Norris, Vice President, Total Health Partnerships.

DISTRACTION TOPS DRIVERS' LIST OF GROWING DANGERS ON THE ROAD

Distracted driving tops drivers' list of growing dangers on the road, according to a recent survey from the AAA Foundation for Traffic Safety. The annual Traffic Safety Culture Index shows that 88 percent of drivers believe distracted driving is on the rise, topping other risky behaviors like:

- Aggressive driving: 68 percent
- Drivers using drugs: 55 percent
- Drunk driving: 43 percent

The proportion of drivers who report talking on a cell phone regularly or fairly often when behind the wheel jumped 46 percent since 2013. Nearly half (49 percent) of drivers report recently talking on a hand-held phone while driving and nearly 35 percent have sent a text or email. Despite their behavior, nearly 58 percent of drivers say talking on a cellphone behind the wheel is a very serious threat to their personal safety, while 78 percent believe that texting is a significant danger. A recent study from the AAA Foundation shows drivers talking on a cellphone are up to four times as likely to crash while those who text are up to eight times as likely to be involved in a crash.

"With more than 37,000 deaths on U.S. roads in 2016, we need to continue finding ways to limit driving distractions and improve traffic safety," said Dr. David Yang, executive director of the AAA Foundation for Traffic Safety. "The Foundation's work offers insight on drivers' attitudes toward traffic safety and their behaviors, so we can better understand the issue and identify potential countermeasures to reduce crashes."

While most recognize the dangers created by taking your eyes off the road, they engage in distracting behaviors anyway- creating a 'do as I say, not as I do' culture on the roadway."

Drivers in the AAA survey believe the problem of distracted driving has increased over the past three years, with nearly 50 percent reporting that they regularly see drivers emailing or texting while driving. Counterintuitively, federal estimates show the number of distracted driving crashes has actually dropped two percent. This may be due to the fact that it is difficult to detect distraction following a crash which makes distracted driving one of the most underreported traffic safety issues. According to government estimates, distraction plays a factor in just 14 percent of all crashes. However, past AAA Foundation research looking into teen drivers (one of the most vulnerable driving populations), used in-vehicle dash-cam videos to determine that distraction was a factor in 58 percent of crashes, 44 percent more than federal estimates.

"As the number of distractions behind the wheel increases- from the latest phone apps to in-vehicle technology, it is important that we better educate drivers on the dangers of distraction," said Jake Nelson, AAA director of traffic safety advocacy and research.

"There is a disconnect between what drivers do and what they believe. While most recognize the dangers created by taking your eyes off the road, they engage in distracting behaviors anyway- creating a 'do as I say, not as I do' culture on the roadway."

Any level of risk is too high when it comes to safe driving. Tasks that require a driver to take their eyes or attention off the road should be avoided while the vehicle is in motion- including the use of cellphones, infotainment systems, or navigation systems. AAA urges drivers to act responsibly when behind the wheel. In order to avoid distractions, drivers should:

- Put aside electronic distractions and never use text messaging, email, video games or Internet functions, including those built into the vehicle, while driving.
- Pre-program your GPS and adjust seats, mirrors, climate controls and sound systems before driving.
- Properly secure children and pets and store loose possessions and other items that could roll around in the car.
- Snack smart by avoiding messy foods that can be difficult to manage.

Visit the TxLTAP Library to view the complete 2017 Traffic Safety Culture Index.

TXDOT LAUNCHES 'HEADS UP, TEXAS' CAMPAIGN TO CURB DISTRACTED-DRIVING CRASHES

Nearly 1 in 5 crashes in Texas involves distracted driving – a ratio that has not changed in the past three years. With this in mind, the Texas Department of Transportation (TxDOT) recently launched the Heads Up Texas Campaign to remind drivers that their undivided attention to the road could save a life.

Effective Sept. 1, 2017, a texting-while-driving ban was written into law making it illegal to read, write or send a text while driving in Texas.

"It's extremely concerning that drivers still choose to give their attention to things other than the road when they're behind the wheel," said TxDOT Executive Director James Bass. "As a society, we're more connected than ever to our devices and easily tempted to multitask, but drivers need to understand all of these various distractions can lead to a tragic outcome."

In 2017, 19 percent of vehicle crashes on Texas roads involved distracted driving. Those 100,687 crashes resulted in 444 deaths and 2,889 serious injuries. In an effort to curb distracted-driving crashes, TxDOT launched its new "Heads up, Texas" campaign in partnership with AT&T *It Can Wait*. The centerpiece of the campaign was a 19-city, distracted-driving virtual reality experience which launched on April 4, 2018 in Waco.

According to AT&T *It Can Wait*, the majority of Texans ages 15-54 admit to driving distracted because of their smartphone. Additionally, nearly all Texans surveyed consider smartphone distractions to be dangerous while driving, but nearly 9 out of 10, or 89 percent, admit they do it.

"The *It Can Wait* campaign shares a simple message: Distracted driving is never OK," said Ryan Luckey, assistant vice president of Corporate Brand Marketing for AT&T. "We're proud to join TxDOT in sharing that message with Texans through revealing survey data and events that highlight the dangers and the new law."

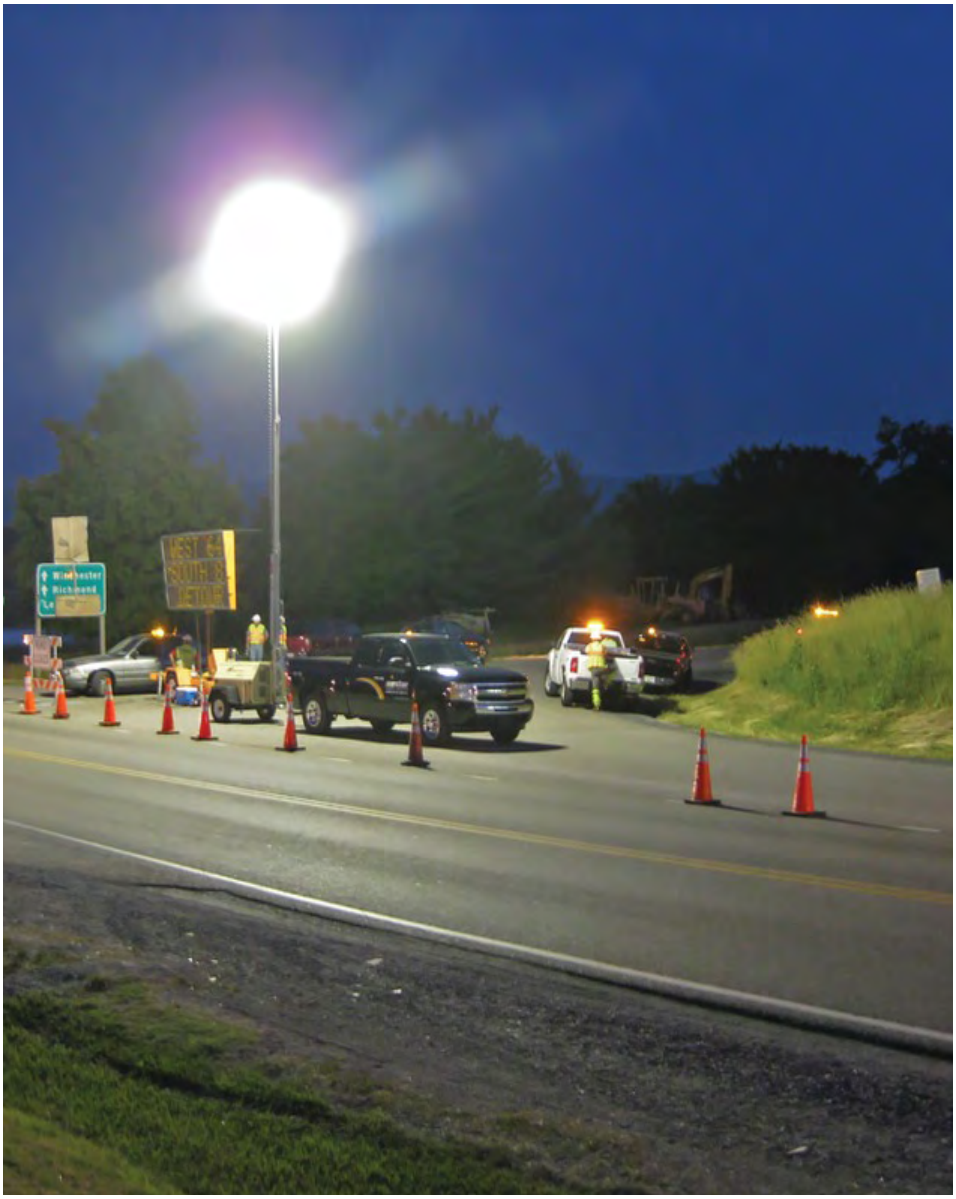
Effective Sept. 1, 2017, a texting-while-driving ban was written into law making it illegal to read, write or send a text while driving in Texas. Violators can face a fine up to $200. Though texting while driving is now punishable by law, it's not the only smartphone activity putting Texas drivers and passengers at risk. Among those Texans surveyed by AT&T *It Can Wait*, the top 5 smartphone distractions while driving are:

- Texting
- Snapping/viewing photos
- Playing music
- Emailing
- Accessing social media

To learn more about TxDOT's "Heads up, Texas" campaign, visit txdot.gov/driver/share-road/distracted.html. For media inquiries related to "Heads up, Texas", contact TxDOT Media Relations at MediaRelations@txdot.gov or (512) 463-8700. For media inquiries related to AT&T *It Can Wait* and smartphone distracted driving, please contact Diane Brandon, Diane.Brandon@att.com, 214-850-0563.

LIMITING GLARE IN WORK ZONES

By Rajaram Bhagavathula, Ph.D.



In 2016, there were over 288 nighttime crashes in work zones, resulting in over 800 fatalities.

Increasing traffic volumes are leading to a rapid increase in nighttime construction activities on our roads. This increase in nighttime construction on highways poses a major safety concern for both workers and motorists, as night traffic volumes are low and travel speeds are high.

Visibility is key

Visibility is an important factor in nighttime construction work on roadways. The light levels in a work zone should provide light enough so that workers can complete their tasks safely and efficiently. In addition, the light levels also should make workers and the work zone itself more visible to the motorists approaching the work zone. While increasing the light levels in a work zone tends to increase visibility for the workers, it also could increase glare for oncoming motorists. Glare reduces visibility for motorists and could preclude them from seeing workers and obstacles in the work zone. Further, increasing the light levels will only increase the visibility up to certain levels, beyond which any increase could negatively impact safety by increasing glare. Thus, light levels for work zones should be carefully designed so that they can ensure a high level of visibility for workers and motorists without causing glare.

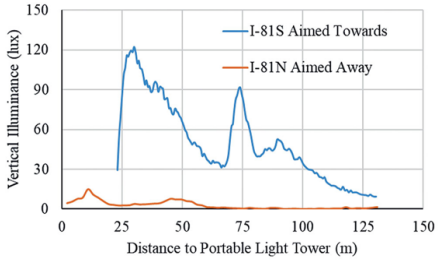


Figure 1. Change in the vertical illuminance as the vehicle gets closer to the portable light tower when aimed towards and away from the travel lane.

The problem with measuring glare

For the purpose of lighting work zones, contractors typically use portable light towers. These portable light towers, when aimed improperly, can significantly increase the glare for motorists entering the work zone. The issue of glare becomes even more important on limited access highways with higher speeds and, as a result, require longer stopping distances for motorists.

Figure 2. TRLMMS developed at VTTI: (a) TRLMMS hitched to vehicle; (b) Illuminance meter that measures the vertical illuminance mounted to the windshield; (c) "Spider" apparatus with GPS unit in the center; and (d) TRLMMS from behind with the headlamp barrier eliminating the influence of the following vehicle's headlamps.

The issue of glare from work-zone lighting has led 30 states in the U.S. to mention "reducing glare" in their respective work-zone lighting specifications. However, only two states (Louisiana and New York) have detailed, quantifiable glare specifications (recommended light positions, angles, maximum light levels, etc.) A majority of the states specify that the contractors must take actions to prevent, minimize or reduce glare for drivers. Nine states specify that glare should be evaluated subjectively or by performing a drive-through at setup. Subjective evaluations have the inherent bias of the engineer/inspector performing the evaluation. Subjective evaluations only at setup also ignore the glare when light tower orientation is changed during the course of the construction work.

NCHRP Report 498: Illumination Guidelines for Nighttime Highway Work specifies task-dependent lighting levels for work-zone lighting. It also lists strategies to reduce glare but does not recommend an objective way to measure glare for motorists. Thus, existing specifications do not provide sufficient guidance for reducing glare for motorists in the work zones. Furthermore, there is currently no way to objectively measure glare in-situ at work zones. Glare can be quantified by calculating veiling luminance, but veiling luminance cannot be calculated quickly, as it involves measuring the angles of glare source, illuminance of glare source and background luminance. Having an easy-to-measure, objective measure of glare could help in easily determining if the orientation and the positioning of the portable light towers is a source of glare to the motorists.

Figure 3. Light towers used in the study.

Light levels and visibility in work zones

Recent research conducted by the Virginia Tech Transportation Institute (VTTI) aimed to address the issue of glare in work zones by: (1) Conducting an on-site evaluation of light levels in work zones in Virginia; (2) recommending light-tower positions and orientations that will result in lower glare for motorists; (3) identifying an objective measure of glare and recommend acceptable levels of glare based on this measure; and (4) developing a protocol to evaluate work-zone lighting.

For measuring light levels in work zones, lighting data were collected from 10 active nighttime work zones in Virginia. Horizontal light levels (light incident on the road) were measured in both the vehicle travel lanes and the lane closed for construction work. In addition to horizontal light levels, vertical light levels at the driver's eye level from inside the vehicle (which can be used as a measure for glare) also were measured. Light levels were measured by a VTTI-developed light measuring system called the Trailer Mounted Mobile Light Measuring System (TRLMMS) (Figure 2). TRLMMS helped measure light levels on roadways without having to stop. TRLMMS is equipped with light meters and a high-precision GPS which enables measuring light levels along with their GPS coordinates. Results from the on-site evaluation of light levels in the work zone showed the horizontal light levels in the work zones were significantly higher than those specified in the NCHRP Report 498. In some cases, these levels were more than 10 times the recommended levels.

In addition, the results also showed that aiming the portable light towers into the travel lane in the work zone increases the vertical illuminance levels at the driver's eye level (Figure 1). These higher vertical illuminance levels can increase the glare perceived by the motorists.

For the second phase of the research, a human-factors evaluation of three kinds of commercially available light towers was conducted to understand the effect of light tower types and their orientations on visibility, glare and driver behavior. This human-factors evaluation also helped identify an objective measure of glare, and recommend illuminance levels and light-placement orientations that can reduce glare for motorists.

For the human-factors evaluation, a realistic work zone was setup on the Virginia Smart Road, a one-of-its-kind test track built to U.S. highway specifications. The simulated work zone resembled an active nighttime work zone on a limited access highway in Virginia with appropriate signage leading to the work zone and merge tapers. Three types of portable light towers were used (Figure 3). The first was a metal halide portable light tower with four 1,000-watt metal halide luminaires. These light towers are commonly used in active nighttime work zones in Virginia. The second was a balloon light tower with four 1,000-watt metal halide luminaires enclosed within a balloon, which diffuses the light. Balloon light towers are being used in mobile paving and

Continued on the next page.

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milling operations, and are usually mounted on vehicles. The third light was a newer LED light tower with 6 LED luminaires.

In the first of three orientations (the "Towards" orientation), the light tower and the luminaires were oriented toward the traffic in such a way that the angle between the driver line of sight and the luminaire beam axis was 45°. In the second orientation (the "Away" orientation), the light tower and luminaires were orientated away from the traffic in such a way that the angle between the driver line of sight and luminaire beam axis was 135°. In the final orientation (the "Perpendicular" orientation), the light tower and luminaires were orientated perpendicular to the direction of traffic in such way that the angle between the driver line of sight and luminaire beam axis was 90°. Recruited participants drove through the simulated work zone, and their visual performance and glare perceptions were measured for each light tower and in all orientations. Results showed that orientation in which the light tower is aimed towards the driver resulted in lowering visibility and increased glare perception. When the light towers were aimed away from or perpendicular to the driver, visibility was higher and glare perception was lower, indicating that these should be the preferred orientation for work-zone light towers.

Specs backed by empirical research

Based on results of the study, lighting specifications to reduce glare for drivers in the work zone were developed. These included specifying the angles between the luminaire beam axis and drivers' line of sight. This angle should always be greater than or equal to 90°. Some of the recommended orientations are shown in Figure 4. The lighting specifications also recommended that the contractor/inspector use a cosine-corrected illuminance meter to measure light levels in the work zone to ensure that adequate light levels are being maintained. The recommended horizontal light levels for the work zones were adapted from the NCHRP Report 498.

[The] increase in nighttime construction on highways poses a major safety concern for both workers and motorists, as night traffic volumes are low and travel speeds are high.

The lighting specifications also involved the development of an objective metric to assess glare in work zones. The average vertical illuminance measured in the traffic lane, at a height of 4.8 ft inside a vehicle's windshield between 65 ft and 260 ft to the portable light tower, should be less than or equal to 17 lux with a maximum allowed value of 50 lux. The inspector or engineer responsible should ensure that average and maximum vertical illuminance levels are lower than the specified values, and if a certain orientation of a portable light tower resulted in higher levels, then the orientation, location or aim of the light tower should change until the vertical illuminance measurements are within the specified limits. Finally, the specifications also involved the development of lighting evaluation protocol for work zones. For developing this protocol, the work-zone lighting plan recommended by the American Traffic Safety Services Association (ATSSA) was modified by including tasks for checking the light levels and changing the light-tower orientations to meet the required light levels. A final version of this protocol is shown in Figure 5.

The results of the research conducted by VTTI are currently being used to develop draft specifications by the Virginia Department of Transportation's (VDOT) Traffic Engineering Division with the support of VDOT's Construction Division and Maintenance Division. After review and necessary revisions, these specifications will be added to the Virginia Work Area Protection Manual. This research study demonstrates how applied research could help in developing lighting specifications that increase safety for motorists and workers in work zones, and requirements that are easy to enforce by the inspectors.

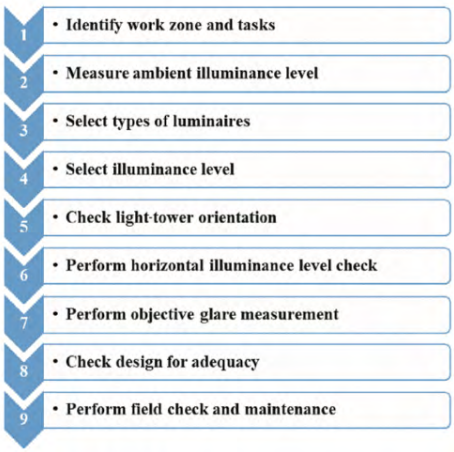

Figure 5. Work-zone lighting evaluation protocol adapted from ATSSA.

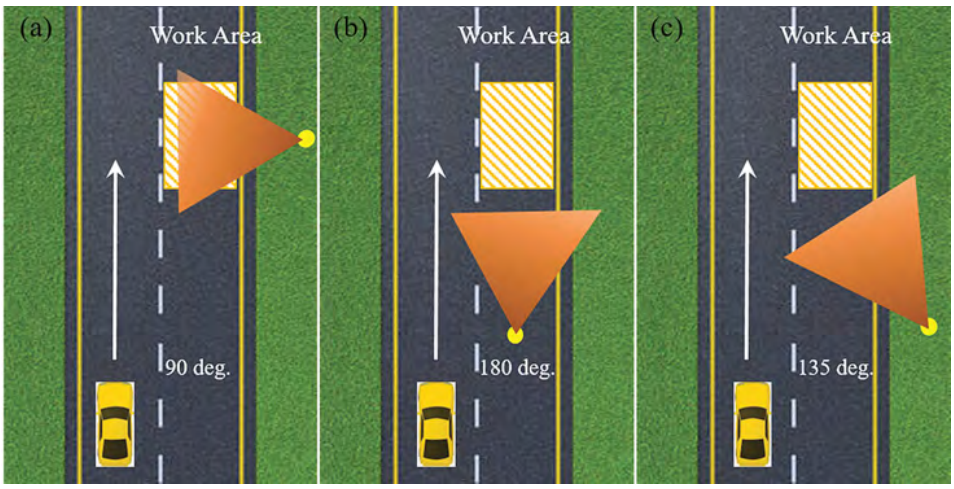

Figure 4. Some of the orientation of the portable light towers that can reduce the glare from drivers in work zones.

About the author:
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100 MOST CONGESTED ROADWAYS IN TEXAS

Traffic congestion leads to more problems than just traffic jams. Traffic congestion creates a ripple effect that impacts nearly every aspect of our lives, whether we drive or not. Where we live, where we work, where we shop and where we play—all are affected by traffic congestion in more ways than we realize:

- Increased stress and pollution that affect our health and environment.
- Increased fuel consumption and vehicle wear and tear that affect our finances.
- Increased costs of goods and services due to increased fuel usage and delivery times.
- Increased collisions, injury, law suits and insurance rates.
- Decreased time to spend time with family and friends, or at work, etc.
- Decreased emergency response times that can mean the difference between life and death.

It's simple: More time on the highway means less time with family and friends. Extra time on the road isn't just a drain on our patience; it's a drain on our wallets and our health. And gridlock, left unchecked, chokes the environment, our economy and our quality of life.

In response to increased roadway congestion throughout the state, in 2009 the Texas Legislature mandated that the Texas Department of Transportation annually produce a ranked list of the top most congested roadways in the state. This list measures congestion by the number of delay hours experienced by travelers on each section of road analyzed. Because of the slow nature of both the increase in use of the roads, as well as the ability to address a congested roadway, the overall list changes little from year to year.

2017 Top 10 Most Congested Roads in Texas

2017	County	Road Segment	From	To	2016
1	Harris	W Loop Fwy / IH 610	Katy Fwy / IH10/ US90	Southwest Fwy / US 59 / IH 69	1
2	Travis	IH 35	US 290 N / SS69	Ben White Blvd / SH71	2
3	Harris	Southwest Fwy / IH 69 / US 59	W Loop Fwy / IH 610	South Fwy / SH 288	11
4	Dallas	Woodall Rodgers Fwy / SS 366	US 75	N Beckley Ave	4
5	Harris	Eastex Fwy / IH 69 / US 59	SH 288	IH 10	3
6	Dallas	Stemmons Fwy / IH 35E/ US 77	John W. Carpenter / SH 183	Tom Landry Fwy / IH 30	8
7	Harris	Katy Fwy / IH10 / US90	N Eldridge Pkwy	Sam Houston Tollway W	5
8	Harris	Gulf Fwy/ IH 45	IH10 / US 90	S Loop E Fwy/ IH 610	10
9	Harris	North Fwy / IH 45	Sam Houston Tollway N	N Loop Fwy / IH 610	6
10	Dallas	US 75	Lyndon B Johnson / IH 635	Woodall Rodgers Freeway / SS 366	13

In November of 2014 and 2015, Texas voters approved extra funding in the forms of two amendments:

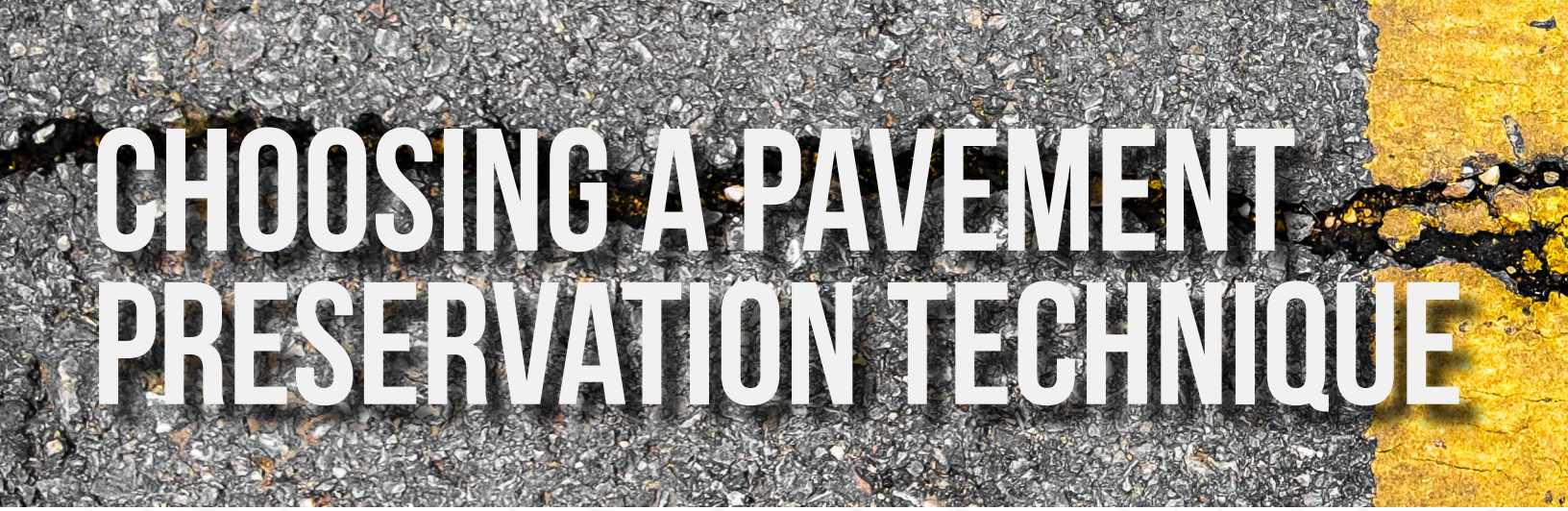
- Proposition 1 – which directs a portion of oil and gas tax revenues into the State Highway Fund.
- Proposition 7 – which directs a portion of the state's general sales and use tax, and motor vehicle sales and rental taxes to the State Highway Fund.

With this additional funding and collaboration with local transportation leaders across the state, TxDOT has dedicated $1.3 billion to the following metro areas in an effort to address congestion. These projects have now been approved and included in the state's Unified Transportation Program (UTP) and the 10-year project development plan.

UTP 10-Year Project Development Plan

Metro Area	Formula Distribution	Funding ($ million)
Austin	12.2%	$158.6
Dallas	28.0%	$364.0
Fort Worth	12.6%	$163.8
Houston	34.1%	$443.3
San Antonio	13.1%	$170.3
	100.0%	$1,300.00

To review the complete list of the 100 Most Congested Roadways in Texas, visit https://mobility.tamu.edu/texas-most-congested-roadways/.



CHOOSING A PAVEMENT PRESERVATION TECHNIQUE

By Dwight Walker, P.E.

Pavement preservation can be described as a proactive approach to protecting and maintaining existing pavements. Today there are numerous preservation techniques available. These techniques are regularly being refined and expanded as owners recognize that pavement preservation is a cost-effective approach and move from emphasizing construction and rehabilitation to focusing on preservation.

When most people think of preservation techniques, treatments such as chip seals, thin overlays and micro-surfacing probably come to mind, but there are several additional options. An important question then arises, "What is the best, or the most appropriate, treatment option?" Unfortunately, there is no easy or exact answer to that question. "It depends," is a frustrating but accurate summation. At this point in time, many owners rely on applying engineering judgment to select their preservation technique. But there is guidance available in making these judgments.

Maryland's approach

Many state DOTs have developed guidance documents that assist in their selection of pavement preservation treatments. Typical selection guidelines include treatment descriptions, benefits, applicable pavement conditions and recommended materials and procedures. According to Larry Galehouse, Director of the National Center for Pavement Preservation, one of the better guidance documents has been developed by the Maryland State Highway Administration. The Maryland guidance document is comprehensive and ties into their pavement management system. The following excerpt from the preface of the Maryland guidance document captures their approach:

"This guide will assist in determining 'the right fix for the right road at the right time' when used in conjunction with network-level and project-specific data. Step-by-step instructions on determining treatment options are provided through the use of flow charts, decision trees and treatment tables. At the end of the step-by-step process there will be many treatment options available. One or a combination of treatment options may be selected, depending on project-specific conditions. It is not the intent of this guide to provide a final treatment option(s). This guide will provide a series of options for preliminary consideration by District Offices and the Office of Materials Technology (OMT). It is anticipated that further project specific review, analysis and design will be required…"

Input information

In order to select the appropriate preservation technique, some basic information is needed. A good handle on the current pavement condition is critical, including information on the type and severity of existing distresses. Knowing the causes of the distresses is also important. Distresses may often have more than one cause. Without knowing the cause of the distress, an inappropriate treatment may be selected and may not be effective.

A distress identification manual is a useful resource in determining the type of distress and probable cause. The distress manual developed as part of the Long Term Pavement Performance (LTPP) study in SHRP is an excellent document.

The amount and type of traffic is another important piece of information to consider in selecting a treatment. Another consideration is the availability and experience of contractors for a particular type of treatment. Not all types of treatments may be readily available in all locations. As preservation work is more commonly performed, this concern is becoming less of a problem.

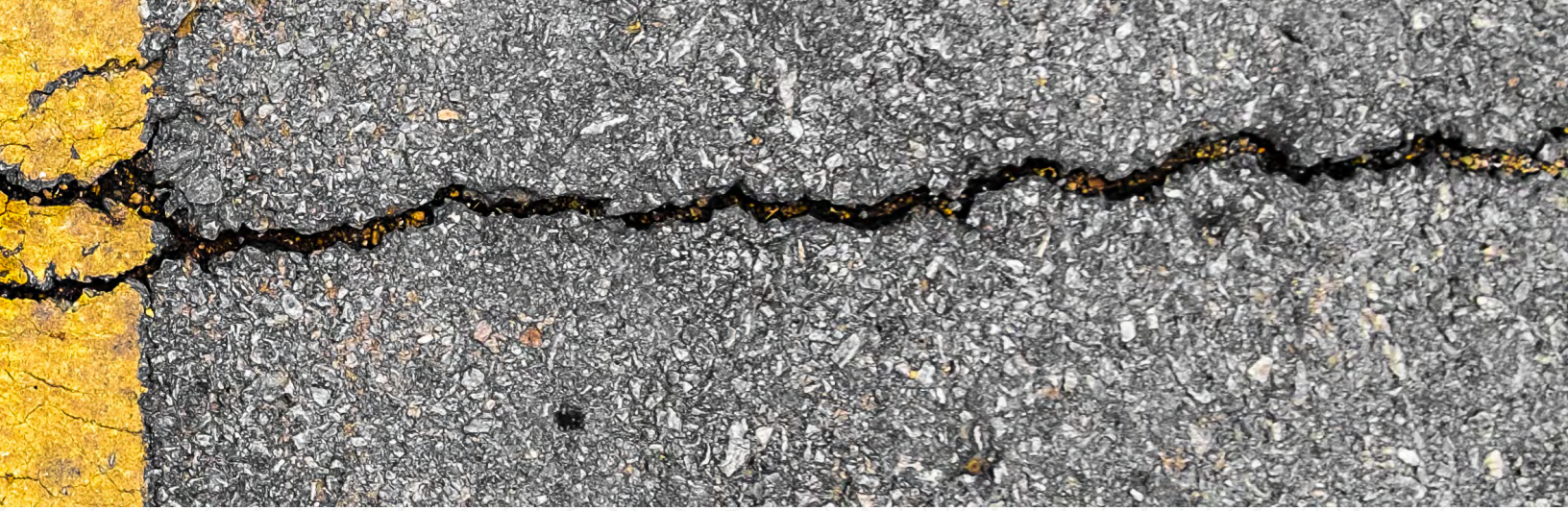
Treatment selection details

The various preservation treatment options have certain advantages, some disadvantages and a few limits associated with their use. The following information provides a brief description of how the more common treatment options may fit a particular pavement.

Crack sealing and filling

Cracking is an almost inevitable form of damage on asphalt and composite pavements. Sealing cracks is a common technique used as a preventative maintenance treatment. Cracks should be promptly treated to prevent water penetration, which accelerates pavement deterioration and results in potholes or base failures. Crack sealing/filling reduces water entering the pavement and lessens future deterioration by keeping debris from entering the crack. Milling is not required; routing is encouraged.

Filling or sealing cracks is not appropriate for a pavement with significant structural problems such as base failures, severe rutting or extensive fatigue (alligator) cracking. Excess sealing application can reduce a pavement's skid resistance and create a poor visual appearance. Crack sealing/filling does not provide any structural improvement.



Traffic should not be allowed on the sealed cracks until the sealant has cured. Blotting with an application of fine aggregate can protect the sealant from tracking or prevent the surface from losing friction.

Sealing and filling operations should not be done on wet surfaces to avoid adhesion problems between the crack and the sealant. Sealing should be done when the temperature is above 40°F. However, cool temperatures cause the pavement to contract and open the crack, so sealing at temperatures just above 40°F can result in better crack sealing.

Chip seals

Chip seals are used to address aged, cracked and raveled surfaces. They reduce water penetration and can improve frictional characteristics of mildly bleeding pavements. A seal coat will not improve a pavement with structural problems. Seal coats are not effective on cracks wider than 0.25 inches, pavements with lots of potholes or high severity fatigue cracking or severe rutting. Pavements that have stripping problems should not be chip sealed; a chip seal could accelerate the stripping.

Clean, cubical aggregate (chips) are important. Embedment of the chips is critical. Excess or loose chips can result in broken windshields. Seal coats can fail due to aggregate loss and bleeding. Chip loss failures are usually caused by dirty chips, improper selection or application of emulsion or other asphalt binder application, delayed spreading or rolling of chips, and failed traffic control. Bleeding is typically caused by loss of aggregate or spraying too much liquid.

Micro-surfacing and slurry seals

These treatments are very thin emulsion-based treatments placed on pavements with minor deterioration. Micro-surfacing is a mixture of a cationic polymer-modified asphalt emulsion, select aggregate, mineral filler, water and possibly some other additives. Micro-surfacing can be placed in multiple courses (for rut-filling, leveling and surface courses). Micro-surfacing is used to prevent oxidation (aging) and raveling and to improve skid resistance and rideability. It can be used on high traffic roads. It sets quickly and can usually be opened to traffic in about an hour. Micro-surfaces should not be placed when the temperature is below 50°F.

Slurry seals are similar treatments but do not typically use a modified emulsion and are limited to one layer/application. These treatments do not improve a pavement's structural (load carrying) capacity and should not be placed on pavements with stripping concerns. Crack sealing can be done before placing micro-surfacing or slurry.

Thin overlays

This category includes thin (generally 0.75 to 1 inch thick) HMA (and WMA) overlays and ultra-thin bonded wearing courses (UTBWC). We commonly describe these treatments as overlays, but they can also be placed in mill-and-fill installations.

Thin HMA overlays consist of a thin layer of pavement placed on a milled or leveled existing surface. This preservation treatment has the advantage of being a familiar technique. It can be used to improve skid resistance and rideability and to improve minor pavement cross-section problems (rutting, wear, etc.).

Pavements with minor cracking, weathering, friction loss and rutting problems are good candidates for a thin overlay. These overlays are not recommended for problems such as fatigue cracking, significant rutting or other major pavement deterioration.

An UTBWC is a very thin asphalt mixture layer, about 0.75 to 1 inch thick, which is placed in one pass using a specialized paver that applies a thick polymer-modified emulsion membrane on an existing pavement surface. NovaChip® is a well-known proprietary version of this treatment.

Before applying a thin overlay, cracks wider 0.25 inch should be sealed. Overbanding of cracks is not recommended for thin overlays. These treatments are not appropriate for existing pavements with more than 0.25 inch rut depth.

Conclusion

Selecting the appropriate treatment may take a bit of work, but there is assistance available. The websites of the National Center for Pavement Preservation and FP2 are excellent resources. One or a combination of treatment techniques can provide additional service life for our pavements.

Article reprinted from April 2018 issue of Asphalt Magazine.

GETTING TO KNOW THE U.S. ROAD ASSESSMENT PROGRAM

The United States Road Assessment Program (usRAP) is an innovative and proactive tool for analyzing the safety of a roadway and generating data-driven solutions for correcting hazards. Existing or newly-collected video of a road network is coded in 100-meter segments, and software, known as ViDA, outputs star ratings on a familiar 1-5 scale (for each star increase, the socioeconomic cost of crashes is halved on that road section). Additionally, ViDA will generate a safer roads investment plan, which is a ranked list of over 70 possible engineering solutions that meet a user-defined minimum cost-benefit target.

usRAP is NOT a substitute for professional engineering studies, Road Safety Audits (RSAs), or other activities performed by highway agencies and traffic engineers. Instead, it is a data-driven planning tool that provides unique additional benefits, including:

- Proactive risk assessment: Using video data and predictive risk models developed through decades of global research, usRAP allows transportation departments to focus on and correct hazardous locations, even before a crash or serious injury/fatality has ever occurred.
- Mapping: usRAP can be used to present clear and compelling visualizations of safety needs to planners, engineers, elected officials, and road users. Maps generated by ViDA show the scope of existing safety challenges and how a strategic, systemic approach to safety planning can save lives and prevent injuries.
- User-friendliness: 75% of the nation's roads are locally-owned, but many sub-State level agencies don't have access to extensive, robust crash data needed for traditional safety assessment tools. In contrast, usRAP simply uses video logs (in many cases, these have already been collected by certain tech companies and are freely available online) and free online software to generate a thorough and data-driven guide for engineers to implement according to local determinations, needs, and priorities.
- Reliability and focus on cost-benefit considerations: Many roads across the country have hazardous design features but low traffic volumes, such that crash patterns don't emerge in a consistent and actionable manner. usRAP focuses on trouble spots that may not be identifiable from crash data, and provides solutions based on 20-year return on investment potential.

STAR RATINGS

The first step in generating a safer roads investment program is that ViDA assigns star ratings to each roadway segment on the road network. A road safety score is determined for each road segment and the star ratings are assigned for specific bands of the road safety score. The road safety score and the star ratings, derived from the same data elements used to develop the safer roads investment plans, described above, are based on the presence or absence of design and traffic control features known to be related to safety for both roadways and intersections. The star ratings range from one star to five stars. One-star roads have the fewest safety-related design and traffic operational features. Five-star roads have many safety-related design and traffic control features. Separate star ratings are assigned for vehicle occupants, motorcyclists, bicyclists, and pedestrians because the features that affect crash frequencies for these various travel modes differ substantially. The star ratings consider factors related to both crash likelihood and crash protection. Star ratings are strongly influenced by traffic

> ...an innovative and proactive tool for analyzing the safety of a roadway and generating data-driven solutions for correcting hazards.

speeds on the roadway (whenever possible represented by the higher of the speed limit and the 85th percentile speed). The ViDA software can display maps of the star ratings for individual road sections.

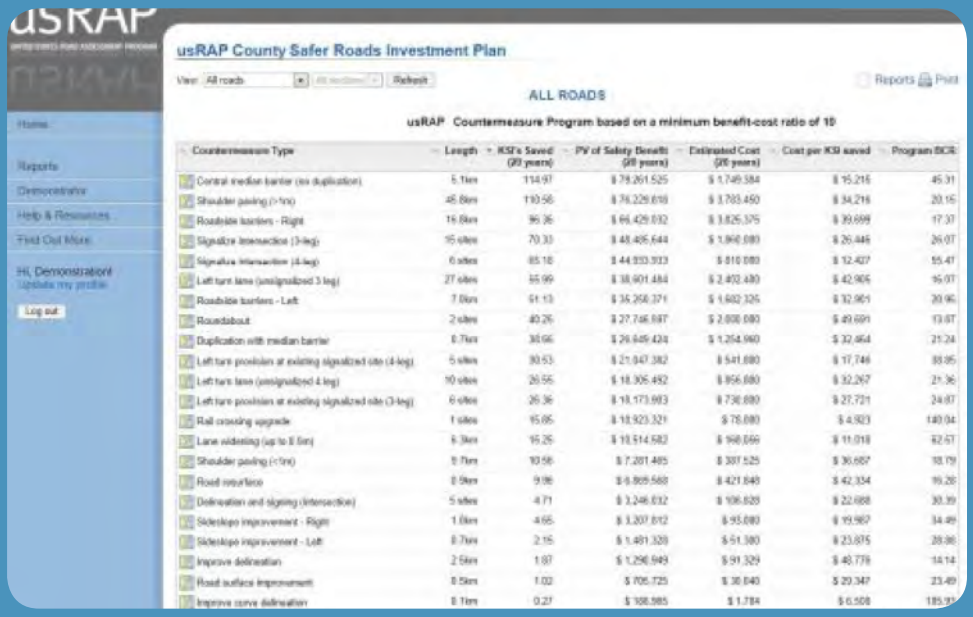
Star ratings are not influenced by traffic volumes. The star rating concept has been extensively documented by the International Road Assessment Programme (iRAP). Previous research has demonstrated that the vehicle-occupant star ratings for roads are strongly related to fatal and serious injury crash frequencies; thus, it has been documented that road safety scores and star ratings do vary with the frequency of severe crashes. **For more information on the global body of research that underpins ViDA, visit www.iRAP.org.**

DEVELOPMENT OF SAFER ROADS INVESTMENT PLANS

Once the star ratings have been established, the ViDA software assesses the engineering need at specific sites for nearly 70 specific countermeasures and performs a benefit-cost analysis of every countermeasure for which a need is identified. The benefits of countermeasures are estimated by determining the change in the road safety score that would result from implementation of the countermeasure. Normally all countermeasures are considered for each road network, although the software can also be used to target specific countermeasure types. The user specifies a minimum benefit-cost ratio which all projects in the final improvement program must meet. While site-specific crash data are not required, network-wide totals for fatal and serious-injury

crashes are desirable for calibration to local conditions. While star ratings are based on the presence or absence of design features and therefore are not influenced by traffic volume data, safer roads investment plans ARE impacted by VMT because they explicitly consider estimates of how many lives could be saved over 20 years if each improvement were made.

Visit http://www.usrap.org/ for more information on U.S. Road Assessment Program.



TTI PEDESTRIAN SAFETY RESEARCH INFLUENCES NATIONAL POLICY

Senior Research Engineer Kay Fitzpatrick, nationally known pedestrian safety researcher at the Texas A&M Transportation Institute (TTI), is accustomed to phone calls from traffic engineers who want to discuss her lifesaving research results. She is expecting a lot more of those calls now that the Federal Highway Administration (FHWA) has issued Interim Approval 21 for a pedestrian traffic control device she's extensively studied.

Fitzpatrick led several research projects on the Rectangular Rapid-Flashing Beacon (RRFB), a pedestrian-activated crossing warning sign. With FHWA's interim approval, Fitzpatrick believes a lot more engineers will want to install the device.

"Two of those studies were referenced in the interim approval document," Fitzpatrick explains. "Our research demonstrated that the RRFB shows a lot of promise in creating safer pedestrian and school crossings, in some cases. But the RRFB is not a panacea. There are conditions where it may not be very effective based on our studies that focused on driver yield rates, which varied dramatically depending on the individual pedestrian crossing."

The project—Will You Stop for Me? Roadway Design and Traffic Control Device Influences on Drivers Yielding to Pedestrians in a Crosswalk with a Rectangular Rapid-Flashing Beacon—was funded by TTI's Center for Transportation Safety in 2016 and analyzed data collected that year along with data from previous research. The research team discovered some of those variables that could have an effect on driver yielding.

"When I talk to engineers interested in the RRFB device and our research, I emphasize the use of caution," Fitzpatrick says. "Our research did not answer all the questions, and it's clear that additional studies are needed to determine under what conditions this particular traffic control device is most effective."

SYSTEM TO PROVIDE DATA ON RISKY WORK ZONE INCIDENTS

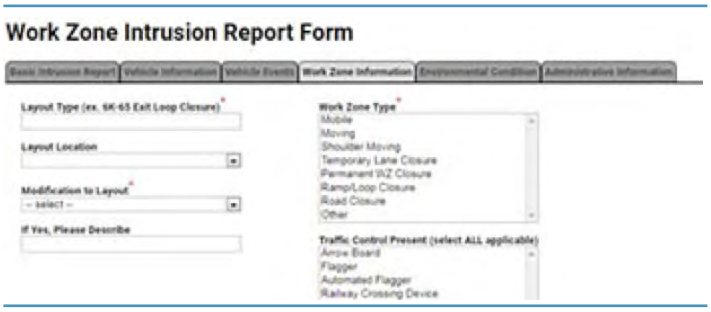
Work zone intrusions—in which vehicles breach the boundaries of roadway construction or maintenance operations—are a serious safety concern. From 2005 to 2010, 733 road workers were killed in work zones in the United States, with about half struck by motorists, according to the Federal Highway Administration. Motorists themselves are also injured or killed by intrusion crashes.

To address this safety risk, it's critical to understand what contributes to work zone intrusions. Yet little is known because the methods and standards for capturing data around these events are not well established.

To fill this gap, researchers with the University of Minnesota's HumanFIRST Laboratory created a system for road crew workers to report work zone intrusions. The data collected could then be used to examine risk factors, provide feedback to workers and the Minnesota Department of Transportation (MnDOT), and provide an empirical basis for future policy recommendations to the state.

Research associate Curtis Craig says that in aiming to make the system comprehensive yet efficient and user friendly, the researchers needed to first learn about the work zone crews—what they knew, the context of their work, and how they carried it out. "And we wanted to make sure we were testing [the system] in ways that reflect how they would use it in the real world," Craig says.

The researchers interviewed workers across Minnesota in both urban and rural settings. They found that workers understood an intrusion as a vehicle entering the area cordoned off by cones, but they felt it was practical to report an intrusion only when there was an actual increased risk to the workers onsite. "Whenever there were high risks, they were more likely to want to report it," Craig says.



During testing of the initial design, researchers asked potential users to input either a researcher-generated intrusion scenario or an actual one from their experience—"and they all had experiences that they were scared by or that were very memorable to them," Craig says.

Workers and supervisors were asked to "think aloud" as they interacted with the interface and were timed as they completed the reports. "We wanted to make sure it wasn't taking too much time out of their day. And we wanted to get a feeling for how usable the interface was," Craig says.

The second phase of testing showed that workers struggled with whether they would use the report to record minor intrusions that they personally didn't feel at risk for, Craig says. "Like a car coming in to and out of the work zone and knocking over a few cones. They could just go put the cones back up and get on with their workday. So that was an ongoing tension between what we wanted, which was to get as much data as possible, and what they felt they needed to provide," he says.

As a result, the researchers revised the earlier reporting logic by splitting it into an immediate "minor" report and a more comprehensive "major" report for higher-risk incidents. Users also tested different modes of the interface with a laptop, a tablet, and a paper form.

Work crew supervisors noted that the final version of the system should provide a clear explanation and rationale, which would help them motivate their crews to reliably report intrusions, Craig says. The success of the reporting system will depend not only on workers using it, he adds, but on a sustained dialogue between the users and the administrators of the system, adding that this engagement will help users feel "they're in the process of improving safety culture."

According to Craig, MnDOT staff are currently reviewing ways in which the intrusion reporting system could be integrated into the agency's operations.

TXDOT HSIP CALL FOR PROJECTS

The Texas Department of Transportation (TxDOT) expects to open the 2018 Highway Safety Improvements Program (HSIP) Call for Projects in early June 2018. The TxDOT HSIP is for highway safety projects that eliminate or reduce the number and severity of traffic crashes. It is limited to improvements that address the crash types identified in the Texas Strategic Highway Safety Plan (SHSP). Funds are provided for construction and operational improvements both on and off the state highway system. Funding will be available statewide for this program focusing primarily on improving safety and reducing severe crashes. Local governments are encouraged to work closely with their area or district offices to submit applications by the submittal deadline.

TxDOT HSIP information can be accessed on the TxDOT Highway Safety Engineering Forms and Publications web page.

For more information on upcoming events and workshops, visit txltap.org

Call the TxLTAP office at 817-272-9678 or email us at txltap@uta.edu to schedule an event or workshop near you.

TXLTAP EVENTS & WORKSHOPS

CDL KNOWLEDGE TEST PREPARATION

The overall goal of this workshop is to improve a Texas Commercial Driver's License (CDL) candidate's chance of successfully passing the CDL written examination and walk-around, pre-trip inspection. Please note, this workshop does not involve drive time.

HEAVY EQUIPMENT FOR WILDFIRES

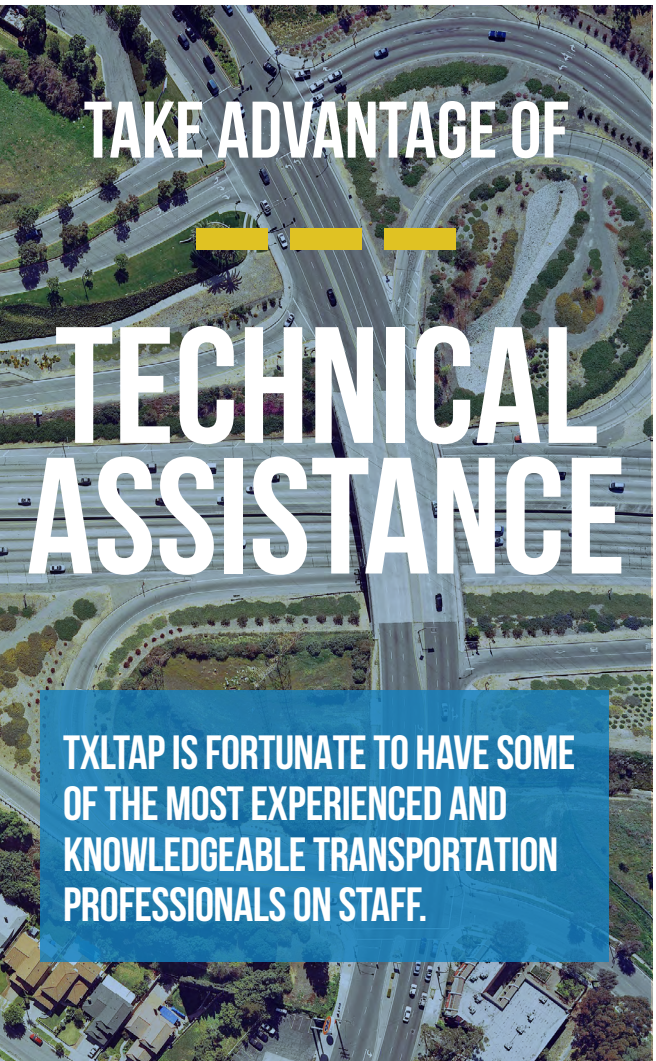
Heavy Equipment Operators are sometimes called out to assist fire fighters in wildland fire situations. Learn methods of attacking a fire, techniques of diminishing a fire with a dozer and grader, and dangerous situations to avoid.

HEAVY EQUIPMENT RODEO

Heavy equipment operators will be given a chance to learn and practice new skills while stressing safety and excellence. Operators will use maintainers, backhoes, dump trucks, loaders, and more to steer through a series of exercises designed to test their abilities.

SNOW AND ICE TECHNIQUES

Snow and ice control is a complex process. This workshop will cover personal and operational safety, plowing techniques, salt and abrasive application, and decision making based on the forecast and actual in storm conditions.



TAKE ADVANTAGE OF TECHNICAL ASSISTANCE

TXLTAP IS FORTUNATE TO HAVE SOME OF THE MOST EXPERIENCED AND KNOWLEDGEABLE TRANSPORTATION PROFESSIONALS ON STAFF.

This staff includes former maintenance managers, heavy equipment operators, road crew chiefs, civil and transportation engineers, inspectors, and the public works directors who all worked on the state's road system and in a nutshell "have been there, done that." Now Texas' local roadway agencies can directly benefit from their street smarts.

While training and information sharing at conferences or through a newsletter can do a lot of good, TxLTAP recognizes sometimes there is just nothing like rolling up your sleeves, experiencing the problem first hand and then offering a meaningful solution. That's why in addition to hosting classes and publishing Better Roads, Safer Roads, our program offers local roadway agencies an opportunity to consult directly with a TxLTAP subject matter expert to specifically address your organization's unique issue. And like all resources TxLTAP offers, there is no charge to receive our help or expertise.

Do you need information on proper method for fixing your lingering road problem? Would it help if someone came out to watch your road crew perform a repair and offer suggestions on how to save time and money in the future? Could you use the help of a traffic engineer who could assess a problematic intersection? Would it be a benefit to you if a subject matter expert came to ride the roads and developed a training presentation specific to your needs?

Take advantage of our technical assistance service!

Call 817-272-9678 or email us at txtlap@uta.edu. We're ready to help!

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