



Placing safety treatments at horizontal curves can significantly reduce crashes. Fortunately, countermeasures related to signage and pavement surface don't have to break the bank.

Enhanced Delineation & Friction for Horizontal Curves

FHWA Office of Safety
Proven Safety Countermeasures

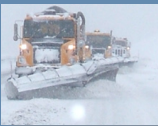
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Low-cost safety treatments vary by the severity of the curvature and the operating speed. Low-cost treatments typically include methods for warning the driver in advance of the curve, but treatments will vary by intensity of the warning. Implementing the recently published curve treatments included in the Manual on Uniform Traffic Control Devices (MUTCD) should improve curve safety over past practices by providing consistency. However, additional enhancements can be made with post-mounted delineation in the curve or an enhanced signing treatment that may include larger chevron signs with enhanced retroreflectivity. For more challenging curves, dual indicated advanced signs with constant flashing beacons may be effective. Pavement markings are also an effective communication tool to indicate the alignment change. Pavement friction is critical for changing vehicle direction and ensuring the vehicle remains in its lane. Traditional friction courses or high friction surface treatments should be considered for curves with numerous wet weather crashes or severe curves with higher operating speeds.

Background

Horizontal curves are a change in roadway alignment that creates a more demanding environment for the driver, vehicle, and pavement. The challenges associated with safe navigation of horizontal curves compound with the addition of a nighttime driving environment or inclement weather. Recent data analysis shows that 28 percent of all fatal crashes occur on horizontal curves. Furthermore, about three times as many

crashes occur on curves as on tangential sections of roadways. These statistics make horizontal curves prime sites for safety improvements.

Early driver perception and appropriate reaction to changes in the roadway greatly improve the safety of the curve. Inconsistent use of warning signs has been identified as an important factor contributing to the high incidence of crashes on curves. The MUTCD was recently revised to attempt to provide a more uniform application across the United States. Other recent research on signing practices in curves has shown great potential for improving safety with low-cost options. In addition to these treatments, new technologies are being evaluated for challenging curves, such as dynamic advanced curve warning signs and dynamic sequential light-emitting diodes (LED lights) on chevrons.

28% of all fatal crashes occur on horizontal curves

There are a variety of high-friction surface treatments available. While they typically have a higher unit cost than traditional friction courses, they can often be applied at the specific curve location for a relatively low cost. Additionally, where cross-section problems such as lack of appropriate superelevation exist, this can be a low-cost alternative to address a problem in the short-term until further improvements can be made.

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Michigan's Local Technical Assistance Program

Center for Technology & Training
Michigan Technological University
309 Dillman Hall
1400 Townsend Dr.
Houghton, MI 49931-1295

Telephone 906-487-2102
Fax 906-487-3409
E-mail CTT@mtu.edu
On the web www.MichiganLTAP.org

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Michigan LTAP Staff

Katherine Baeckeroot Technical Writing Intern
Andi Barajas Technical Writing Intern
Holly Burbank Workshop Coordinator/Marketing Assistant
Christine Codere Sr. Project Manager, Training & Operations
Tim Colling, PhD, PE Director
Enneesa Ewing Technical Writer
Shelley Farrey Technical Writer
Chris Gilbertson, PhD, PE Sr. Research Engineer
Shaughn Kern Editor/Technical Writer
John Kiefer, PE Research Engineer II
Cassandra Machinski Technical Writing Intern
Michelle Reed Office and Account Assistant
Pete Torola, PE Research Engineer II
Belle Wirtanen Technical Writer/Business Associate

About LTAP

The Local Technical Assistance Program (LTAP) is a nationwide effort funded by the Federal Highway Administration and individual state departments of transportation. The goal of the LTAP effort is to foster a safe, efficient, and environmentally sound surface transportation system by improving skills and increasing knowledge of the transportation workforce and decision makers.

Steering Committee

The LTAP Steering Committee makes recommendations on, and evaluations of, the activities of Michigan's LTAP.

Federal Highway Administration
Kurt E. Zachary, P.E. 517-702-1832
Local Program Engineer, FHWA

Michigan Department of Transportation
Bruce Kadzban, P.E. 517-335-2229
Local Agency Programs, MDOT

County Road Association of Michigan
Wayne Schoonover, P.E. 231-757-2882
Manager/Director, Mason County Road Commission

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Federal Highway Administration



As a child, I was inseparable from any sort of writing utensil. I would walk around the house, pen in hand, scribbling over books and writing on walls. After I learned the alphabet, I would just write words for hours. Now as a soon to be graduate of Michigan Technological University with a degree in communication and writing, I strongly believe our childhood dreams play a large role in determining what we do later in life and how well we accomplish these goals.

Children are often most passionate and instinctively in tune to their forte. With encouragement, opportunities are endless. However, it's important not to overlook these young age tendencies. When you listen to your inner calling, you are guided to where you are meant to be. According to John Milton, "Childhood shows the man, as morning shows the day."

Some of the most important aspects of life are continual growth and learning. Within all disciplines there are many characteristics necessary for achieving goals, among the most important are: perseverance, intensity, and a willingness to learn. Essentially, this is passion proceeded with accomplishment. When you have a clear purpose for doing something and enjoy its process, the inherent value increases for everyone; a vast majority of people are happier as a result of this. In this issue, the People in Transportation section features the Byle family and the pursuit of their passion for roads. Successful outcomes are the product of hard work, desire, and growth; the Byle family demonstrates these qualities as do other individuals featured in this edition.

As transportation professionals we have an impact on the community; in this quarterly edition of *The Bridge*, we touch base with individuals such as Tom and Jennifer Byle, a family dedicated to improving the quality of life through better structured roads. Their dedication helps them excel in their own careers but also improve the well-being of community members; for example, their current restoration project of White's Bridge.

The articles of this edition feature improvements and updates, as well as the winner of the 2014 Great Ideas Challenge competition, Randy Nagelkirk of Ottawa County Road Commission. Nagelkirk used his skills to provide innovative solutions for paving badly deteriorated road edges. This practice has now spread throughout many of their different garages. At the Center for Technology and Training we are proud to highlight those who foster a more positive and intense environment; we encourage you to work with the passion and willingness similar to those we have as children, paving the way toward a greater future and better roads.

Katherine Baeckeroot
Technical Writing Intern



Michigan's
Local Technical
Assistance Program

The Center for Technology & Training (CTT) is a part of the Department of Civil & Environmental Engineering at Michigan Technological University in Houghton, Michigan. The mission of the CTT is to develop technology and software, coordinate training and conduct research to support the agencies that manage public infrastructure. In support of this mission, the CTT houses Michigan's Local Technical Assistance Program, which is part of a national effort sponsored by the Federal Highway Administration to help local road agencies manage their roads and bridges. For more information, visit www.MichiganLTAP.org.

Childhood Passion, Lifelong Career

Katherine Baeckeroot, Technical Writer Intern
Center for Technology & Training



Photo Credit

The year is 1963 and construction on I-196 is underway. Approximately one mile from the construction site, Tom Byle lived with his family. Tom was well known for riding to the construction site during the morning, returning for lunch, and once again riding back in the afternoon, eager to see the impressive road equipment and construction. He did this almost every day during the summers of 1963 and 1964, ultimately establishing his passion for road equipment and engineering.

Now a civil engineer, Tom recalls his early childhood days building roads in sandboxes and seeing construction zones with warmth, humor, and as the highlight of his vacation trips. Not many can say that they love their jobs and enjoy attending work every single day. Tom has been the exception during his more than 40-year career as a civil engineer for Kent County Road Commission. He

currently works as the Assistant Director of Engineering, enthusiastically sharing that he has the best job in the industry. "When I get tired of sitting in the office I always have a bridge to inspect!" And with 173 bridges under his jurisdiction, Tom has numerous opportunities to get out of the office.

Over the years Tom's passion for civil engineering has not only influenced Kent County, but also his daughter Jennifer. Thirty or so years after the beginning of Tom's

the M-6 Bike Path. Tom had no idea that the company his daughter worked for had been hired to design the paths, as he was not involved in the selection process. When the two realized that they were working together on the same project they were immediately thrilled and began discussing their plans. This project was a great learning experience for Jennifer because on top of receiving marks for corrections and alterations, she also had time to discuss and understand the reasoning

"Seeing how happy my dad was with his job made a huge impression... you need to love what you do."

career Jennifer continued in his footsteps by attending Michigan Technological University and earning a degree in civil engineering. This news was a surprise to both Tom and his wife, although they perhaps could have foreseen it. Jennifer's childhood involved Sunday afternoon drives around West Michigan viewing the latest construction projects. "While most people would go out of their way to avoid construction sites we would head straight for them!" she laughed. They both stressed the importance of being passionate about what you do in the field. According to Jennifer, "Seeing how happy my dad was with his job made a huge impression on me... You need to love what you do, that's what is most important." Jennifer now works in Grand Rapids for the United Research Services (URS) Corporation, an engineering, design, and construction firm.

The Byles have had the opportunity to work together on specific projects, such as

behind the suggestions as Tom dedicated time to thoroughly explain these changes. Their work won the 2010 MI APWA Quality of Life Project of the Year Award.

Their passion for roads goes beyond the office and construction sites. Over the years Tom has collected a rather impressive fleet of old construction equipment and the duo occasionally has the opportunity to bring some pieces to shows. Outside of work the pair is donating their time and engineering knowledge to rebuild Whites Bridge in Keene Township. The original bridge was lost to arson in July of 2013. They are both board members for the Whites Bridge Historical Society, working together with the design and plan production for eventual construction of a replica covered bridge. You can follow this project online at

[Facebook.com/RebuildWhitesBridge](https://www.facebook.com/RebuildWhitesBridge)

and

WhitesBridgeHistoricalSociety.org



Tom and Jennifer Byle's work on the M-6 Bike Path project earned them the 2010 MI APWA Quality of Life Project of the Year Award.



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Online Winter Maintenance Resources

Winter is fast approaching, and while many are preparing to keep warm and shovel immense amounts of snow, others are preparing to re-familiarize with best practices for winter operations. Below, are a few of the numerous online resources for forecasting, plowing, deicing, salt use, and workforce management. We hope that these resources will help guide you through a safer and easier winter season.

Hyperlinks to these resources are at MichiganLTAP.org/WinterResources

Forecasting/Responding

[MI Drive Interactive](#) provides video feeds from along highways in Michigan, as well as realtime information on traffic incidents.

[The National Center for Atmospheric Research](#) allows you to view real-time weather data including satellite, radar, surface and air temperatures, and forecasts.

[Response to Extreme Weather Impacts on Transportation Systems](#) (2014) is an NCHRP Synthesis that identifies common themes in state-level responses to extreme weather events, including case reports on communications, data, knowledge management and lessons learned.

[@MDOT](#), MDOT's primary Twitter account, frequently contains information on severe weather events. MDOT has three regional Twitter accounts well: [@MDOT MetroDet](#), [@MDOT West](#), and [@MDOT SouthWest](#).

Anti-icing/De-icing

[Strategies to Mitigate the Impacts of Chloride Roadway Deicers on the Natural Environment](#) (2013) is an NCHRP Synthesis of proactive and reactive mitigation strategies as well as new technologies for ice removal.

[An Experimental Study on the Effectiveness of Anti-icing Operations for Snow and Ice Control of Parking Lots and Sidewalks](#) (2013) investigates studies done to assess the effectiveness of anti-icing.

<http://SaltInstitute.org/Road/Publications> lists The Salt Institute's handbooks, brochures and newsletters on winter operations, focusing on effective and safe salt use.

Plowing

[Snow Plowing Near Railroad Crossings](#) (2009) includes tips regarding snow removal and de-icing pertaining to rail safety.

[Repurposing Truck Tires](#) (2013) gives instructions on how to utilize old truck tires as wing plow cutting edges.

Workforce

[Reduce the Risk of Drowsy Driving](#) (2011) illustrates the risks of extended driving schedules during winter maintenance, and outlines ways to prevent workers from driving while tired.



To help you get the most out of your winter season, the CTT will publish the presentations from this year's Winter Operations Conference (October 28th and 29th in Gaylord Michigan).

This year's Winter Ops topics include discussions of road weather information system (RWIS) environmental sensor stations (ESS), tow and dual-wing plows, and a panel on law enforcement, as well as breakout sessions for managers and operators.

The presentations from this year and others will be available at

ctt.mtu.edu/WinterOps

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City of Farmington Hills' Bryan Pickworth demonstrates salt spreader calibration at the 2013 Winter Ops conference.

Minnesota Snow & Ice Control Handbook Updated

This update was originally published in Minnesota LTAP's quarterly newsletter, Technology Exchange, in winter of 2013 (21.1). The Minnesota Snow & Ice Control handbook is used by several local agencies in Michigan to supplement their winter maintenance practices.

The Minnesota LTAP and Minnesota DOT have updated the *Minnesota Snow and Ice Control: Field Handbook for Snowplow Operators*.

The handbook helps promote the understanding of the tools, best practices, and limitations for snow and ice control. It also helps users understand when to use and when not to use these tools and practices. In addition, it encourages progressive changes in snow and ice control practices that will help agencies reduce salt/sand use and

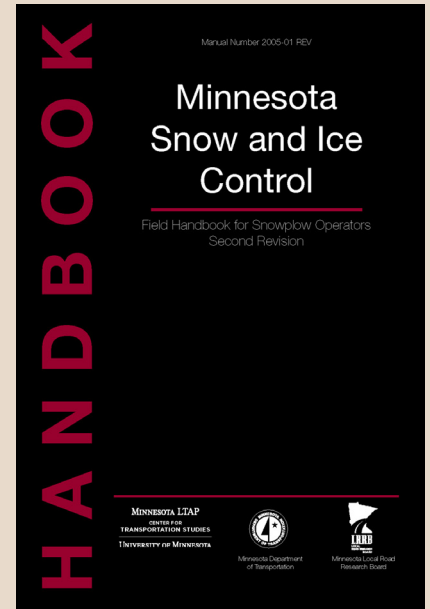
environmental impacts while meeting the safety and mobility needs of roadway users. Sections of the handbook include:

- Basic concepts
- Before the winter
- Before the storm
- During the storm
- After the storm
- Application rate guidelines
- Materials and quality control
- Additional resources

The new version includes updates from CTAP instructor Kathy Schaefer and other experts at MnDOT. It incorporates new data and other changes since the original was published in 2005.

The handbook is published by Minnesota LTAP, MnDOT, and the Minnesota Local Research Board (LRRB). It is available for download at

www.mnltap.umn.edu/publications/handbooks/documents/snowice.pdf



New Rules, Resources for ADA Compliance

The FHWA and Department of Justice have changed the requirements for whether or not curb ramps are required to be installed for Public Right of Way. In the past, this Americans with Disabilities Act (ADA) compliance was determined by measuring resurfacing thickness. However, as of March 2014 this compliance is now based on the designation of pavement projects as being either “maintenance” or “alteration”. Any pavement project designated as alteration, including resurfacing, requires installation of ADA-compliant curb ramps.

According to Kurt Zachary, Local Program Manager for the FHWA's Michigan Division, even though this change is subtle, “distinguishing between a maintenance treatment and an alteration greatly impacts how Local Public Agencies will need to scope projects.”

To aid in this compliance, the FHWA's Federal-aid Essentials Video Library added a video that defines resurfacing versus maintenance projects and curb ramp compliance:

fhwa.dot.gov/federal-aidessentials/catmod.cfm?id=107



This video is specifically geared toward local agencies, and includes companion resources and links to other web pages. Larry Doyle, Local Agency Program Manager for MDOT, states that this video “provides excellent information including answers to many frequently asked questions on providing accessible transportation facilities.”

Zachary notes that MDOT has also taken a proactive role in helping local agencies with ADA compliance. Along

with working with the FHWA to thoroughly clarify the difference between alteration and maintenance, each year MDOT coordinates with the Michigan Concrete Association to offer several workshops on how to comply with ADA standards. The next “Constructing Pedestrian Facilities for Accessibility” workshops will take place in early 2015, and be announced through CTT email lists.

Upcoming CTT events can be found at ctt.mtu.edu/training ■

Horizontal Curves (from Page 1)

Crash Modification Factors are available from the FHWA Clearinghouse and present effectiveness levels for various horizontal curve treatments. For example:

- Installing chevron signs, curve warning signs, and/or sequential flashing beacons can result in a 38-43% reduction in all fatal and injury crashes.
- Installing chevron signs on horizontal curves can produce a 16% reduction in non-intersection fatal and injury crashes.
- Installing new fluorescent curve signs or upgrading existing curve signs to fluorescent sheeting can result in a 25% reduction in non-intersection fatal and injury crashes.
- Providing static combination horizontal alignment/advisory speed signs can generate a 13% reduction in all injury crashes.
- Refinishing pavement with microsurfacing treatment can bring about a 43% reduction in all fatal and serious injury crashes.

Guidance

Each State with identified problems on horizontal curves should review those locations in light of the guidance provided in Section 2C.05 of the 2009 MUTCD to improve consistency within and across jurisdictions. Additionally, States should review signing practices and policies to ensure they comply with the intent of the new guidance.

Each State should also develop a process for identifying and treating problem curves. This process should consider the full range of available treatments described here and use the appropriate application for the identified problem(s), as noted in the countermeasure description above. ■

FHWA Contacts

Office of Safety: Joseph Cheung
joseph.cheung@dot.gov, 202-366-6994

FHWA Resource Center: Frank Julian
frank.julian@dot.gov, 404-562-3689

Key Resources

FHWA Web site:

http://safety.fhwa.dot.gov/roadway_dept/horicurves

Manual on Uniform Traffic Control Devices, FHWA, 2009:

<http://mutcd.fhwa.dot.gov/>

Low-Cost Treatments for Horizontal Curve Safety, 2006, FHWA-SA-07-002:

http://safety.fhwa.dot.gov/roadway_dept/horicurves/fhwasa07002/

Safety Evaluation of Improved Curve Delineation:

<http://fhwa.dot.gov/publications/research/safety/09045/09045.pdf>

AASHTO Highway Safety Manual (Available for purchase from AASHTO):

<http://highwaysafetymanual.org/pages/default.aspx>

Crash Modification Factor (CMF) Clearinghouse (search “horizontal curve”):

<http://www.cmfclearinghouse.org/>



Utah Department of Transportation

Where pavement safety is concerned, there is a strong correlation between friction and crash reduction—particularly for curves and intersections. High friction surface treatments (HFST), one of the FHWA’s Every Day Counts initiatives, specialize in creating as much helpful friction as possible, and can be applied specifically to areas of pavement where there is safety concern.

Dave Morena, Safety and Traffic Operations Engineer at the FHWA’s Michigan Division, explains that HFST of horizontal curves has resulted in a crash reduction of over 50% in most states where long-term studies have been conducted. It should be noted that this value may be higher than certain reported CMFs that also take intersection-related crashes into consideration.

The FHWA has published a 12-page FAQ on HFST, including maintenance and operations, cost, site conditions, and studies done in several states. It can be found on the FHWA’s website, or by visiting:

<http://tinyurl.com/ne9nykx>

(This link will send to you directly to the PDF on the FHWA’s website)

Grader Paver Wins 2014 Great Ideas Challenge



Ottawa County Road Commission's Grader Paver won first prize in Michigan LTAP's 2014 Great Ideas Challenge. The Great Ideas Challenge identifies, shares and rewards the great work done by local road agencies in Michigan. The challenge is open to all employees of road agencies that serve counties, townships, cities and villages in Michigan.

This year's first place idea, the "Grader Paver," was submitted by Randy Nagelkirk, Ottawa County Road Commission's (OCRC) Assistant Equipment Supervisor. The Grader Paver is a grader that uses a custom-built wing—operated using the grader's front plow controls and hydraulics—to wedge badly deteriorated road edges. "Wedging" uses a variable-thickness asphalt patch to reestablish cross slope and structure to the outer ¼ to ½ of a pavement. This is particularly useful for repairing failed pavement edges where the center of the pavement is still structurally sound.

The idea for the Grade Paver came from the Hudsonville garage when foreman Mike

TerHorst got together with his grader operator, Ed Stein. Nagelkirk explained that from there, the design evolved from trial and error. "Back in the day we used a box paver attached to the back of the truck. It didn't pave nicely, so it had to be touched up with the grader. Maintenance eventually thought to just try it with the grader from the start." Unfortunately, the grader alone couldn't produce an ideal result, so the custom grader wing was created. Originally the wing was stationary, but later it became clear that some control over the wing was necessary, so a chain was added. "At some point we thought, 'Why don't we use the hydraulic system? It's already out there!'" After that, it was easy said Nagelkirk. A cylinder was added to the wing to make it movable, "It's a collaboration. Everybody works together, and now the grader operator and the dump truck driver have it down to a science." According to Nagelkirk, the Hudsonville Garage is fantastic at this new process, carrying it out in three of their four garages. Ed Stein has even been traveling between them to teach the new practice, and

workers have gone to their satellite garages to do wedging for them. Nagelkirk says that for this type of repair, the results are just as good as if an actual paver were used, "perhaps even better since the OCRC doesn't have a paver and this is much faster."

In the past three years, OCRC has used the Grader Paver on approximately 10-15 miles of road in Ottawa County; three miles were done last year. It's a fast process, and when done correctly the roads appear like new. The Grader Paver is ideal for sections of low volume, low traffic roads where hiring a paving contractor wouldn't make sense. Furthermore, the grader can pave over uneven surfaces that would normally be unsuited to a paver. "To me it's just as good as a paver in this situation...it's phenomenal." However, Nagelkirk cautions that not all roads are good for this type of process since there may not be enough cross slope, and a good crown needs to be maintained. "You don't want to make a bowl out of the road."

Ottawa County's first place prize included \$600 toward registration fees or travel costs for any transportation-related conference or workshop, and an additional \$200 in LTAP Bucks toward attending any event sponsored by the Center for Technology & Training. OCRC also won the second place prize (another \$100 in LTAP Bucks) for work on the hub plug retainer quick fix used on their trucks. For more information regarding LTAP's Great Ideas Challenge and how to become involved, watch for announcements in *The Bridge* newsletter.

For questions regarding the Grader Paver, Randy Nagelkirk can be contacted at

RNagelkirk@ottawacorc.com ■



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- ▶ Like father, like daughter
- ▶ New resource for new ADA requirements
- ▶ Winter resources for the upcoming season
- ▶ Paver Grader wins Great Ideas Challenge



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Michigan Technological University
309 Dillman Hall
1400 Townsend Drive
Houghton, MI 49931-1295
906-487-2102

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Upcoming Events

Register at ctt.mtu.edu/training

Special Topics in Roadsoft: Road Module

Nov 6 – Webinar

DEQ Transportation and the Environment Conference

Dec 3-4 – Bay City

Asset Management Workshops

Dec 9 – Battle Creek

Dec 10 – Ann Arbor

Materials Acceptance Process Seminar

Dec 10 – Escanaba

Asset Management for Elected Officials

Dec 11 – Okemos

2015 County Engineers Workshop

Feb 3-5 – Manistee

2015 Michigan Bridge Conference

Mar 17-18 – Bay City

2014 National Accelerated Bridge Construction Conference

December 4-5 – Miami, FL

The 2014 National Accelerated Bridge Construction (ABC) Conference will focus on pre-fabricated bridge elements, systems, and technologies that will allow accelerating construction of bridges using various materials and techniques. ABC projects successfully completed in the US and overseas will be presented.

Several ABC workshops will be held on December 3, one day prior to the conference. The attendees will include DOT engineers and other bridge professionals including consultants, material suppliers, contractors, academia, and representatives of governmental agencies.

Registration for this conference is handled through the organizer's website. Visit www.2014abc.fiu.edu for the conference program, opportunities to exhibit, registration and more.