

CROSSROADS



WISCONSIN TRANSPORTATION INFORMATION CENTER – LTAP at the University of Wisconsin–Madison

“The goal was to make sure there was good research and informed judgment behind every decision to change or add.”

Revised MUTCD sets new safety standards

RECENT RELEASE of the 2009 Manual on Uniform Traffic Control Devices (MUTCD) introduces a range of updates and additions local road officials will need to apply in their jurisdictions.

The first comprehensive revision of the national standard in six years features changes from expanded use of symbol signs to new guidance on establishing right-of-way control at intersections. It also incorporates minimum sign retro-reflectivity standards adopted in January 2008.

Crossroads highlights here a selection of the updated provisions that will influence transportation infrastructure for state and local governments. The Wisconsin Department of Transportation hopes to publish its supplement officially adopting 2009 MUTCD by the end of 2010.

Safety data provides framework

Tom Heydel, Traffic Engineer for WisDOT Southeast Region—who served on a review committee for the 2009 edition—says the basis for many key changes came from data from traffic safety and operational studies and observed trends.

“More than previous editions, this manual reflects the results of individual FHWA initiatives focused on improving safety,” he observes. “The goal was to make sure there was good research and informed judgment behind every decision to change or add.”

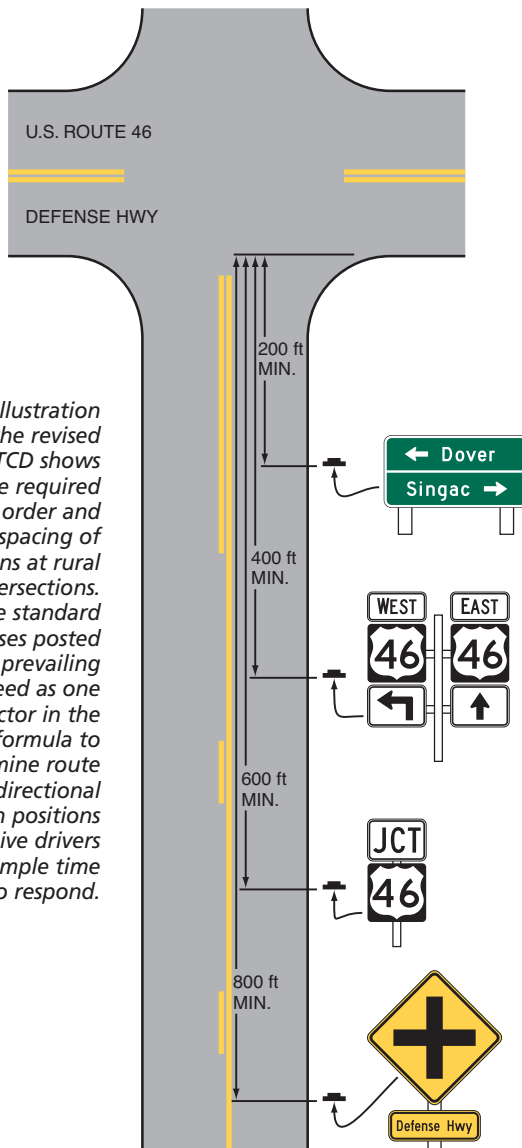
John Berg, Division Design and Operations Engineer for the Federal Highway Administration (FHWA), based in Madison, says the updated MUTCD also furthers the “complete streets” concept by requiring better pavement markings and longer walk times at crosswalks

to increase safety for bicyclists and pedestrians.

Berg and Heydel identified the various provisions they know, from experience and feedback, will have an impact on keeping local roads safe and in compliance.

More sign visibility

The MUTCD update adds methods for enhancing the conspicuity, or visibility of regulatory, warning or guide signs with flags, plaques, reflective stripes and beacons.



An illustration from the revised MUTCD shows the required order and spacing of signs at rural intersections. The standard uses posted or prevailing speed as one factor in the formula to determine route and directional sign positions that give drivers ample time to respond.



Plaque in black on yellow background alerts drivers to a new turn restriction.



Red/orange flags call attention to a change in the posted speed limit.

It also specifies the order and spacing of directional and route signs at rural intersections, and the minimum horizontal offset from the edge of the travel lane and/or shoulder. Here as elsewhere in the new edition, Heydel says detailed figures illustrating the standards make them easier to understand.

Changes in the 2009 edition strengthen requirements for sign-

The grinding process produces blended materials in gradations that make good backfill and, often, a better base under new pavement.



Asphalt Zipper reclaimer attached to wheel loader.

Contacts

Chris Elstran
Chippewa County
Highway Department
715-738-2616
celstran@co.chippewa.wi.us

Dave Teunissen
Sheboygan County
Highway Department
920-946-6194

Resources

<http://www.asphaltzipper.com/>
<http://www.zanetispower.com/>
Vendor sites with information on self-powered reclaimer attachments.

Full-depth reclamation made easy

PULVERIZING rutted, broken or severely cracked asphalt pavement on a short section of road or intersection is an efficient operation for the Sheboygan County Highway Department these days thanks to a reclaimer attachment its crews use on a range of small jobs.

Foreman Dave Teunissen says the compact reclaimer attachment the department purchased two years ago gives the department a cost-effective way to handle those jobs in less time. They can schedule the unit quickly if there's an emergency road repair or prepare a utility trench a day ahead of a storm sewer crew, leaving the pulverized material in place for the crew to use as backfill.

Practical road recycling

Highway and street departments around Wisconsin are learning these portable reclaimers can make practical and easy work of full-depth reclamation (FDR) on smaller local road projects. Operators attach the unit to a wheel loader or backhoe and set it to pulverize the surface asphalt layer along with a portion of underlying base materials. Teunissen reports going as deep as 12 inches with the county's 48-inch reclaimer.

This road recycling technique eliminates the need to saw, remove and haul away chunks of pavement. Besides speeding work on individual projects, the grinding process produces blended materials in gradations that make good backfill and, often, a better base under new pavement. Adding gravel or stabilizers like cement, fly ash or asphalt emulsion also can improve the strength and stability of the base.

Projects where Sheboygan County found the technique and equipment fit the task include stabilizing a 1500-foot section of county road with a bad base. The winter freeze/thaw cycle further weakened the base and accelerated surface deterioration. Crew Operator Pat Campbell says his workers pulverized down through the existing base, put the pulverized material back in place, graded it and repaved the road.

In another scenario, he describes how towns and villages contract with the county to make a low-cost improvement on lightly traveled roads using the reclaimer. They pulverize the old asphalt to a determined depth then simply compact the blended material in place to create a "new" road.

Besides small reconstruction projects on roads and opening utility trenches, the department routinely deploys the unit for FDR on pavement patching jobs or to repair broken shoulders. Here as with other applications, workers can reclaim damaged, deteriorated areas of the asphalt and base layers while leaving adjacent pavement undisturbed.

The process also minimizes the impact on traffic. After they grind out the asphalt for a storm sewer project in advance of the construction crew, Campbell and his operators do not need to erect barricades or place steel plates. They simply post a "loose gravel" sign.

Efficient operation

Campbell and Teunissen estimate the county's reclaimer averages about 42 feet per minute on most projects. Designed for smaller jobs, it runs most efficiently on pavement sections measuring less than one mile.

They report the equipment requires minimal maintenance. A less-than-full-depth milling operation requires a wash of water over the grinder to keep it cool.

Adding the reclaimer attachment to the department's equipment list was expensive up front, Teunissen explains. But after only two years in operation, he sees the potential for savings over time as the department finds more opportunities to make efficient use of FDR on improvement projects.

Equipment specs

Two self-powered reclaiming attachments now on the market are the Asphalt Zipper and the Zanetis RoadHog. The units differ from typical milling attachments because they do not rely on the hydraulics of the loader or backhoe to operate. The reclaimers have their own diesel engine that powers the cutting drum.

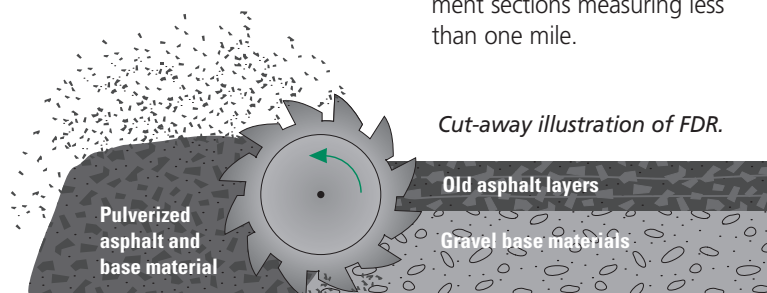
Units range in cutting width from 30 to 72 inches. They attach to backhoes and wheel loaders. Costs range from \$89,000 to \$173,000 depending on cutting width, engine horsepower, and options and accessories. Replacement bits cost between \$8 and \$10 apiece.

Sheboygan County purchased a 48-inch model with hydraulic depth control that is powered by a 173 HP John Deere turbo diesel engine. The reclaiming unit is easy to transport, attach and remove from the loader.

Points for flexibility

Patrol Superintendent Chris Elstran says a major reason the Chippewa County Highway Department purchased a reclaimer attachment last year was the chance to schedule and perform FDR without having to coordinate with an outside contractor. "There are plenty of projects where we need the flexibility to do full-depth grinding on our own."

The department plans to deploy its new 72-inch reclaimer for the first time this spring after on-site training from the equipment vendor. Elstran says they will use FDR on a variety of projects, ►



Make safe work zones a priority

ROAD CONSTRUCTION

and maintenance projects require coordinating workers, equipment, special events and sometimes the weather. Another item on the must-do list for any project that affects the flow of traffic is setting up safe work zones in and around the job site. Like other operations, doing it right takes training.

Local street and highway departments in Wisconsin and contractors that work with them can tap the resources of the Transportation Information Center (TIC) for a choice of training programs that help keep their employees up to date on work zone safety. Besides the one-day workshops TIC presents annually at locations throughout the state, officials responsible for local roads can book work zone or flagger training courses that instructors can customize and present at their location.

Teach uniform approach

TIC instructor Jim Schneider says his goal with these on-site courses is to include everything participants need to know about follow-

including pothole and bump repairs, culvert repair and replacement and work on intersections.

Other projects include milling asphalt overlays on bridges down to the concrete to do repairs. Elstran says he expects to manage precise profiling that does not go to full depth, allowing work crews to remove as little as 2 inches of the road surface without affecting the base layers.

Small-scale solution

Judging from the experience of Sheboygan County and other highway departments, Elstran anticipates making efficient use of his department's equipment and people with this application. The reclamation attachment offers local road officials a good option for integrating FDR as a solution for more small-scale road improvement projects. ■

ing federal standards to lay out temporary traffic control zones and set up a flagging operation. "The course content is based on requirements in the MUTCD, but also on what we hear from participants about specific issues," Schneider explains. "We keep our approach pertinent so the information they take away relates to what they're actually doing."

The programs cover the basics and specify correct procedures on urban or rural roadways.

Where a local government plans to contract with an outside firm on projects, they often include employees of the company in the training so all workers understand the essentials of work zone safety and their role in it. TIC instructors sometimes use actual problem areas identified by the local department in the hands-on portion of the workshop, asking participants to lay out traffic control measures for sites they know.

Schneider says this generates suggestions that provide the framework for a learning give-and-take that helps them consider outcomes in a realistic light. "Our goal is to train supervisors and workers on how to make a work zone safe and efficient, teaching them to adopt the standards uniformly for all projects."

Building confidence

The Marathon County Highway Department plans to bring in the TIC to conduct its day-long workshop on every aspect of work zone safety for about 70 employees this spring. Assistant Operations Supervisor Kris Baguhn is asking Schneider to emphasize use of TIC's *Work Zone Safety* flipbook. He keeps one in every truck so workers have a reliable resource available for scheduled work or emergencies.

"I want a way to get everyone uniform in how they set up a work zone and use the safety precautions for flagging outlined in the book—like wearing the required clothing, using the correct

Media sheds light on work zone crashes

Risks to drivers traveling near or through highway work zones was the subject of a December 2009 *New York Times* article that raised the question of whether there is adequate and uniform enforcement of national safety standards. The story surveyed more than 100 legal cases involving work zone crashes. It described incidents where problems like edge drops or the absence of warning signs led to vehicle fatalities. Highway officials who commented for the article acknowledged work zone crashes are a concern but stopped short of attributing them to deficient work zone traffic controls or lack of oversight. The coverage sheds critical light on the problem, noting that federal standards do address operations in temporary traffic control zones set up for routine maintenance and major road projects. It also draws attention to the public's concern about work zone traffic safety and the liability risk to government agencies when something goes wrong. For local road officials, the story underscores the need to train employees in uniform safe procedures and make work zone inspections a standard of operation to reduce the likelihood of crashes or injuries. Check archives at <http://www.nytimes.com/> for "Efforts Lag to Improve Safety at Work Zones," *New York Times*, December 21, 2009.

signs," Baguhn says. "To me, learning to use the flipbook is the best way to build people's confidence."

As training scenarios, Baguhn concentrates on typical road and utility projects where proper flagging is essential. These include crack filling and paving on state and county roads, ditching and culvert cleaning, brush removal in right-of-ways, minor bridge repairs and shouldering on four-lane highways. And when bigger projects come up he says having workers familiar with the "book of rules" assures him they will know how to create work zones that work—for his project crews and the driving public. Go to the *Calendar* for On-Site Workshop listing. Contact TIC to learn more and book a program. ■

Contact

Transportation Information Center
800-442-4615
tic@epd.engr.wisc.edu

"Our goal is to train supervisors and workers on how to make a work zone safe and efficient, teaching them to adopt the standards uniformly for all projects."

Resource

<http://tic.engr.wisc.edu/workshops/listing.lasso>

Page on TIC site with complete workshop information.

Engineering study helps town save on road project



Pulverizing and blending the existing asphalt with a portion of new base aggregate.

The soil borings revealed a strong foundation that did not need repair. What did need attention was the pavement surface, 10 inches of sequential asphalt overlays, some of them pulverized from the impact of the heavy loads.

AN IMPORTANT truck route in the Town of Maine went from rough road to tough road last year thanks in part to an engineering study that helped local officials in the Marathon County Township decide what kind of improvement to make. The town board also used study results to secure a grant from the state that offset project costs by 50 percent.

Maine's experience demonstrates how valuable it is to do an engineering investigation early in the planning process on a road reconstruction project. The resulting information was critical to the board's decision making.

Borings reveal strong base

The two-lane road in question runs adjacent to a quarry 3M owns where the company mines rock for use in roof shingles. Town Chair Betty Hoenisch says it is no surprise the steady convoy of trucks hauling heavy loads out of the quarry along a one-mile stretch put stress on the road. Rutted and cracked, it was in poor condition.

Initial proposals were to dig out and replace the sub-base before resurfacing with traditional

asphalt. Before agreeing to that approach, Hoenisch asked the board to approve an engineering study so they could learn more about the road and what level of reconstruction it needed. "Local



Rutting and cracks show poor condition of pavement before rebuilding.

residents had talked for years about how well built the road was and I thought it was time to find out exactly what we had."

According to Andy Walters, a geotechnical engineer with the Wausau office of Tetra Tech who conducted the preliminary study, what they had was an original

road built on a sub-base of granite blast rock from the quarry. Tetra Tech's soil borings revealed a strong foundation that did not need repair. What did need attention was the pavement surface, 10 inches of sequential asphalt overlays, some of them pulverized from the impact of the heavy loads.

Wausau-based REI Engineering then analyzed the results of a traffic study, documenting daily traffic loading from the quarry trucks and other vehicles. Their findings indicated that the heavy truck traffic equaled 250,000 cars per day compared to an average of 200 actual cars per day on the road. With 3M in the process of requesting an allowance from the town for exceeding the 80,000-weight limit, everyone saw the improvement project as an opportunity to rebuild the road for handling heavy loads.

TEA grant covers half

3M had a history of reimbursing the Town of Maine for a portion of maintenance costs on the road from the quarry. The prospect of a major upgrade prompted the company to suggest the town apply to the TEA (Transportation Economic Assistance) grant program. Administered by the Wisconsin Department of Transportation, the grants cover up to 50 percent of the cost for transportation facility improvements that encourage business and industry to remain and expand in the state.

"3M was a real partner with the town on this project, they were with us every step of the way," Hoenisch says. Ultimately, the town and 3M shared the \$400,000 cost of the improvement project. The TEA grant covered \$198,000 of the total.

REI co-owner and Registered Land Surveyor Tom Radanz notes



Many layers of old asphalt are visible during a saw-cutting operation to replace a culvert at the start of the road improvement project.



A worker prepares the road base for paving.

that TEA grants demand more pre-planning and documentation. He and REI Project Manager Alan Farrell prepared the required design study report that includes information on the road's functional class, its current condition and why it needs improvement. REI also explored sight lines and stopping distances on the road to determine if the speed limit met state specifications. At REI's recommendation, the town lowered the posted limit from 35 to 30 mph.

Radanz and Farrell also participated with Walters in meetings with the town board and 3M to discuss all options, and submitted project drawings and specifications to support the grant application. Radanz recalls, "It was important for us to communicate what all the findings told us and help everyone at the table understand the design approach that fit those findings."

Highway-level solution

Radanz says knowing as much as possible about the existing road helped REI develop a feasible design and create a better product. "In this case, the facts we had about the sub-base, traffic loads and safety issues led us to a pavement design that will stand up to current and future loads a lot longer."

The final design was for a road that will require minimal maintenance over the next 15 to 20 years. After milling off the top 6 inches of old asphalt—set aside to use on other town overlay projects this summer—the contractor, American Asphalt, then pulverized the remaining asphalt and blended it with 2 inches of 1¼-inch base aggregate to create the finished base. The aggregate composition helps transfer pavement moisture to the ditch.

Over the base aggregate, the asphalt design featured a 4-inch layer of binder (large rock mix) that meets WisDOT pavement



Applying final E10 asphalt layers.

type 37.5 mm and 2 inches of tough surface asphalt, an E10 mix that reduces rutting, a major concern due to the heavy truck traffic on the road.

Tetra Tech provided construction oversight on the road project and conducted materials testing during base preparation and asphalt placement, an investment the town made to ensure good construction practices and the use of high-quality materials.

Follow the facts

Hoenisch estimates the \$30,000 invested in preliminary studies and grant documentation saved the town a minimum of \$600,000 on the project. Following the facts gleaned from the soil borings and traffic study, the town steered away from a more-complex project that would require closing the road completely and spending to prepare an alternate route for the quarry trucks. Instead, the contractor kept one lane open throughout the project, allowing traffic movement and commerce to continue.

"The test bores told us exactly what we had and sent us in a different—and better—direction than we were headed," Hoenisch adds. "It was the best money we ever spent." ■

Contacts

Betty Hoenisch
Town of Maine
715-675-5607
chairman@townofmaine.com

Alan Farrell
REI Engineering
715-675-9784
afarrell@reiengineering.com

Tom Radanz
REI Engineering
715-551-4433
tradanz@reiengineering.com

Andy Walters
Tetra Tech
715-432-9490
Andy.Walters@tetrattech.com

"The facts we had about the sub-base, traffic loads and safety issues led us to a pavement design that will stand up to current and future loads a lot longer."



3M trucks haul their quarry loads on the new road.

The town steered away from a more-complex project that would require closing the road completely.

Resource

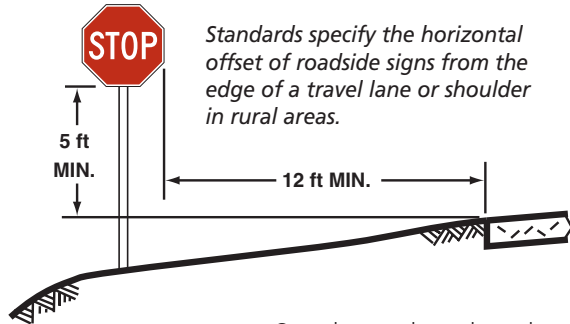
<http://www.dot.wisconsin.gov/localgov/aid/tea.htm>

Link to WisDOT's Transportation Economic Assistance program.

Revised MUTCD sets safety standards

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ing horizontal curves to reduce crashes. A new table defines various approaches based on the difference between the posted or prevailing speed and advisory speed. Heydel suggests the information makes it easier to establish safe speeds under every condition and install signs that match.



Using studies that show growing public recognition of traffic control symbols, the 2009 MUTCD specifies them in many cases to replace language signs.



New "school bus stop ahead" symbol sign has a black legend on green fluorescent background with red to show flashing lights and stop sign on a standing bus.

One change that takes a broad stroke is the standards now apply to private roads open to public travel. The MUTCD covers roads within shopping centers, airports, arenas and other privately owned facilities. Berg notes some rules do not translate easily to conditions in parking lots and facilities so these are exempt.

Roundabouts and setting speeds

In response to the growing use of roundabouts in the United States, the new MUTCD expands its section on signing and pavement markings for this new style of intersection. The manual introduces new directional arrow signs and circulation signs specific to roundabouts.

Speed studies get a strong endorsement in the 2009 MUTCD. According to Heydel, it emphasizes development and use of these engineering studies for setting speed zones. Current Wisconsin policy mirrors this provision. The TIC fact sheet *Setting Speed Limits on Local Roads* covers all the latest changes and is available free from the Transportation Information Center.

There is new guidance in the manual for establishing right-of-way control at intersections. Traffic volume on all legs of the

intersection, approach speeds and approach angle, sight distances and crash data are among factors to consider.

Signs and signals

Using studies that show growing public recognition of traffic control symbols, the 2009 MUTCD specifies them in many cases to replace language signs. Examples include "School bus stop ahead" and "Turning traffic must yield to pedestrians." It also retires word signs like "HILL" or "DIVIDED HIGHWAY" in favor of universal symbols.

Extensive research prompted FHWA to take a new look at determining signal warrants related to pedestrian volume. The provision requires road officials to examine a combination of vehicle and pedestrian volumes over a four-hour period or during a single peak hour. Berg says this makes it easier to meet Warrant 4 requirements with lower pedestrian volumes on streets with a high volume of vehicle traffic but harder to meet it on streets with low volume.

A new section on countdown pedestrian signals addresses application of hybrid beacons as an option at unsignalized crosswalks or where emergency vehicles cross traffic. Known as the HAWK, the device combines features of a traffic control signal with a warning beacon and goes dark between activations. Judged effective in studies around the country, Heydel says WisDOT is evaluating its response to this device and its usage.

Legible street name signs

The anticipated update of requirements for street name signs is part of the 2009 edition. Sign legends must be a mix of uppercase and lowercase letters, see *below*. Traffic speed dictates letter size: signs along a 45 mph or faster multi-lane roadway require 8-inch uppercase and 6-inch lowercase lettering



versus 6-inch uppercase and 4 1/2-inch lowercase for lower posted speeds. For local roads posted at 25 mph or less, the 4-inch/3-inch standard still applies.

The new provisions allow the use of blue, brown or white as an alternative to green for the background color of street name signs. The new standard for legend colors is white lettering on green, blue and brown signs, black letters on white signs.

With changes in sign sizes related to road speeds and other regulatory factors, the MUTCD also features a new Sign Size table to give street and road officials an easy reference for updating their signs.

Attention to work zones

Provisions that update measures to keep temporary traffic control zones safe for workers and road users reinforce the MUTCD focus on reducing crashes and fatalities in every roadwork scenario.

Among a series of revisions in this section, an important change for local governments is the rule requiring high-visibility safety apparel for all workers in the public right-of-way on all roads, not only federal aid highways.

Flaggers in a work zone must use a visible paddle or a flag to signal approaching drivers. The standard no longer permits hand signals alone.



The 2009 MUTCD details proper flagging protocols that require visible apparel and paddles or flags motorists can see clearly.

The 2009 edition also expands on a recommendation to develop complete traffic control plans for special events that, like road construction projects, effect normal traffic movement.

Time to review

The 2009 MUTCD is available for review online at the FHWA website or purchase in printed form. The site includes resources that go with the revisions in this edition, including a series of slideshow presentations that highlight key changes throughout the MUTCD.

Crossroads plans to revisit the topic in future issues and explore individual revisions in more depth. ■

Contacts

John Berg
Federal Highway Administration
608-829-7515
john.berg@fhwa.dot.gov

Tom Heydel
Wisconsin Department of Transportation
262-548-6763
Tom.Heydel@dot.wi.gov

Resources

<http://mutcd.fhwa.dot.gov/>
Link to the Manual on Uniform Traffic Control Devices information and resources on the FHWA site.

Setting Speed Limits on Local Roads, TIC Bulletin #21, updated in 2009, publication outlines the process of studying and setting safe speeds on Wisconsin roads.

CROSSROADS provides road and bridge information for local officials. Published quarterly by the Wisconsin Transportation Information Center (TIC) at the University of Wisconsin-Madison, it is part of the nationwide Local Technical Assistance Program (LTAP). TIC is operated by UW-Madison and sponsored by the Wisconsin Department of Transportation and the Federal Highway Administration. Please contact us for permission to reproduce articles or graphics.

Steve Pudloski, Director
pudloski@epd.engr.wisc.edu
Ben Jordan, Staff Engineer
jordan@epd.engr.wisc.edu
Katie Pawley, Program Associate
ticepd@epd.engr.wisc.edu
Mary Maher, Writer/Editor
WRITING & CREATIVE CONCEPTS
Susan Kummer, Graphic Designer
ARTIFAX, PUBLICATIONS BY DESIGN

RESOURCES

Print copies of listed publications available free from TIC. Download or request items at **Publications** on TIC website. Video, CDs, and DVDs loaned free at county UW-Extension offices. Also see **Video Catalog** on TIC website.

TIC website
<http://tic.engr.wisc.edu/>

Publications

Setting Speed Limits on Local Roads, TIC Bulletin #21, 6 pp., updated 2009. Available from TIC. Reviews the role of local governments in setting limits. Update includes information from new *Statewide Speed Management Guidelines*.

Flagger's Handbook, 28 pp., 2007. Pocket-sized handbook on flagger safety includes important changes in the MUTCD.

Work Zone Safety: Guidelines for Construction, Maintenance & Utility Operations, 55 pp., 2006. Illustrated handbook reviews temporary traffic control applications that promote safety for vehicles, pedestrians, workers and equipment.

Web Sources

Page on FHWA site with link to 2009 Manual on Uniform Traffic Control Devices (MUTCD) and information discussing changes.
<http://mutcd.fhwa.dot.gov>

DVD/VHS/Multimedia

Timely resources new to TIC collection or related to current newsletter topics.

Flagging Operations and Procedures, North Carolina State Institute for Transportation Research and Education, 2002, 24 minutes, #18610 VHS (also DVD). Demonstrates proper equipment and procedures in the Wisconsin *Flagger's Handbook* for single flagger, two flaggers, pilot car, night flagging, one-direction flagging and emergency flagging operations. Recommended for flaggers and their supervisors.



CALENDAR

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Other Events

April 14 . . . Pewaukee
2010 Traffic Engineering Workshop and Transportation Planning Forum

Sponsored by the Institute of Transportation Engineers (ITE) at the Country Springs Hotel in Pewaukee. Fee: \$65. Contact John Cambell at jcambell@traffic-ad.com for more information.

May 19 Madison
Maintenance Decision Support System Showcase

Free FHWA-sponsored training session discusses the experience of state DOTs and large cities in implementing Maintenance Decision Support Systems (MDSS) for winter maintenance operations. MDSS is a computer-based, customizable tool that provides route-specific weather forecast information and treatment recommendations. It helps support efficient use of salt and other deicing materials, effective use of operators and equipment, reduced environmental impact from deicing chemicals, and improved road condition monitoring and reporting. Register online at <http://www.utahltap.org>

FEEDBACK

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NAME _____ TITLE/AGENCY _____

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Mailing list change/addition Information/resource request Idea/comment

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TEL 800.442.4615
FAX 608.263.3160

Wisconsin Transportation Information Center
432 N. Lake Street Rm 805
Madison, WI 53706

<http://tic.engr.wisc.edu>



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- 2 FDR made easy
- 3 Safe work zones a priority
- 4 Study helps town save on road project
- 7 Resources/Feedback

“The test bores told us exactly what we had and sent us in a different direction than we were headed. It was the best money we ever spent.”

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CALENDAR

TIC Workshops

Details, locations and registration forms are sent to all **Crossroads** recipients prior to each workshop. More information and online registration at: <http://tic.engr.wisc.edu/workshops/listing.lasso>

Highway Safety

This workshop reviews the basics of signing and marking, and highlights good sign installation and maintenance practices on local roads. Includes review of changes in the 2009 MUTCD, how to set speed limits on local roads and review of sign retroreflectivity requirements. Fee: \$60

Nov 11	Waukesha
Nov 12	Barneveld
Nov 15	Tomah
Nov 16	Eau Claire
Nov 17	Hayward
Nov 18	Tomahawk
Nov 19	Green Bay

On-Site Workshops

Save time and travel costs by bringing instruction that is tailored to your specific needs to your shop or office. On-site workshops let you train more people for the same cost or less, including staff from other municipal departments, nearby communities, and businesses you contract with. Contact TIC to book the program and date you want. On-site workshops include:

- Basic Surveying for Local Highway Departments
- Basic Work Zone Traffic Control
- Flagger Training

UW-Madison Seminars

Local government officials are eligible for a limited number of scholarships for these EPD courses held in Madison. Go to <http://epd.engr.wisc.edu> or 800-462-0876 for course details.

APRIL 2010

- 12-13** Keys to Maximize Maintenance Performance #L087
- 13-14** Soil Engineering for Non-Soils Engineers and Technicians #L278

- 15-16** Slope Stability and Landslides #L279
- 19-20** Comprehensive Practices for Effective Construction Project Management #K034
- 19-20** Successfully Installing Total Productive Maintenance #L027
- 19-20** Meeting TMDL, LID and MS4 Stormwater Requirements: Using WinSLAMM to Assess Quality and Volume Controls #L488
- 20-22** Repair of Concrete #L425
- 21** Principles and Practices of Construction Project Scheduling #K035
- 21-22** Establishing an Effective Preventive/Predictive Maintenance Program #L028
- 21-23** Highway Bridge Design #L374
- 22-23** Principles and Practices of Estimating for Construction and Design Professionals #K036
- 28-30** Watershed Modeling Using the New HEC-HMS #L045
- 28-30** Effectively Managing Technical Teams #L407

MAY 2010

- 3-5** Mastering the Fundamentals of HEC-RAS #L046
- 4-5** Highway/Rail Grade Crossing Safety Course #L377
- 17-18** Introductory Principles of Engineering Project Management #L442
- 19-20** Successful Execution and Control of Engineering Projects #L443
- 21** Computer Tools for Engineering Project Management #L444
- 25-26** Fleet Management: Effective Practices for Public and Private Fleets #L561

JUNE 2010

- 7-8** Reading and Interpreting Construction Drawings for Non-Technical Professionals #L553

Independent Study

Project Management 100: The Basics, Plus Important Insights #L107 **Enroll Anytime**

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