



Safety in mobile and short-term stationary work zones

Mobile and short term stationary road maintenance operations produce some of the biggest headaches for work zone safety. You want to protect crews and the traveling public and stay efficient too. A handy new booklet, *Work Zone Safety: Guidelines for Construction, Maintenance, and Utility Operations*, just published by the T.I.C. and WisDOT, can help.



Reasonable maintenance behavior or unnecessary risk-taking?

"It's a dilemma. Safety should be the number one priority for these folks. Still, you can't sign an entire work-zone for what may end up being a 30-second patch," says Dan Fedderley, St. Croix County highway commissioner and president of the Wisconsin County Highways Association (WCHA).

Based on the *MUTCD* and modified to reflect Wisconsin practices, it shows how to lay out traffic control for work zones in a variety of common situations. The booklet emphasizes short term work sites and gives explicit guidelines for mobile operations. It also provides guidance for short duration operations which can last up to an hour. More than 30 readable diagrams show work zone signing and setup for shoulder work, lane closures, and intersection projects for various traffic speeds and highway types.

"We tried to reach consensus on the best practices for some common situations and put them in a booklet that is easy to use in the field," says Steve Pudloski of the T.I.C. "The *MUTCD* covers everything but it's pretty bulky to lug along in the truck." Pudloski worked with a team of WisDOT, FHWA, county highway, and utility representatives, along with experienced construction contractors, to produce the booklet.

"People have a lot of questions about where to put signs in relation to the work area, when to use arrow boards, when they need a flagger, et cetera," says Pudloski. The *Work Zone Safety* booklet is designed to help answer such questions quickly and clearly.

The pothole "patch and dash"

Scene: It's mid-afternoon and you're driving 65 mph on a rural 4-lane highway. Topping a rise you see a highway maintenance truck about a quarter-mile ahead, parked on the right shoulder, dome light flashing. Suddenly you spot two men in the right lane patching a pothole. A third is on the shoulder watching traffic. No work zone signs, no lane closure cones, no protective vehicle.

"It really is not appropriate," says Tom Heydel, WisDOT District 2 traffic operations engineer. "If the task took less than 15 minutes, then it's a mobile operation. They should have advance signs, either stationary or mounted on a vehicle moving on the shoulder behind the work, and they should have a protection vehicle with an arrow board protecting the workers."

"We call this the 'pothole patch and dash,'" says Bob Fasick, WisDOT highway operations engineer, "and it's been a problem. We have to establish reasonable and safe methods to perform this type of work but within our available budget. One man and one truck may be okay on a rural, 55 mph, 2-lane highway, or local street, but not on the interstate. We have been operating the same way for a long time now. It has to change."

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Idea Exchange

Plastic better for temporary signs

Municipalities need temporary No PARKING signs for everything from special events to construction. Most use cardboard but the City of Milwaukee uses corrugated plastic.

"I like it. It's easy to screen print messages on. Vinyl letters can also be easily applied. Plastic signs have been in the field for up to three years," says Paul Piotrowski who manages the City of Milwaukee Traffic Sign Shop.

The 18x24 inch white plastic sign blanks come from several distributors. The cost of the material varies depending on quantities purchased. Milwaukee generally purchases in quantities of 4000 or more, at about 50 cents apiece. The material also comes in yellow and orange and in 4x8 foot sheets that can be cut to size.

"The sign crews like working with the product because it is easy to install," says Piotrowski. "It can be fastened with wire to trees or light posts or bolted directly over existing signs." Frames are available as well.

For information on plastic temporary signs, contact Paul Piotrowski at 414/286-5965.

Culvert end markers save lives



Last summer an employee of a Dodge County highway contractor died when his tractor overturned after a wheel dropped over a culvert endwall. All highway workers mowing grass, cutting brush, collecting trash and doing other roadside maintenance work are at risk from unmarked culvert ends.

To help keep workers safer, all municipalities should make sure that crossdrain culverts are identified with end markers. Markers should be

flexible and made of fiberglass, thermoplastic or co-extruded polyethylene. They should not be reflective to avoid distracting driver attention from the roadway and prevent confusion with delineators. WisDOT now specifies culvert end markers on all new construction.

Marker posts are relatively inexpensive, \$8 to \$10 each when bought in quantity. Dane County Highway Department has used two types for about 10 years. The Safe-hit, two-piece system, has an 18-inch base and two-inch diameter posts four feet high, at \$10 each. The Carsonite Survivor is an integral post and base costing \$7.88 each. Both prices are based on quantities of 5000-6000 units.

"We have found them effective and cost efficient," says Steve Haag, Dane County Highway Superintendent.

WisDOT has a standard detail drawing and specification. Contact Tom Lorfeld, 608/267-3149 for more information.



Yellow-green vests more visible in work zones

A number of new studies show that fluorescent yellow-green is the preferred vest color for roadway visibility. This is true in twilight or hazy conditions as well as normal situations. One study, done for FHWA, ranked them in terms of perceived safety value.

Fluorescent orange-red is also an adequate safety garment color, according to this same study. However, the orange-red vest may tend to blend in with the surroundings when there is a lot of orange workzone machinery and equipment on the site.

Wisconsin is one of a few states which provide yellow-green safety clothing as an option for state employees exposed to traffic. Others include Minnesota, Michigan, Massachusetts, and Arizona. "It's an option for state employees," says Tom Notbohm, traffic operations engineer with WisDOT. "However for private sector employees doing flagging under the jurisdiction of OSHA regulations, only orange colored clothing is acceptable."

According to a study in Minnesota, when two workers stood side by side, one in an orange vest and the other in a high-visibility yellow vest, drivers could see the second worker from a distance twice as far away as the first.

"There are some concerns about wearing the yellow green when there is a lot of greenery in the background or a lot of yellow or green-colored equipment," says Notbohm. "It won't stand out as well under those conditions."

MnDOT now uses primarily a tight weave high-visibility yellow vest made of Supplex, with stripes in double retro-reflective orange. The orange stripes were added for contrast against spring vegetation which is yellower. Supplex fabric is hot to wear in warm weather, so MnDOT is testing a looser weave nylon fabric. Mesh vests in high-visibility yellow are not effective because there is not enough surface area to maintain high visibility.

For information related to work zone safety in Wisconsin, contact Tom Notbohm at 608/266-0982, e-mail: thomas.notbohm@dot.state.wi.us. Portions of this story were adapted from a December 1998 article in the Alabama Technology Transfer Center newsletter.

Crossroads

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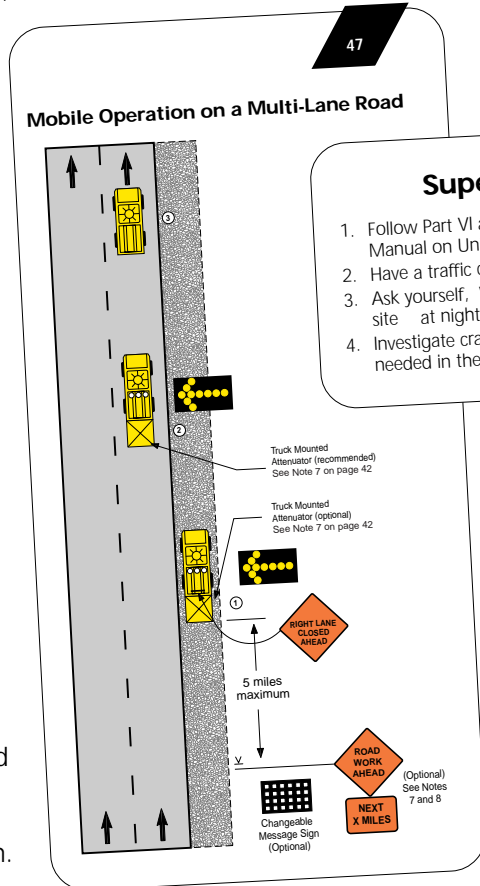
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Pothole patching, shouldering, and similar short term activities are some of the biggest work zone safety challenges. You have to give motorists the proper advance warning within a reasonable distance of the work area. Unlike stationary work zones, though, there are typically no barricades, drums or cones to outline the area.

For mobile situations, the *Work Zone Safety* booklet has four basic diagrams: shoulder work on a 2-lane road, lane work on a 2-lane road, using flaggers on a 2-lane road, and lane work on a multi-lane road. With the first situation, you may only need one vehicle with a "shoulder work" sign mounted in back if traffic volumes are low. With the last situation, as many as three vehicles may be needed – most equipped with arrow boards and truck mounted attenuators, if available. To help address the many variables associated with mobile operations, the booklet also has notes associated with each diagram.



"This is an issue that the WCHA's safety committee is currently discussing," says Fedderley. "Whatever we come up with, we need to implement it uniformly and consistently



across the state. The biggest benefit will be that drivers will become familiar with the situation and react appropriately."

Supervisors are responsible for making sure that

crews take safety seriously and set up work zones correctly, says the T.I.C.'s Pudloski. Encouraging workers and supervisors to do it, and to do it uniformly, is a major goal of the *Work Zone Safety* handbook and training programs offered by the T.I.C.

"We'd like to see a booklet in every patrol truck," says Pudloski. "Supervisors should request enough copies for everyone who works on their roads and streets."

Copies of Work Zone Safety: Guidelines for Construction, Maintenance, and Utility Operations are available free from the T.I.C. Call, fax, e-mail, or write TODAY for the number of copies you need.

Anticipating Y2K for roadway operations

Fortunately, Y2K computer glitches are expected to be a relatively minor problem for streets and highway operations.

One of the three major vendors of ground speed controllers, the Gresen Hydraulics Division of Dana Corporation will be issuing a procedure for resetting the current date on its GRS-32, GRS-31 models after January 1, 2000. When not reset, the printed data sheet will record the wrong year. Raven and the Component Technology Division, Certified Power Inc. have reported to WisDOT that they are Year 2000 compatible, according to Tom Martinelli, WisDOT maintenance engineer.

Traffic signal controllers first started incorporating clocks with specific dates in the mid-1980s, according to Bill Gilding, WisDOT electronics unit shop superintendent. Of the three types WisDOT uses, one manufacturer, Eagle, reports that its DP-9000 controller is not compliant. The

EPAC-300 should be compliant, but may need a software upgrade. Traffic Control reports that its LC8000 signal is compliant. "We've checked our signal controllers on the bench, running them through year 2000 and not seen anything that causes concern," says Gilding. "They may jump off by a day. In that case, there are 'work arounds' like resetting to 1994 when the days and dates were the same as 2000." Gilding's section has focused mostly on preparing in case Y2K problems cause a power outage that knocks signals out of service.

Radio and communication systems, street lighting controls, overhead signs and freeway ramp meters are other equipment that may be affected. The general advice is to contact the supplier and ask if your equipment and models are Y2K compliant.

Washing, sealing, sweeping, and spot painting extend bridge life

"We used to ignore our bridges until we started taking a serious look at their value to us," says Glen Speich, Marathon County Highway Commissioner. "Now we're washing the bearings, sealing the decks, and doing what we can to preserve the ones that are in good shape." With 367 bridges over 20 feet long, Marathon County has considerable incentive to protect the large investment it has in its bridges.

Marathon County cleans bridges with high pressure steam (the same equipment they use to thaw culverts in the spring). In addition to washing the decks, crews climb down on riprap under the bridges to get at the beam ends and bearings. For a few they use a pontoon boat to get at bearings in the middle of the span.

"The bearings tend to rust in place if you ignore them," Speich says. "We've even jacked a bridge up, taken out and cleaned the bearings, painted them and put them back." It takes about one day's work to steam clean a bridge, he estimates. In addition to cleaning, the county is also sealing bridge decks every three to four years.

State highway bridges and overpass structures are also getting a spring cleaning this year, according to Tom Hardinger, District Bridge Maintenance and Inspection Engineer in WisDOT District 4, Wisconsin Rapids.

"Two years ago we started with washing the abutments and abutment bearings to get rid of debris, sand and dirt, and to remove any chloride," he says. "This year we've implemented washing the whole bridge." The state uses a high pressure washer (1000-2500 psi) and a soluble chloride remover called "Chlo*rid," mixed with the wash water.

Hardinger estimates that they can wash about two bridges a day and hopes to get 75-100 bridges cleaned this year. They are concentrating on bridges with a good, intact paint system and those that have been repainted recently.



Sealing cracks and decks keeps out salt

Salt, the winter driver's friend, is the enemy of bridge decks. Chlorides can penetrate the deck and get into the reinforcing steel, causing it to rust and expand. This in turn causes the concrete to spall or chip away at the surface.

The first line of defense is to seal any cracks in the deck. An epoxy product, TK-9000, is what WisDOT uses. This 2-part, low viscosity material can be poured or squeegeed into cracks, or brushed on. Another relatively low cost way to extend the useful lives of bridge decks is coating the whole deck with a penetrating sealer like TK-290.

"All new bridges in the state are sealed when they are first built," says Hardinger. "Then we come in three to five years later and seal them again and continue the application on that cycle." Crews apply the sealant at about one gallon per 200-300 square feet, about half the rate used on new decks. It dries in about an hour, depending on how porous the concrete is. The cost is estimated at between 10 and 20 cents per square foot, including labor and equipment use costs.



They use hand sprayers and a small pump that runs on DC current and attaches directly to the 55 gallon drum. The pumps cost about \$500 and can be mounted with one or two drums on the back of a small patrol truck. Operators work with hand sprayers and 40 feet of hose. Electric leads run to

the truck's battery. Most concrete suppliers have this type of pump available and also supply the TK sealants.

"Typically it takes less time to spray the deck than to set up the traffic control," says Hardinger. "You get the deck sprayed in 15 to 20 minutes, wait about an hour for the deck to dry, then switch over to the other side."

Sweeping: quick and cheap

"We've found that if you leave a lot of debris, like sand from winter, in the gutter line on bridges it holds moisture and you can get heavy spalling and scaling," says WisDOT's Tom Hardinger. "We have some eight-year-old bridges with three-quarters of an inch lost to scaling." Salt mixed with the sand leeches directly into the concrete on the decks, causing the damage.

Every spring they hire private operators to run mobile sweepers across the bridges and clean the gutters and



decks. The equipment can travel across the deck at about 20 mph and generally needs little or no traffic control. They typically cost about \$75 per hour, Hardinger says, and can quickly clear off the decks. "The biggest time is the drive between bridges," Hardinger says. Last year it took four days to sweep all the Highway 51 bridges in four counties. Crews also use portable leaf blowers to clean debris out of bridge joints.

Paint repair

Because of the hazards associated with lead based paint on old bridges, many bridge owners may be shying away from doing paint repairs. Spot repairs are possible, however, and can help lengthen bridge life and put off the day when complete removal and repainting are necessary.

"Zone painting for ten feet on either side of the pier joints can protect them from water and salt corrosion," says Pat Kern, Bridge Maintenance and Inspection Engineer for WisDOT District 6, Eau Claire. "You can prepare the area with vacuum-equipped hand tools and don't have to use the full negative pressure dust capture system," he says. Spot painting can last for up to 10 years.

Spot painting operations can also make it easier to inspect and maintain crucial bridge elements. Kern's crews recently began cleaning rust off a bridge joint for spot painting and discovered a major section loss. "Now at least we can see it to inspect it," he says. "I'm sure glad we did it."

Larger areas that need paint repair can be power washed and encapsulated. This also postpones the cost and disruption of a full lead paint removal project.

"Our experience with paint top coats hasn't been good," says Kern. "We found bad adhesion about three-quarters of the time. I figure that you'll have to get rid of the lead sometime, so you might as well face up to it right away. It's certainly not going to get any cheaper in the future."

Overall, though, preventive maintenance will save money in the long run by extending the lives of your bridges. As Glen Speich says: "You have to have faith. The dividends are not necessarily immediate. We're doing this for those who come after us."

For more information about preventive maintenance on bridges, contact: Glen Speich, 715/842- 2205, Ext. 301, Tom Hardinger, 715/421-8323, e-mail thomas.hardinger@dot.state.wi.us, or Pat Kern, 715/836-3918.

Resources

Materials listed here are available from the Wisconsin T.I.C. unless otherwise noted. To get your copy call 800/442-4615 or use the form on page 7. Videotapes are loaned free through Wisconsin County Extension Offices.

The New Generation of Snow and Ice Control: Anti-icing and RWIS, FHWA 14 page booklet. This pamphlet introduces new snow and ice control technology, such as anti-icing, road weather information systems (RWIS), and other resources. Could be helpful explaining new technology to elected officials and the public. The companion videotape #18187 is in the T.I.C. video lending library.

Improving Highway Safety at Bridges on Local Roads and Streets, FHWA Publication SA-98-083, 35 pp. Leading locations of severe, single-vehicle crashes are bridges and bridge approaches. This booklet will help you identify unsafe bridge rail and approach guardrail and then discuss how to correct or mitigate the hazard. Practical. Pictures and drawings make it easy to use.

Inspectors Job Guide and Highway Maintenance Tables, T.I.C. This pocket-sized guide is filled with checklists, tips and suggestions for inspecting asphalt, concrete, and underground construction and easy-to-follow ways to figure quantities. There are two versions: one in English units and the other in metric. Multiple copies are available.

Another Five Traffic Information Program Tips from Florida, Florida Section of ITE, 1998. One-page answers to five tough traffic questions often asked by residents and neighborhood groups. Included are (1) Do marked crosswalks provide better pedestrian safety? (2) Why are traffic engineers reluctant to install "deaf child" or "blind child" signs? (3) How do pedestrian signals work? (4) What is the harm of installing an unwarranted traffic control device? (5) Why limit the number of driveways?

New approaches for winter maintenance

Several local agencies are learning how to use new techniques to fight Wisconsin's winters. This includes new chemicals, application techniques and equipment.

Salt and calcium chloride are the traditional deicing chemicals used to keep roads clear of snow and ice. Research sponsored by the FHWA is leading to the use of other chemicals and techniques.

The biggest change has centered on anti-icing—making a light application of liquid chemicals before the storm to keep ice or snow from bonding to the pavement. It has proven particularly effective in fighting frost on bridge decks.

Wis DOT is working with county highway departments to test these new procedures on state highways. Early results are promising. Tom Martinelli, WisDOT maintenance engineer is analyzing the results of last winter's trials and will be issuing a report early this summer. Preliminary discussions revealed some useful lessons.

Anti-icing bridge decks with magnesium chloride seems particularly successful. Applying about 25-40 gallons per lane mile of a 30% liquid MgCl solution seems to effectively prevent frost formation, especially in the fall and spring. The material can be applied during regular working hours since it is effective for four to seven days. Some counties set up regular bi-weekly or weekly applications while others spray when weather forecasts predict icing conditions.

Light anti-icing treatments can be effective with light snow. Applications should not be made when blowing snow is possible, however, since the MgCl attracts moisture and tends to collect snow on the pavement. Rain also quickly washes away the chemical. When heavy snow conditions develop, normal deicing operations using dry or pre-wetted salt are required.

Pre-wetting of salt has been done for many years. It speeds up deicing and helps keep the salt on the pavement, lowering salt use. Several agencies report good results using either MgCl or ICE BAN as a pre-wetting chemical. Ed Kaszick, Brown County Highway Department superintendent of operations used 30 gallons of MgCl per yard of coarse salt.

"We applied a slurry just as the storm was starting to prevent bonding of the snow to the pavement," Kaszick says. "It seemed to act quickly, getting the salt brine down into the concrete pavement's tining so the snow couldn't bond."

Although mag chloride is currently more expensive than calcium chloride for pre-wetting, it has the advantage of being much less corrosive on equipment and on vehicles using the roads.

"I think it has a lot of potential if we can work out the details," says Dick Leffler, Florence County Highway Commissioner.

WisDOT is also working with several counties on developing a winter maintenance "concept vehicle" to test new snow removal



Icing on bridge decks is a frequent problem. Spraying liquid magnesium chloride can help prevent it.



Jefferson County built its own double spray bar to apply mag chloride to bridge decks.

equipment. In cooperation with Monroe Truck Equipment, they are investigating improved spreader controls, on-board pre-wetting and anti-icing equipment. They are also working on ways to reduce blowing snow around snow plows (the so-called white cloud effect), and to improve safety through lighting equipment and improving driver safety.

Using these alternative chemicals, procedures and equipment requires new skills and a firm understanding of all aspects of winter road maintenance. The T.I.C. will present the latest in snow-fighting information at its updated winter maintenance workshops scheduled for September. Plan to attend and learn how your agency can take advantage of new technology and avoid the mistakes of others.

*See Calendar page 8 for dates and locations of the September Winter Maintenance workshops. Copies of a new booklet from FHWA, **The New Generation of Snow and Ice Control: Anti-icing and RWIS**, are also available. See Resources on page 5.*

New roads data base taking shape

WisDOT's 20-year-old database of road information, with its piles of unhelpful paper reports, will soon be history. By January the agency will begin accepting data into a new state-of-the-art data base. The system will, for the first time, include Geographic Information System (GIS) mapping capabilities and data on local road conditions.

While the old system was only good for counting roads to report them to the Federal highway agency, or to distribute state aids, the new one will provide more useful information. By collecting and analyzing road conditions and quality measures, it can help local officials identify needs and plan maintenance and reconstruction projects.

The project began in 1995 with the Local Roads and Streets Council, which advises the Transportation Secretary. Council members were frustrated because there was no good way to analyze the conditions of local roadways.

"With all the money going into local roads—at least \$300 million a year in state funds, and much more counting local property taxes—they couldn't connect that investment to road condition," says Mailei Pa'alani, analysis unit leader for WisDOT's Bureau of Transit and Local Roads and spokesperson for the WisDOT database project. "We are getting questions from legislators about what we're getting for all this money."

Locals have concerns

Local municipalities, especially towns, are concerned about taking responsibility for supplying information to the database. Although the state did all the data collection for the old database, it now will act mostly as a custodian and will work to assure quality and accuracy.

"Locals really do know about their roads," says Pa'alani. "The main added responsibility will be to rate their roads and that is something many already do anyway." In the future condition ratings will be required.

Most existing data can be imported or converted to the new system, including the majority of data stored in the

T.I.C.'s PASERWARE road condition rating software. The database system is being designed to accommodate as many data elements as local officials ask for, Pa'alani says.

"PASER is what is being recommended for towns to rate their road conditions," Pa'alani says. "It is simple and relatively quick, and it offers the information we want. It's not adequate for re-engineering a road, but will give them what is needed for setting priorities, assessing progress, and analyzing costs and benefits."

Liability is another local concern. Proposed legislation will relieve municipalities of liability responsibilities, says Pa'alani. Fears that the system will be used to see if money has been spent and to impose penalties are also unjustified.

Benefits and help

One of the biggest benefits for small local governments is safe record keeping. With a 25 percent turnover in elected officials every year, vital records are often lost. The database will provide secure storage and will be easier to retrieve than a box of papers left in somebody's attic.

Finding and sharing more efficient maintenance practices is another benefit. Communities will be able to review what neighboring towns and villages are doing and share best practices on how to maintain roadways. Right now there is no way to do such analysis.

Supporting funding requests will also be easier. "When locals go to the Legislature to lobby for more money, right now they don't have anything to show for what they've done already," says Pa'alani. "The legislators want qualitative and quantitative data, and this system will let us give it to them."

Local officials and staff with little or no computer experience will still be able to supply and receive information in hard copy form, at least at first. "My recommendation is for local governments with computers or Internet access to become proficient as soon as possible," Pa'alani, says. "Starting now to rate their roads would also put them a step ahead. Several systems for supplying computer help are being evaluated, and training and support will be widely available."

Reader Response

If you have a comment on a **Crossroads** story, a question about roadways or equipment, an item for the *Idea Exchange*, a request for workshop information or resources, or a name for our mailing list, fill in this form and mail *in an envelope* to:

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University of Wisconsin-Madison
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Madison, WI 53706

Or call, fax, or e-mail us:

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Calendar

T.I.C. workshops

Specific details and locations for workshops are in the announcements mailed to all **Crossroads** recipients. For additional copies, or more information, call the T.I.C. at 800/442-4615.

Winter Road Maintenance Prepare for winter operations. This workshop covers equipment preparation, the latest on de-icing and ice control materials, operations planning, and an opportunity to share experiences and tips for better winter operations.

- Sep 13 Rhinelander Sep 21 Green Bay
- Sep 14 Cable Sep 22 Brookfield
- Sep 15 Eau Claire Sep 23 Barneveld
- Sep 16 Tomah

Local Transportation Issues The UW Local Government Center and T.I.C. present an ETN series of five two-hour workshops focusing on transportation issues. Available at over 103 locations in Wisconsin. Take one workshop or the whole series.

- Oct 7 Utilities in the Right-of-Way
- Nov 4 Managing Sidewalk Programs
- Jan 20 Financing Local Road Projects
- Feb 9 Liability for Local Road Agencies
- Mar 9 Bidding and Inspecting Local Road Projects

Roadway Drainage An opportunity to brush up on culvert and ditch maintenance; learn how to size and construct ditches and install culverts.

- Nov 15 Rhinelander Dec 14 Green Bay

- Nov 16 Cable Dec 15 Brookfield
- Nov 17 Eau Claire Dec 16 Barneveld
- Nov 18 Tomah

UW-Madison seminars

Local government officials are eligible for scholarships for the following engineering courses in Madison. For details, use the form on page 7, call 800/442-4615, or e-mail: ranum@engr.wisc.edu

- Managing Snow and Ice Control Operations, Oct. 4-5
- Implementing a Sidewalk Management System, Oct. 6-7
- Neighborhood Design and Traffic Calming, Oct 11-13
- Drainage System Design, Oct 18-21
- Evaluation and Rehabilitation of Pavements, Nov 1-2
- Managing Urban Forestry Programs, Nov 4-5
- Development Review and Access Management, Nov 15-17
- Bridge Evaluation and Rating, Dec 6-8
- Managing Utility Cuts, Dec 12-13

Other training opportunities

The Wisconsin Chapter, American Public Works, Snow Plow Roadeo is your opportunity to test the best crew you've got against the best crews from other communities in friendly competition. It's also a great way to get everyone tuned up and ready for winter. Held Wednesday, September 29, at the Waukesha County fairgrounds. Call Bill Kappel at 414/286-2369 for more details.

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