Bridge replacement solution saves money and time

WALWORTH COUNTY replaced a bridge well past its prime last November with a low-cost solution that took only seven days to build. Budgeted for replacement in 2012, the Depression-era span north of the Town of Delavan moved to the top of the list in late summer when a chunk of concrete from the bridge deck fell into the creek. The County Highway Department inspected and reduced the load limit to five tons.

Road users, including a school bus company, emergency services and county snowplow operators raised concerns about many vehicles having to bypass the road for an extended period. The pressure was on. The county needed to find an effective fix at a reasonable cost so they could put the bridge safely back in service soon. Assistant Superintendent Dale Poggensee researched alternatives to the planned reconstruction and found one in an aluminum box culvert from Contech Engineered Solutions.

Fast tracked

Working with the manufacturer and its own crews, the county installed the culvert two months later at a total cost of $110,000, including materials, equipment rental and all force account costs. County Operations Director Larry Price says they originally budgeted $400,000 for a concrete cast-in-place bridge, a project that would have taken from three-to-five-months to complete. Deterioration of the bridge and the load posting made replacing it a priority so the project was fast tracked as an emergency, exempting it from the usual bid process.

The Walworth County case illustrates how important regular inspections are for local bridges with spans of less than 20 feet. In good condition, they keep roads passable and protect water resources. Price notes the situation also gave his department a chance to try something new that could save money and time.

The county received necessary permits from the Wisconsin Department of Natural Resources and good advice about diverting the stream during installation using a water bladder to filter out silt. They also talked to the local land resource management division of the U.S. Army Corps of Engineers.
PUBLIC ROAD AGENCIES and contractors fine-tuned the method for installing the Safety Edge on a range of local road projects in Wisconsin last year. The sloped paving detail reduces the severity of run-off-the-road crashes. It is an innovative technology from the Federal Highway Administration’s (FHWA) Every Day Counts (EDC) program that has real application on rural roads with high crash rates and narrow shoulders.

Through EDC, the FHWA collaborates with the transportation community nationwide on introducing and deploying Safety Edge and other ideas that improve road safety or increase project efficiency. The Wisconsin Department of Transportation (WisDOT) participated in this effort last year with pilot projects that included Safety Edge. And the Wisconsin Transportation Information Center (TIC) gave local road officials a chance to see a Safety Edge installation on a county project, partnering with the Chippewa County Highway Department in October for a Demonstration Day workshop. Representatives from ten counties and nine towns attended the workshop. The FHWA and WisDOT provided technical expertise and support.

Test and observe

The October program included presentations on constructing the angled edge instead of the typical vertical edge on an asphalt overlay project. As the gravel shoulder erodes from this edge, it often creates an edge drop that can cause drivers to lose control when they try re-entering the roadway after wandering off. The Demonstration Day included a discussion of safety benefits and how to combine Safety Edge with other safety improvements.

One concern local agencies raise is whether the sloped edge is less durable. Steve Krebs, Chief Materials Management Engineer with the Division of Transportation Systems Development at WisDOT, talked at the workshop about the compaction data WisDOT is gathering on Safety Edge, data he is using to benchmark densities at the edge of asphalt pavements that are constructed with the new technology.

“Testing and observing the results on our pilot projects helps us understand all the benefits of a Safety Edge installation,” Krebs says. “Sloping the pavement edge may help with compaction and produce higher density readings compared to pavements built without the added material of Safety Edge. It has the potential to improve performance.”

He adds that exploring Safety Edge construction in detail and improving in the field generates valuable data to share with local governments and contractors who are ready to give the paving add-on a try.

In the field

After presentations, the group assembled for a field demonstration featuring one of two Safety Edge projects constructed by the Chippewa County paving crew. The Chippewa County Highway Department said one of the roads in their Safety Edge demonstration projects had crash rates seven times the state average and many crashes were due to run-offs. Adding a 30-to-40-degree slope to the pavement edge would help prevent overcorrection and loss of control when a vehicle drifts off the pavement. The county installed the new edge along with these other safety improvements: paving a portion of the shoulder, correcting super elevations on curves and adding guardrails.

The estimated cost of adding Safety Edge to the projects averaged about a one-percent increase in asphalt material, similar to FHWA estimates.

Judging a new idea

The demonstration day rated high among participants, says TIC Staff Engineer Ben Jordan, who asked them for feedback. The event was a good opportunity for the local public agencies that came to judge a new idea close up. Some plan to incorporate Safety Edge into future projects. Others wanted to see the impact of rollers on the stability of the sloped asphalt edge and learn more about which roads benefit most from applying Safety Edge.

Safety Edge paves way to safer rural roads

It is an innovative technology that has real application on rural roads with narrow shoulders and high crash rates.

The Safety Edge detail replaces vertical edge drops like this with a sloped edge that helps drivers recover control after leaving the roadway.

Paver places Safety Edge on Chippewa County Demonstration Day project last October.
Research from FHWA and results from state and local projects across the country indicate Safety Edge improves safety most on roads with significant accident rates, substandard geometry, narrow lanes, unpaved shoulders and paved shoulders less than three-feet wide. Many of the 56,000 miles of town roads in Wisconsin fit this description.

Jordan stresses that the majority of local rural roads have gravel or earth shoulders and, with fewer resources for maintaining those shoulders, the Safety Edge is an improvement worth considering.

“Installing the Safety Edge on new paving and resurfacing projects can reduce the crash risk for a driver who veers onto a shoulder with an edge drop-off,” he notes. “Local roads may carry less traffic but they often have more hazards. Safety Edge is an effective way to reduce crash severity for run-off-the-road accidents and improve safety.”

Limited access to the Safety Edge paver attachment is an issue right now, Jordan says. But TIC is supporting the use of the Safety Edge on local road resurfacing or rehabilitation projects with the loan of a Safety Edge shoe. TIC will provide the attachment to local governments wanting to try the technology on upcoming projects and hopes to offer a second one soon.

“As costs go down and more contractors gain experience with laying down a Safety Edge, counties and towns will have more options,” Jordan notes. He agrees with WisDOT engineers that in time, Safety Edge probably will become a standard that is included in paving contracts.

More demos and tests

TIC plans a second Safety Edge Demonstration Day in collaboration with the Fond du Lac County Highway Department in the near future. It is part of a commitment...
create a steep drop-off or ridges that hold water on the surface.

Gravel roads need regular maintenance to keep their shape. A simple design makes this easier, says Heiden, as long as maintenance crews know to preserve the original shape and slope when they regrade or repair it.

**Find a good blend**

Compacting a proper crown with good gravel is another aspect of preparing the road surface so it holds up to traffic and weather. A good gravel blend is a proportional mixture of hard stone for strength and stability, porous sand for drainage, and enough silt or clay for binding the surface mix together.

Heiden will discuss soil properties in the TIC workshop, differentiating between road base and surface materials. Choosing the right gradation of selected materials is better than using naturally occurring, unprocessed gravel, he observes, even in a state with access to good local sources.

The workshop includes a review of grading techniques, and a discussion of the type of equipment used to spread the gravel material and shape the road.

**Correcting problems**

Heiden calls reducing “roadside intimidation” a critical element of a gravel road maintenance program. This refers to controlling weeds and grass that crowd the roadway, keeping mailboxes, trees, power poles and fences back from the road edge, and prohibiting the grading of driveways that encroach on the road and disrupt the crown. Any of these hazards can cause drivers to drive in the center of the road, which produces a wear pattern that flattens the crown and reduces the road to two or three worn wheel tracks.

Blowing dust is another major problem on gravel roads. Heiden will discuss solutions to keep the dust under control by stabilizing the surface materials with dust suppressants like calcium chloride, magnesium chloride, lignum sulfates and polymers.

**Resources**

Link to download *Gravel Roads*, TIC Bulletin #5. Reviews effective design and maintenance of gravel roads. Describes gravel types and special grading techniques.

[http://tic.engr.wisc.edu/Publications.lasso](http://tic.engr.wisc.edu/Publications.lasso)

Link to *Gravel Roads Maintenance and Design Manual* from the South Dakota Local Technical Assistance Program. Addresses gravel road maintenance and when to pave a gravel road.

[http://ntlsearch.bts.gov/repository/record/ntl/12188.html](http://ntlsearch.bts.gov/repository/record/ntl/12188.html)

**Careful design and regular maintenance prevents problems on gravel roads like washboarding ABOVE and severe potholes BELOW.**

**Know the road**

Sound design and construction plus regular maintenance are the ingredients for keeping a good gravel road operating and free of problems. The *Gravel Road Maintenance* workshops and other resources included here offer elected officials, engineers, superintendents, equipment operators and others responsible for local roads practical insights about cost-effective management of their gravel roads.
Safety Edge for safer rural roads
from page 3

to giving local governments more exposure to technologies that meet their needs.

Jerry Zogg, Chief Roadway Standards Engineer with WisDOT, says they want to implement Safety Edge on more state roads over the next two years and also demonstrate this technology for more local road officials and contractors. The department will do at least two Safety Edge projects in each region of the state in 2012 and five to ten projects per region in 2013. There are plans to test the application on a concrete pavement project in the near future.

Research findings

Research is another aspect of the WisDOT/FHWA Safety Edge collaboration. The Construction and Materials Support Center (CMSC) at the UW–Madison is studying the pilot projects to monitor methods and measure outcomes. Tom Martinelli, an engineering consultant working with CMSC, conducted field observations of the WisDOT 2011 Safety Edge pilots. CMSC issued its findings at the end of 2011 in a report titled Constructability Review of the Safety Edge Construction Technique, co-authored by Martinelli and Gary Whited of CMSC.

Martinelli surveyed project engineers and contractors about their initial experience with the Safety Edge equipment. They told him the attachment was easy to install but required periodic adjustments to keep the proper shape and slope. Martinelli found that some contractors waited to roll the 6-to-12 inches of asphalt mat along the edge of the road surface last, giving the edge material more time to cool and hold its shape.

Wisconsin’s current acceptable slope for the edge—at 29-to-40 degrees, broader than FHWA’s standard 30-to-35 degrees—came from the CMSC recommendations. The researchers found that where achieving a tight tolerance was difficult, creating a reasonable angle at the edge was better than none at all. New performance specifications from WisDOT define the target range for state projects. Local road officials can contact Erik Emerson, WisDOT Standards Development Engineer, for a copy of the construction specifications or download them from the TIC website at tic.engr.wisc.edu. WisDOT will issue a detailed construction note on Safety Edge for subscribers to the state’s Construction Materials Manual.

The edge holds

The pilot projects are helping WisDOT and CMSC spot problems and discuss solutions with the project engineers and contractors. A good example in 2011 was the occasional presence of longitudinal cracking at the edge break point during rolling operations. Martinelli says the engineers and paving crews corrected this problem by preparing a wider compacted base to support the Safety Edge.

The Constructability Review also reports on the condition of a Safety Edge project from 2010, State Highway 55 in Menominee County. Martinelli returned a year later and found it in good shape. There was routine erosion of the aggregate shoulder. But the Safety Edge held up well, providing drivers who leave the road a safe and durable return to their driving lane.

Early indications for the 2011 projects are promising. “We saw no negative impact on the paving operations,” says Martinelli. “The more knowledge people in the industry gain, the closer we’ll be to Safety Edge as a routine add-on to many resurfacing and reconstruction projects.”

Potential for safer roads

Zogg agrees the state’s Safety Edge installations are a success and a source of useful data. He anticipates putting WisDOT’s complete design policy into effect in 2013 and implementing Safety Edge statewide in 2014. “The vast majority of our road system in Wisconsin consists of two-lane roads with three-foot shoulders so the policy will cover most projects on most roads,” Zogg explains. “As contractors get more experience installing Safety Edge and the equipment becomes available, we see the potential for growth in the application of this technology. And safer roads as a result.”

Watch for more about TIC’s upcoming Fond du Lac County Safety Edge Demonstration Day and details on how to participate. Local governments can contact Ben Jordan or Steve Pudloski at TIC for information about borrowing the agency’s Safety Edge attachment for a local road resurfacing or rehabilitation project.

Resources

FHWA Every Day Counts intro page on Safety Edge technology includes background information, case studies and links to other resources.

www.fhwa.dot.gov/everydaycounts/technology/safetyedge/intro.cfm

Construction and Materials Support Center link to current reports, including the Constructability Review on Safety Edge in Wisconsin.

http://cmsc.engr.wisc.edu/reports.html

Link to April 2011 Safety Evaluation of the Safety Edge Treatment report on FHWA site.

www.fhwa.dot.gov/publications/researchsafety/11024/

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Crews roll the asphalt mat along the edge of the road on a Safety Edge installation.
INNOVATIVE NEW METHODS for designing and building small bridges could give local governments and state agencies cost-effective options for keeping those bridges open and safe. The Federal Highway Administration (FHWA) is promoting one of these new technologies through its Every Day Counts (EDC) initiative and will work with the Wisconsin Department of Transportation this year on a pilot project to test it out.

The Geosynthetic Reinforced Soil-Integrated Bridge System, or GRS-IBS, is a bridge construction method that alternates layers of compacted granular fill material with geotextile fabric to build an abutment. The FHWA says the technique reduces project time and costs, and produces a smooth transition from roadway to bridge.

The pilot project, slated to begin in early summer on State Highway 40 in Chippewa County, will give state and local road officials the chance to see a GRS-IBS installation for themselves.

Vertical strength
Wisconsin is among the first states in the country to explore the benefits of this alternative to conventional poured concrete abutments, says Structural Engineer Joe Balice, who is with the FHWA Division office in Madison. “What we know about GRS-IBS suggests it could be a good choice for replacing local bridges, especially single spans over low-velocity waterways that drain small watersheds.”

Construction requires readily available materials and basic equipment, a fact that Balice says helps speed the work and reduces construction costs—in some cases, up to 60 percent over conventional methods.

Other suitable GRS-IBS projects include roads crossing streams that have banks with good base soils. Balice says the vertical structures are made strong internally by the interweaving of fabric and aggregate but need a foundation of competent, or well-compacted soils to ensure stability and minimize future settlement and scour concerns.

Once that foundation is ready, the GRS-IBS abutment construction begins with a row of facing block that establishes the outer perimeter of the structure. Next comes a layer of compacted fill placed to the height of the block followed by a layer of geosynthetic fabric positioned over the fill and block. Crews repeat this three-step process to reach the abutment height specified in the design. Then they place the bridge beams on the GRS mass and build the geotextile-reinforced approach to join the bridge and roadway, a detail that eliminates the bump drivers often experience entering or leaving a conventionally constructed bridge. The technology actually eliminates the use of typical abutments.

Explore the benefits
WisDOT’s William Oliva, Chief of the Bureau of Structures Bridge Development Section, says the idea of doing the GRS-IBS pilot came from faculty members in the University of Wisconsin Department of Engineering who contacted WisDOT almost two years ago about developing a proposal to do field research on the characteristics of the technology with funding from FHWA’s Innovative Bridge Research and Deployment program (IBRD). The state agency saw it as an opportunity to learn if the method was a good fit for constructing and replacing bridges. It also aligned with WisDOT/FHWA collaborations on other new EDC road improvement technologies.

Scheduled for replacement in 2012, the 60-year-old Hwy 40 Bridge was a good candidate for the demonstration project. WisDOT altered the original plan to construct it instead as a GRS-IBS project and received help on the redesign from the FHWA Resource Center. “Here was our chance to see where GRS-IBS is appropriate and how we can take advantage of the benefits,” Oliva says.

Among the benefits are lower costs and a smaller construction
A method that takes only days to construct versus a month could make a real difference in project turnaround and the duration of bridge closures that disrupt the flow of traffic.

Monitoring project

The suggestion to secure IBRD funding to research GRS-IBS in action came from Engineering Professor Mike Oliva and Associate Professor Dante Fratta at the UW-Madison and Sam Helwany, Professor of Geotechnical Engineering at UW-Milwaukee. They will lead a group that includes engineering students who will monitor the construction process and, once the new bridge is in service, measure the performance of the GRS-IBS structures.

“We’ll examine building techniques during construction to record any difficulties and identify changes to improve the process on future projects,” Professor Oliva says. “At the same time, the students will install devices that will record the impact of traffic on the new structures over time.”

The group will measure internal pressures in the GRS foundation over a two-year period and deformations in the foundation and roadway.

Worth considering

Monitoring of the Hwy 40 project over the long-term will help transportation engineers in Wisconsin and nationally better understand the structural interaction in a GRS-IBS abutment and approach, according to WisDOT’s Oliva. Balice adds that the research team’s results will contribute to standardizing the GRS-IBS bridge replacement process and expand the use of the technology to other structures.

WisDOT and FHWA plan to host a showcase during the GRS-IBS installation on Hwy 40. Watch for more information about this opportunity to see first-hand the application of a method local governments might want to use on future bridge projects.

Resources

GRS-IBS page on FHWA Every Day Counts website with descriptions of the technology and links to case studies and helpful resources. www.fhwa.dot.gov/everydaycounts/technology/grs_ibs/

Transportation Research Board publication reports on research behind development of a GRS design method and bridge construction guidelines. Available for purchase or as PDF download. www.trb.org/main/blursb/157301.aspx

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about erosion control. Poggensee says the response from the state and federal agencies was timely and helpful. “They understood the tight spot we were in and did their part to expedite matters.”

**Controlling the timeline**

Handling construction on the project with their own employees gave the county control over the timeline and the freedom to move ahead without delay. The fast turnaround time on the project still astounds Poggensee and Price. But thanks to good weather and a capable crew, they beat their projected 10-day timeline by three days.

County workers began removal of the old bridge deck and one abutment on a Friday while crews from Contech delivered the structure to the site in pieces. Contech assembled the culvert over the weekend and on Monday, local crews were back to start pumping out the streambed, continue the tear down and haul away debris.

After another day of excavating the site and putting in a new base for the structure, the county brought in a rented crane on Wednesday to lift the new box culvert into place. Poggensee says they then backfilled around the abutments with a slurry mix, compacted the materials, spread riprap on the stream bank and, by that afternoon, were driving across the new structure. Workers placed the asphalt on Thursday and they opened the road to traffic the next morning.

Price says public feedback was immediate and positive. “People were impressed that the traffic detour lasted such a short time.”

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**Handling construction on the project with their own employees gave the county control over the timeline and the freedom to move ahead without delay.**

*TOP: Local crews remove the old bridge deck and one abutment at the start of the one-week project. CENTER: Crews assemble the culvert on site. No individual piece was bigger than 4’ by 6’ and all weighed less than 100 lbs. BOTTOM: A crane lifts the new box culvert into place.*
Good fit

The pre-assembled product proved a good fit for the short county trunk road bridge. The old bridge measured 19 feet, 11½ inches, half an inch shy of the Federal Highway Administration’s 20-ft bridge span definition. The Contech box culvert replaces spans from 8 feet to 25 feet.

Todd Riebau, the Regional Sales Engineer with Contech who worked with Poggensee, explains the culvert Walworth County used is an old product in a new low-rise shape ideal for small bridges. It meets industry specifications covering corrugated aluminum alloy structural plate for field-bolted pipes and arches (AASHTO M219) used in highway bridges. It is a good option on roads with little room for big equipment. As with Walworth County’s project, he says it lends itself to the many water crossings that exist in Wisconsin.

An important consideration, Poggensee says, was to replace the worn-out bridge with a structure sufficient to withstand a 100-year flood event. The results from a hydrology study helped determine what size structure they needed to achieve adequate flow.

Poggensee also looked for examples of the culvert solution in use and learned Rock and Kenosha counties had experience replacing small streambed bridges with the Contech product.

Rock County has installed half a dozen of the box culverts on low-volume town roads over several years, according to the county’s Highway Commissioner, Benjamin Coopman. Among advantages, Coopman notes the approach does not require sophisticated engineering or the need to detour traffic for long. “It’s a solution that meets a need and works well with available resources,” he says.

A great job

Visually, Walworth County’s new aluminum bridge is striking. And Poggensee notes that it is structurally strong. Having seen the installation close up, he is confident about the integrity of the new span and expects it to meet or exceed its 75-year expected life. Along with routine road maintenance on the bridge, the county also will monitor the streambed closely.

Poggensee and Price take obvious pride in the success of a project that came together quickly and made effective use of county resources on a tight timeline. Poggensee says that replacing the bridge themselves also energized county workers who welcomed the chance to test their construction know-how. “This one was special,” he says. “It was a good project to work on and everyone did a great job. We had the manpower, the skills and the time to put a stretch of road back in service that makes a big difference to the community.”

People were impressed that the traffic detour lasted such a short time.
RECENT DECADES have seen significant increases in farm size and farm equipment. Combined with regulations that encourage farmers to store manure as a liquid and apply it within a short time frame, manure hauling and application equipment is now built to deliver much heavier loads. Local road officials report increased pavement damage due to these heavier loads traveling on their roadways.

Cooperative study
A pooled fund study was launched in 2008 to shed light on this issue. State transportation departments in Minnesota, Iowa, Illinois and Wisconsin sponsored the research along with industry partners that included professional nutrient applicators associations in the four states, farm equipment manufacturers, tire manufacturers, the Minnesota Pork Producers and the Professional Dairy Producers of Wisconsin.

The pavement performance study investigates the effects of farm equipment on the structural responses (stresses and strains) of asphalt and concrete pavements. It also compares the pavement damage caused by heavy farm equipment with that caused by a typical 5-axle, 80,000-pound semi-truck. Researchers used two newly constructed asphalt pavements and two existing concrete pavements at the MnROAD testing facility for the study. They tested axle load, vehicle weight, vehicle speed, wheel type, and traffic wander combinations to determine the structural response of both asphalt and concrete pavements.

Results are in
Study results appear in Effects of Implements of Husbandry (Farm Equipment) on Pavement Performance, a report released in November 2011. It includes information about which factors have a pronounced effect on pavement responses to farm implements—like traffic wander, seasonal effects, pavement structural characteristics, and vehicle type and configuration. The data also demonstrated that the farm equipment tested causes more damage than an 80,000-pound semi-truck.

What can be done?
The research report identifies actions to minimize pavement damage due to farm implement loading. These include:
• increase the number of vehicle axles
• ensure even distribution of load between the axles
• avoid travel on fully saturated and/or thawed base and subgrade
• avoid travel on asphalt pavement with high surface temperatures
• construct a paved shoulder
• design and build the road to meet the heavier loads
• operate vehicles at least 16 inches away from the edge of the pavement

Putting these recommendations into practice will require major capital expenditures by the farmer and the local road agency. Some towns and counties are starting to work with farmers to modify hauling and spreading operations in ways that increase traffic safety and reduce road damage. One such approach is creating a one-way road system that allows farm equipment to travel down the center of the road away from the pavement edge.

An operation like this requires cooperation, planning, public communication, traffic control and local leadership to succeed. Look for more details about study results and what some Wisconsin local road officials are doing to help protect their roads and facilitate farm equipment operations in the next issue of Crossroads.
RESOURCES

Publications


Safety Edge Demonstration Day notebook materials from the October 2011 Every Day Counts program include information on techniques for implementing Safety Edge and combining the paving detail with other low-cost improvements.

FHWA Safety Edge brochure describes safety issues associated with pavement edge drop-off and explains Safety Edge construction.

Web Sources
Safety Edge presentations, publications and resources from FHWA. www.fhwa.dot.gov/everydaycounts/technology/safetyedge/training.cfm
Gravel roads resources relating to maintenance and factors to consider for selection of a gravel or asphalt surface. www.mnltap.umn.edu/topics/lowvolume/

DVD/VHS/Multimedia
Resources new to TIC collection that include DVDs relevant to recent newsletter articles on drowsy and distracted driving.

Distracted Driving: Real Accidents, Real Stories 2, Wumbus Corporation, 2011, 15 minutes, #19101 DVD. Powerful personal stories about three fatal crashes caused by distracted driving. A useful introduction to the topic of an organization’s rules on driving while texting, talking on the phone or radio, using a navigation system, and other equipment or activities that can distract a driver’s attention from the road.

Drowsy Driving: It’s Your Wake-Up Call, Wumbus Corporation, 2011, 19 minutes, #19102 DVD. Professional Driver version reviews what happens when workers drive drowsy. Outlines the causes of drowsy driving, like lack of sleep, night driving, long hours, stress and eating the wrong foods. Reviews strategies for recognizing sleepiness and what to do about it.

Valuable training tool for employees, like snowplow drivers, who spend long hours behind the wheel or work a night shift.

Personal Protective Equipment: Your Last Line of Defense! Wumbus Corporation, 2011, 15 minutes, #19103 DVD. Three stories portray the real consequences of improper or casual use of personal protective equipment. This program provides a powerful and persuasive wake-up call for new and experienced employees, crews and their supervisors.

Personal Protective Equipment: Real Accidents, Real Stories, Wumbus Corporation, 2011, 15 minutes, #19104 DVD. Presents the requirements and emphasizes the value of wearing personal protective equipment (PPE) for general maintenance activities. Good introduction for new employees. Program identifies employer and employee responsibilities. Includes review of PPE types: protection for eye and face, head, foot and leg, hand, hearing and body.

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

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TIC Workshops
Details, locations & registration forms sent to Crossroads recipients prior to each workshop. More information & online registration at http://tic.engr.wisc.edu/workshops/listing.lasso

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13-15 Improving Rural Road Safety M528

Independent Study
Project Management 100: The Basics, Plus Important Insights #M825

“GRS-IBS could give [us] a worthwhile option for replacing many of the smaller bridges that need replacement across Wisconsin on a much quicker schedule.”

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UW-Madison Seminars
Wisconsin local government officials are eligible for a limited number of scholarships for these EPD courses held in Madison. http://epd.engr.wisc.edu or 800-462-0876 for more information.

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