Local bridge safety and load ratings

**MANY LOCAL AGENCIES** are completing their biennial bridge inspections. This process is required under federal and state mandates, but more importantly these inspections help assure that our local road bridges are safe.

Trained inspectors carefully review the condition of each bridge element. Using standard forms and procedures, they observe, measure deterioration, and perform tests, recording changes from the last inspection. Results are reported to the bridge owner, the state, and the federal government.

Where a bridge is found to be in poor condition, the responsible agency is required to calculate what load it can safely carry. If this is below legal load limits, the bridge must be posted with the maximum safe load. Calculations must consider several factors:

- original structural data — girder sizes, concrete strength, etc.
- number, length and spacing of spans
- changes since construction, such as new overlays
- condition of the bridge members at inspection
- legal loads, including truck axle loads and axle spacings

**Load ratings**

Starting in 1980 all local road bridges were inspected under federal mandate. The process was standardized with condition to be inspected and reports filed every two years. During those original inspections, consultants gathered structural data and calculated a load rating for each bridge. This information was sent to the owners who load-posted bridges as needed.

In subsequent inspections, a new load rating was not required unless conditions changed. Ratings may be adjusted if inspectors find bridge members in very poor condition, if overlays have been placed on the bridge deck, or if a bridge was reviewed as part of an application for federal aid. On many older bridges, consequently, the load rating has not been updated, possibly since the original inspections 25 years ago.

The recent increase in legal truck loads for certain logging-related products is another good reason to review your bridge load rating and postings. The process requires an engineering analysis and is specific to each bridge. To make the calculations the engineer will need data for each major element: length, girder types and spacing, age, thickness of slab, etc. You should have this information on file from the original 1980 inspection or from construction reports for newer bridges.

Costs for this work are significant, so local agencies may want to screen their bridges and concentrate on those most likely to require new load limits. To identify which bridges to check, review the most recent condition inspection reports. Also consider the WisDOT guidelines described in the next section.

**Review bridge structures, assess budgets**

Wisconsin has more than 13,000 bridges; local agencies own or maintain about 8,500. Of the state’s total bridge inventory:

- 34% are designed for trucks weighing 20 tons or less (roughly 83% are locally owned)
**Idea Exchange**

Between storms — Tasks for no-snow days

Chris Olson, Street Department Foreman, City of Onalaska accepted the challenge in our Fall 2006 Idea Exchange. He offered five more ideas for projects that staff can work on between snowstorms:

- Trim boulevard trees
- Inspect, clean and cut brush in storm sewer outfalls
- Repair damaged barricades
- Inventory supply and tool rooms, repair broken tools, and prepare orders for new tools/supplies/safety equipment
- Pick up Christmas trees

**Low cost ways to keep service techs safe from asbestos**

“*The simplicity of the wet control does not eliminate the need for correct work practices.*”

SHOP WORKERS may not be aware of safety hazards from older and replacement brakes and clutches. Working on these parts without proper precautions can expose them to unsafe levels of cancer-causing asbestos fibers.

You can’t tell by looking at a worn brake shoe if it has asbestos, so mechanics should assume that they all do, says a Safety and Health Information Bulletin from the US EPA and OSHA. The bulletin describes asbestos dust control methods for large and small shops, and summarizes good work practices.

High volume shops need an enclosure and filter system to minimize asbestos exposure. Shops doing five or fewer brake and clutch jobs a week can use a simple wet method or an alternate system using solvent in a spray can. The technician can keep asbestos fibers under control by misting the part with a small amount of water from a spray bottle or a low pressure hose nozzle, or spray-on solvent. The water, solvent, and any wipe cloths must be disposed of safely.

“The simplicity of the wet control does not eliminate the need for correct work practices,” the publication warns. Asbestos particles are a hazard when they are in the air, so worker safety recommendations include:

- hold the spray nozzle away from the part so particles are not blown into the air
- wet and wipe the outside, then saturate components as they are removed
- clean up spilled water immediately. Don’t let it dry
- repair brakes and clutches in an isolated work area
- periodically clean workbenches, floors, etc.
- do not eat, drink or smoke in the brake/clutch work area
- wash hands frequently and change to clean clothes before leaving work

Exposure to asbestos, if not properly controlled can cause debilitating and deadly diseases such as mesothelioma, lung cancer, and asbestosis. Furthermore, symptoms may not appear for years, and even decades, after contact with asbestos fibers.

Don’t risk the health of your workers or yourself. Get the right tools and training for asbestos control.

**Snow Plow Roadeo Champions**

SEVENTY-ONE TEAMS competed at the Wisconsin APWA Chapter’s 17th Annual Snowplow Roadeo in September. They drove unfamiliar equipment (UNIMOGS) through an obstacle course in a Lambeau Field parking lot. The event included vendor displays and mechanic training sessions.

Tied for 1st Place KAUKAUNA—Tony Verhasselt (L-ABOVE) and Roy Vanzeeland and GREEN BAY (L TO R-BELOW): Todd Hermes, Tim Giesler, & Todd Frisch.

Other winning teams (not pictured) were: 3rd Place VILLAGE OF PLEASANT PRAIRIE: Darren Perona and Scott Brennan. 4th Place CITY OF SHEBOYGAN: Scott Buboltz, Mark Pawasarak, and Mark Oldenburg. 5th Place WISCONSIN COUNTY INSURANCE GROUP represented by Jim Kellner from Sauk County and Rod McGee from Polk County.


Or request a print copy from the TIC.
Wisconsin opens Safe Routes to School program

THIRTY YEARS AGO about half of the children in grades K-8 got to school by walking or biking, while these days only 15% of them do. This trend is unhealthy for kids and for the environment. To encourage more children to walk and bike to school by creating safer walking and biking routes, the current federal transportation act provides funding for Safe Routes to School (SRTS) programs.

“This can be achieved through a variety of ways,” says Renee Callaway, SRTS Coordinator for WisDOT. “New sidewalks and bikeways and traffic calming initiatives are some, along with educating parents and children on pedestrian safety, and creating programs that encourage students to walk or bike to school.” A benefit of SRTS programs is that they ease automobile traffic and congestion near schools, and reduce fuel consumption and air pollution, she notes.

In Wisconsin, WisDOT will distribute up to $8 million by 2009 for SRTS projects. Projects that are selected will be reimbursed 100% from federal funds. No match is required. Application forms will be available in early January 2007 with a deadline in March. Learn more about how to develop a plan and apply for funding at one of four TIC workshops in early February.

SRTS projects will be selected through a competitive statewide process, similar to the Transportation Enhancements program. Projects should encourage walking and biking options and make small-scale capital improvements to fill gaps in the existing bicycle and pedestrian system. The majority of the funding (70% minimum) will go toward infrastructure improvement, but at least 10% should go to other activities that encourage walking and biking.

“We are looking for well-rounded programs that emphasize health as well as safety,” says Calloway. “The committee will give weight to having an SRTS plan in place, and to addressing all four “Es”: Education, Encouragement, Enforcement, and Engineering.”

Mailings and a publication describing the program were sent this fall to local communities. Callaway also spoke about the program at meetings around the state.

“The expertise and engineering knowledge of Streets Departments is very important,” says Calloway. “They should be involved in creation of an SRTS plan, doing route audits, and helping set policies that encourage walking and biking to school.”

The SRTS Web page lists a number of preparatory steps to improve route safety, including:

• Crosswalk placement. Does it align with where children now live?
• Car/bus dropoff locations. Can walkers and bikers enter school safely?
• School Zone signage. Has traffic speed and volume changed? Are appropriate signs in place?

“The public works component is very important so people don’t go down the wrong path because they don’t understand what is possible,” says Callaway.

For more information on the Wisconsin program and a community “tool kit” for SRTS planning check the SRTS Web page (under local government aid) www.dot.wisconsin.gov/localgovaid/saferoutes.htm

Contact Callaway at 608/266-3973 or renee.callaway@dot.state.wi.us

For a report on a well-developed SRTS program in Marin County, California, go to:

SRTS planning partners should include law enforcement, public works departments, citizen groups, school districts, and planning agencies.
Local bridge safety and load ratings

continued from page 1

“From a system management perspective, locals need to be aware of the impact of 98,000 lb. loads on bridge life.”

• 65% are designed for trucks weighing more than 20 tons and less than 36 tons (roughly half are locally owned)
• Less than 1% is designed for trucks weighing more than 36 tons

State laws AB678/ACT 167, effective in May 2006, raised certain legal truck loads to 98,000 lbs. Subsequently, WisDOT engineers analyzed data for about 4,500 state-owned structures to determine which ones can safely carry these loads. They used a 98,000-pound sample or “design truck” which reflects 10 truck configurations commonly used in the state. As a result, 58 bridges are now posted with a 45 ton (90,000 pound) limit, 17 that were already posted plus 41 others.

Staff in the WisDOT Bureau of Structures also developed general guidelines that local agencies can use to screen their local bridges. They identified over 1,100 bridges that should be reviewed based on current load ratings and span ratios. Another 1,070 local bridges are timber, concrete box, and prestress channel types that the Bureau recommends be analyzed to determine if they can carry trucks legal under ACT 167. (See chart below).

Considerations for load posting on bridges

This chart provides a rough guide to the number and types of bridges that may need review. It is based on a sample of 4600 structures using two “design truck” configurations—a semi-trailer and a pup—legal under ACT 167. To determine if a particular bridge can handle a particular truck, individualized calculations are required.

* Data not available to develop a guideline
1 HS = rated capacity in tons based on “design truck”
2 NA = Not applicable
3 Aspect ratio = the ratio of continuous adjacent spans: span 1 (larger) ÷ span 2 (smaller)

While local bridges need review, most should not require a complete structural engineering evaluation. “It should be relatively simple to pare the list down and identify bridges that may be susceptible to additional loading,” says Dan Fedderly, Executive Director, Wisconsin County Highways Association. If a structure is already posted, it obviously won’t carry any bigger load, he says. Alternatively, as an example, increased loads are not likely to have much impact on a box culvert under 20 feet of fill.

Beyond the safety issues, accelerated deterioration is also a concern. “From a system management perspective, locals need to be aware of the impact of 98,000 pound loads on bridge life,” says Fedderly. “They need to manage for it and understand the additional costs associated with the increased loads.”

Experience from neighboring states shows the potential impact. Michigan, which allows higher loads based on specific truck configurations, has roughly 28% of its total bridge population defined as deficient, compared to 16% in Wisconsin, says Scot Becker, WisDOT Structures Development Chief, citing the 2005 National Bridge Inventory data. More structurally deficient bridges means that total Wisconsin maintenance costs would increase and likely result in more bridges being posted, he says.

Two critical factors are converging on local bridges: higher legal loads and outdated load ratings. It would be good for all local agencies to review their bridges this year and consider updating the load ratings where appropriate. Your bridge inspection consultant can help with this process.

Local timber bridges should all be analyzed, along with all truss, through girder, concrete box, and prestressed channel types.
Bridge basics

Like the roads they serve, local bridges are designed and built to carry certain predicted loads. Depending on how it will be used, a bridge is currently designed to support a standardized truck weight, using design standards developed by AASHTO, the American Association of State Highway Transportation Officials.

Bridges take many different forms, but in general they all have three basic structural elements: the deck, the substructure, and the superstructure. Together they safely support traffic loads and the weight of the bridge. Bridges are designed to bend slightly under vehicle loads.

The deck is the surface where vehicles travel. On most bridges the deck transfers vehicle loads to the superstructure—the main supporting beams, arches, or cables. The substructure is underneath. It transfers both vehicle loads and the weight of the bridge itself to the soil or rock.

Over the last 50 years, legal vehicle loads have increased steadily along with traffic volumes. Meanwhile, older bridges—if they haven’t been strengthened—may be growing weaker from the accumulated effects of traffic, weather, and age.

Construction materials deteriorate on bridges the same way they do on pavements. Decks are exposed to traffic wear and abrasion, impact damage, and overloads. Freeze-thaw cycles, moisture, deicing chemicals, and other environmental factors also cause damage. In addition, steel elements lose flexibility in colder temperatures. Under repeated loads fractures develop at weak points, much like a chip in a windshield will grow slowly, then suddenly the glass has a crack its entire length.

On steel bridges, the structural steel develops cracks which continue to increase and expand. In steel reinforced concrete bridges, forces crack the concrete and allow water or other contaminants to affect the reinforcing bars. The bars corrode and cause expansion, which breaks off the concrete cover. This creates more exposure for corrosion. In both cases, the process continues until the carrying capacity is reduced to the point that the bridge can no longer support a load.

Heavier and more frequent loads accelerate deterioration; cracks develop sooner and grow faster in size and length. To maintain safety, engineers reduce the allowable loads as bridges suffer damage. Progressive damage may require the bridge to be “load posted” because it can not safely support trucks carrying legal weight limits. Eventually it will need to be strengthened, replaced, or closed entirely.

Current information shows that even slight changes in load limits have major impacts on performance regardless of tire size or axle configurations. An axle carrying 20,000 lbs puts the same total weight on a bridge or a pavement whether 6-inch wide or 12-inch wide tires are used. Similarly, a bridge is only as strong as its weakest span. The load may overburden that element and cause damage or failure.

National Bridge Inspection program

The main purpose of the National Bridge Inspection program is to protect the safety of the traveling public by preventing catastrophic bridge failures from detectable defects and predictable modes of failure. To accomplish this goal and provide highway bridge owners a regulatory framework of appropriate inspection and operation standards, the Federal Highway Administration has developed the National Bridge Inspection Standards (NBIS) in cooperation with the American Association of State Highway and Transportation Officials and other local bridge owners.

While state legislators are free to determine the legal loads on highways other than the Interstate, legislation by itself will not make the state’s bridges any stronger. However, NBIS regulations require that all bridges not capable of safely carrying the state legal loads, need to be load posted (Section 7.4, Manual for Condition Evaluation of Bridges). Legislative action raising the state legal load from 80,000 lbs. to 98,000 lbs. will require all bridge owners to re-evaluate their bridges’ ability to carry the new loads.

The Wisconsin Department of Transportation has already re-evaluated their bridges and begun to install the appropriate signage. Local bridge owners have the same responsibility. Obviously a failure to comply with this requirement would result in a finding of non-compliance with the NBIS and may potentially result in the loss of federal aid highway funds until compliance is obtained. However, we do not anticipate any problems in this area, as all bridge owners know that the safety of the traveling public is a primary consideration.

As a result, bridge postings for 40 and 45 tons will soon be seen. Some bridges may have 50+ ton postings to provide an additional degree of safety for the Annual Permit Haulers that are traveling around the state. While States are not required to post bridges with capacities greater than legal loads, they are highly encouraged to provide this additional degree of safety to the public.

“...all bridge owners know that the safety of the traveling public is a primary consideration.”
Winter maintenance ideas from 2006 workshops

by Don Walker, Director

A workshop highlight was the chance to look over new plowing equipment like this flared plow that improves snow casting.

The critical decision revolves around the need for bare pavements after a storm versus acceptance of driving on snow pack.

THE TIC has completed another round of successful winter maintenance workshops. Over 500 local officials and staff were able to attend. Discussions of plowing and salting revealed the different approaches to maintaining rural or low volume roads compared to urban streets and major highways.

The critical decision revolves around the need for bare pavements after a storm versus acceptance of driving on snow pack. Where the goal is bare pavement following the storm, then using straight salt and overtime plowing are the norms. Agencies responsible for high volume roads also are tending to prevert their salt and to apply liquids directly to the pavement (anti-icing), frequently using salt brine for the liquid. TIC Bulletin #22, Pre-wetting and Anti-icing, provides a handy resource to learn more about these more proactive techniques.

On the other end of the scale, many roads in Wisconsin are either gravel or very low volume rural roads and residential streets. It is not advisable to use straight salt on gravel roads because they become soft, and plows remove surface gravel. Lower volume roads can function well with snow pack if icy areas are sanded. Some roads are also used by snowmobiles, and they require maintaining the snow pack.

Some local officials are facing the decision of whether to upgrade winter road service by providing clear surfaces after the storm. This public request often occurs in developing rural areas. While a higher level of service can be provided, it will usually come with a higher cost. Clearing pavements requires more salt, and it is usually best done with straight salt.

THE TIC Bulletins with more information (see page 10):
Using Salt and Sand for Winter Road Maintenance #6 and Pre-wetting and Anti-icing—Techniques for Winter Road Maintenance #22.

Drivers do not need a special Tank Endorsement to operate trucks with pre-wetting/anti-icing tanks of less than 1,000 gallons, according to the State Patrol.

Salt spreaders with left and right side discharge are becoming more common.

Equipment and operators

Winter road maintenance requires good equipment and experienced operators. These topics were also covered in the recent workshop series. Some confusion continues regarding CDLs. As stated in previous Crossroads articles, a Haz Mat Endorsement is required for driving a commercial vehicle with a Haz Mat placard. However, local agencies in Wisconsin are no longer required to placard their vehicles for Haz Mat. Therefore, if there is no placard, then the driver does not need this endorsement.

A CDL is not required to drive vehicles with air brakes unless that vehicle is a commercial vehicle (over 26,000 lb. GVW, etc.). Vehicles such as plow trucks with tanks for prewetting or anti-icing, do not require the driver to have a Tank Endorsement when the tank holds less than 1,000 gallons.

Drivers do not need a special Tank Endorsement to operate trucks with pre-wetting/anti-icing tanks of less than 1,000 gallons, according to the State Patrol.

That type tank is assumed to be "portable" under Section 8 of the CDL Manual, according to the Wisconsin State Patrol. For many participants, the chance to look over new plowing equipment was the highlight of this year’s workshops. Five different counties, two cities, and a town volunteered to bring their equipment to one of the workshops. (See Resources page 10.)

The equipment shown had many similarities and a few predictable differences. Agencies plowing in rugged terrain or on narrow streets often prefer single axle trucks, while agencies which also use their trucks for hauling and construction prefer tandem or tri-axle vehicles. One-way plows are preferred if the roads are rural and mostly two-lane. Reversible plows are the norm for urban areas and multi-lane roads.

All plow vehicles had automatic transmissions, joy stick plow controls, and wing plows with safety lighting. Most are using the newer HID front auxiliary plow lights. Those spreading straight salt have thermal sensors to read both road and air temperatures.

Popular safety features include power windows, heated wipers and heated mirrors. One county has had good luck with heated windshield fluid equipment. Salt spreaders with left and right side discharge are becoming more common, along with LED-type truck lighting. Several trucks are using the instant chains for the rear wheels.

That type tank is assumed to be "portable" under Section 8 of the CDL Manual, according to the Wisconsin State Patrol. For many participants, the chance to look over new plowing equipment was the highlight of this year's workshops. Five different counties, two cities, and a town volunteered to bring their equipment to one of the workshops. (See Resources page 10.)

The equipment shown had many similarities and a few predictable differences. Agencies plowing in rugged terrain or on narrow streets often prefer single axle trucks, while agencies which also use their trucks for hauling and construction prefer tandem or tri-axle vehicles. One-way plows are preferred if the roads are rural and mostly two-lane. Reversible plows are the norm for urban areas and multi-lane roads.

All plow vehicles had automatic transmissions, joy stick plow controls, and wing plows with safety lighting. Most are using the newer HID front auxiliary plow lights. Those spreading straight salt have thermal sensors to read both road and air temperatures.

Joystick plow controls enhance safety and convenience.

Popular safety features include power windows, heated wipers and heated mirrors. One county has had good luck with heated windshield fluid equipment. Salt spreaders with left and right side discharge are becoming more common, along with LED-type truck lighting. Several trucks are using the instant chains for the rear wheels.
Gravel to asphalt. When should you convert?

GRAVEL ROADS need frequent maintenance. In dry weather, residents complain about dust; in wet weather, rutts and potholes are the problem. Converting to hard surface roads seems like a good solution, and maybe it will save money on maintenance. Or will it? When are conditions right to upgrade and why?

Researchers at Iowa State University found answers to some of those questions. They identified issues and decision processes, and developed economic analysis tools for deciding to convert a road. The Minnesota counties being studied chose asphalt as their preferred hard surface. Local Wisconsin officials should find this study very helpful for planning an upgrade and helping the public understand the choices.

The report, Economics of Upgrading an Aggregate Road, describes the steps taken to gather cost information. First, to gather “historic” costs for maintaining gravel roads the researchers reviewed annual state aid reports from four Minnesota counties. Reported gravel maintenance costs per mile varied from county to county from $1,597 to $1,997. This disparity led the researchers to develop a formula for calculating a maintenance cost estimate.

“Estimated” costs for comparable road miles proved to be significantly higher than historic costs: $4,160 per mile. This is an annual average for a 28’ cross section. Using a five-year maintenance cycle they estimate four years of normal grading at $1,400 per year plus re-graveling/resurfacing in YEAR FIVE at $15,000.

\[
\begin{align*}
& \text{($1400 \times 4) + 15,000 = 20,8005} \\
& \text{20,8005 ÷ 5 = $4160}
\end{align*}
\]

The notable difference from historic cost suggests that local officials may prefer to use estimates to budget for future maintenance costs. Relatively accurate cost predictions for labor, equipment, and materials are needed, however. The method can be a valuable resource when expense records are sketchy and when material sources or maintenance methods have changed. The report lists detailed assumptions and calculations that local officials can adapt.

In a similar calculation for Hot Mix Asphalt (HMA) pavements, annual maintenance was calculated at $2,460 per year. This is based on a seven-year cycle that includes painting traffic control markings, routine edge rutting, and annual cleaning, along with a chip seal or other surface treatment at YEAR SEVEN. It does not include the initial reconstruction and paving investment.

As traffic volumes increase, so do annual maintenance costs for both road surface types. However, they increase faster on aggregate roads. “We wanted to find out if the savings in maintenance costs would offset the initial investment for asphalt any time in the life of the road,” says Duane Smith of Iowa State University’s Civil Engineering department, one of the authors.

The researchers’ conclusion is: No. “The maintenance savings alone could not justify the investment in the HMA upgrade,” the report concludes.

Upgrade decisions usually involve other considerations: quality of life for neighbors, safety for road users, and encouraging local economic development, for example. Unfortunately, it is hard to put a monetary value on these benefits.

In practice, these Minnesota counties begin to convert their roads as traffic volumes grow through the range of 100-200 a day. “We found that at 200 vehicles a day very few miles were still in gravel, and there was a noticeable jump in costs for gravel road maintenance,” says Smith. For roads with 150-199 vehicles per day, counties had paved about 50% of the mileage. Nearly all roads carrying 300 per day are paved (see table).

It takes several years to include a road upgrade in a construction program. With traffic volume growing steadily on most roads, the report recommends, “It seems reasonable for local officials to commence planning for the upgrade when traffic volumes reach 100 vehicles per day.” In making the case, they can take advantage of the issues, cost data, sample calculations, and references gathered in this report.

### Surface-related maintenance cost per mile vs traffic volume (AADT) for four Minnesota counties from 1997 to 2001

<table>
<thead>
<tr>
<th>Traffic volume</th>
<th>Cost/mile for gravel</th>
<th>Gravel mileage</th>
<th>Cost/mile for bituminous</th>
<th>Bituminous mileage</th>
<th>Total mileage</th>
<th>Percent bituminous</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-49</td>
<td>1,639</td>
<td>252</td>
<td>767</td>
<td>3.6</td>
<td>256</td>
<td>1%</td>
</tr>
<tr>
<td>50-99</td>
<td>1,851</td>
<td>359</td>
<td>2,041</td>
<td>33.8</td>
<td>393</td>
<td>9%</td>
</tr>
<tr>
<td>100-149</td>
<td>1,788</td>
<td>143</td>
<td>2,116</td>
<td>70.6</td>
<td>214</td>
<td>33%</td>
</tr>
<tr>
<td>150-199</td>
<td>1,878</td>
<td>71</td>
<td>1,958</td>
<td>84.2</td>
<td>155</td>
<td>54%</td>
</tr>
<tr>
<td>200-249</td>
<td>2,466</td>
<td>34</td>
<td>1,446</td>
<td>120</td>
<td>154</td>
<td>78%</td>
</tr>
<tr>
<td>250-300</td>
<td>2,746</td>
<td>1</td>
<td>1,623</td>
<td>109</td>
<td>110</td>
<td>99%</td>
</tr>
<tr>
<td>300+</td>
<td>1,847</td>
<td>10</td>
<td>1,199</td>
<td>887</td>
<td>897</td>
<td>99%</td>
</tr>
</tbody>
</table>

Source: Economics of Upgrading an Aggregate Road, Jahren et. al., Minnesota Department of Transportation, January 2005, Table 4, page 17.
**EVERYBODY KNOWS** that Wisconsin has two seasons: winter and road construction. The well-worn joke expresses some of the public’s frustration with torn up surfaces, traffic snarls, and detours. Some inconvenience is inevitable, but local governments can keep it manageable, and improve work zone safety as well, with good transportation management planning. New tools coming from WisDOT can help.

Work zone traffic plans are often not considered until just before bid documents go out. Then, the local roadway agency may delegate responsibility to the contractor. While the contractor can provide safety and signing at the work site, someone needs to think community-wide and season-long.

Who will the project affect? Can people get across town? Will construction interfere with emergency access, school bus routes, parades, downtown sales, or seasonal attractions? What about other types of construction, maintenance, or utility work? Could they constrict or block alternate routes?

“Planning for public mobility is a good business practice, and hopefully local agencies already do it as a standard practice,” says Bill Bremer, Safety & Traffic Operations Engineer for the FHWA-Wisconsin Division. New guidelines at the state level will help ensure that public mobility is routinely addressed along with work zone safety.

Starting in October 2007, all federal aid projects must have written Transportation Management Plans (TMPs). The amount of detail depends on the scope of the project. For example, more detailed plans are required for projects in the Milwaukee and Dane County areas where lanes will be closed for more than three days.

To get more information on work zone safety, come to one of the TIC Work Zone and Flagger Safety workshops held in late January at seven locations. See Calendar on page 12.

For more details on WisDOT’s TMP guidelines contact Peter Amakobe, 608-261-0138

“To get more information on work zone safety, come to one of the TIC Work Zone and Flagger Safety workshops held in late January at seven locations. See Calendar on page 12.

For more details on WisDOT’s TMP guidelines contact Peter Amakobe, 608-261-0138

**Guidelines and more**

WisDOT expects to have TMP development aids ready in early 2007. They will include a flow chart and guidelines to help planners, engineers and designers consider mobility impacts and strategies. Local agencies may find the materials helpful also.

“Planning for public mobility is a good business practice, and hopefully local agencies already do it as a standard practice.”

A key approach is looking at the corridor as a whole and doing so when the project scope is first considered. Strategies include: avoiding work during peak traffic hours if possible, not scheduling work on adjacent routes at the same time, using supplemental law enforcement, improving detours and alternate routes, and providing temporary lanes.

“We are also testing new technologies,” says Peter Amakobe, WisDOT Work Zone Traffic Safety Engineer. One example is an automated system that predicts delay times and updates them on electronic signboards placed ahead of the work zone. The information allows drivers to choose an alternate route. Automated flagging devices, temporary portable rumble strips, and better lighting systems for night construction work are among others.

“The technology is helpful, but a lot of the strategies to anticipate the effects on safety, access, and traveler inconvenience are things we have been employing for years,” says Tom Notbohm, WisDOT State Traffic Engineer of Design. “They are good practices for a work program regardless of whether there’s a federal rule or not.”

“Planning for public mobility is a good business practice, and hopefully local agencies already do it as a standard practice.”

New technology, like this dynamic travel time estimate, can help reduce traffic backups.
Roundabouts make safer intersections

MORE MODERN ROUNDABOUT intersections are being implemented around the state. A new urban roundabout recently opened in Milwaukee, joining others in Brown and Dane counties. Many more are in the plans for future construction. Roundabouts have an outstanding safety record, according to WisDOT. They also can keep costs down because roadways leading to the intersection do not need widening. This prompted the agency in 2002 to require that roundabouts be routinely considered for state road project intersections instead of traffic signals or all-way STOP sign control.

Statewide, many engineering professionals have embraced the design alternative. “Three years ago there was skepticism on roundabouts. Since then the knowledge base within the profession has grown exponentially,” says traffic engineer Pat Hawley of R.A. Smith Engineering. He has reviewed numerous intersection designs under a consulting contract with WisDOT.

Citizen acceptance is also growing. “People can be reluctant during the planning phases of the project, but once the roundabout is built, they get used to it and find it works well. Up in north-eastern Wisconsin the public is now advocating for roundabouts,” Hawley says.

Roundabouts significantly lower the severity of vehicle crashes and the number of pedestrian and bicycle crashes, studies show. They are a particularly good option for interchanges because they handle turning traffic well. Dangerous weaving maneuvers — crossing multiple lanes to make an immediate left turn — are much lower, Hawley notes.

“Probably the biggest benefit after safety is the cost saving potential,” Hawley says. For example, on Hwy 60 south of West Bend two roundabouts are planned at the US 45 interchange during reconstruction in 2011. Alternate designs to handle the same traffic flow required additional travel lanes on Hwy 60 which, in turn, required larger bridge structures on US 45. “Building the roundabouts will save the public over $1 million just at that one interchange,” Hawley says.

Good design required

“Roundabouts are a tried, proven technology that works. They are based on 40 years of engineering science out of the UK (United Kingdom),” says roundabout expert Mark Johnson. “However, they need to be designed properly, especially when they have multiple lanes.” Johnson, a former WisDOT project development engineer, owns MTJ Engineering.

Design standards in the WisDOT Facilities Development Manual are a help, but they have to be applied correctly. “In reviews we see problems with interpretation,” says Hawley. “With experience you learn which design elements to adjust for the specific site conditions.” This knowledge differential is why WisDOT contracts for reviews of roundabout designs.

Designs are evolving, too. The UK built roundabouts in the late 1970s that were quite large, making it harder for pedestrians and bicycles to get through, some studies showed. “What we’re designing and building today is much more compact,” says Johnson. “The design criteria provide safety for pedestrians and bicyclists as well.” Also, when it takes less roadway width to move the same amount of traffic, more off-street ped/bike facilities are possible.

Roundabouts are excellent solutions when well designed, but they don’t work everywhere. “It boils down to good transportation and traffic engineering,” Johnson says. You have to follow the engineering principles, rather than prescribed rules.”

For more information see the WisDOT roundabout Web page:

www.dot.wisconsin.gov/safety/motorist/roaddesign/roundabout-design.htm

“Probably the biggest benefit [of roundabouts] after safety is the cost saving potential.”
Publications

Gravel Road Maintenance: Meeting the Challenge (DVD and CD). DVD has video modules on correct roadway shape, shaping the roadway, good surface gravel, and dust control. CD has an instructor’s guide and the FHWA Gravel Roads Maintenance and Design Manual—supply limited. A limited number of print copies are also available.

Winter Road Maintenance Workshop packet. Includes a CDL Update, 2007 EPA emission requirements, plow driving safety, truck maintenance lists, sample specifications for a conventional single axle patrol truck chassis and dump box, and examples of winter maintenance plans and policies.

Using Salt and Sand for Winter Road Maintenance, WTB No. 6 Basic information and practical tips on how to use deicing chemicals and sand.

Pre-wetting and Anti-icing -- Techniques for Winter Road Maintenance, WTB No. 22. Describes new options for winter road maintenance that liquid chemicals offer and gives basic information on pre-wetting and anti-icing.

Websites

WisTransPortal is adding more databases. Wisconsin crash data opened in 2006. Coming online in early 2007 are: health outcomes, crash costs, road weather information, citation data, emergency vehicle run data, lane and ramp closure data, and traffic detector data. The Fall 2006 Crossroads featured this TOPS Lab project. http://transportal.cee.wisc.edu

Roundabout planning and design resources:

- WisDOT information is available at: www.dot.wisconsin.gov/safety/motorist/roaddesign/roundabout-design.htm
- Safe Routes to School resources:
  - Wisconsin Safe Routes to School Program is available at www.dot.wisconsin.gov/local-gov/aid/saferoutes.htm
  - The National Center for Safe Routes to School at: www.saferoutesinfo.org/
  - Federal Highway Administration resources at: http://safety.fhwa.dot.gov/saferoutes/index.htm


CALENDAR

continued from page 12

UW–Madison Seminars

Local government officials can request a scholarship for the following Engineering Professional Development courses. See details at http://epd.engr.wisc.edu or call 800-462-0876. Courses are held in Madison unless otherwise noted.

MARCH 2007

21-22 Highway-Rail Grade Crossing Safety Course
21-23 Traffic Signal Design and Operation
26-28 Designing Efficient Culverts and Open Channels

APRIL 2007

10-11 Municipal Engineering Fundamentals for Non-Engineers
10-12 Foundation Engineering

Other Opportunities

Pesticide Applicator Training

Right-of-Way sessions:

Jan 30 Waukesha Jan 31 Wausau

No walk-ins. Pre-register by 1/16 or 1/17. Information and pre-registration online at http://ipcm.wisc.edu/PAT/ or call Rose Scott at 608/262-7588, or e-mail at PAT-program@facstaff.wisc.edu
Low Cost Local Road Safety Solutions booklet at: www.atssa.com/galleries/default-file/LowCostLocalRoads.pdf

Improvements described are:
- Sign and pavement marking improvements
- Post-mounted delineators and chevrons
- In-street pedestrian crossing signs
- Edge lines on two-lane roadways
- Raised pavement markers
- Shoulder and edge line rumble strips
- Centerline rumble strips
- Roadside and median cable barriers

The FHWA Roadway Departure Web sites at: http://safety.fhwa.dot.gov/roadway_dept/ provides information on rumble strips, “safety edge,” and other techniques that can be used to reduce run-off-the-road crashes and crashes where vehicles cross the centerline.

Edge drop-off reports, Iowa DOT, at www.dot.state.ia.us/crash-analysis/iowadot_safety_research_studies.htm
- Quantifying the Magnitude and Characteristics of Pavement Edge Drop-Offs Crashes, Hallmark, et. al., Paper Number: #06-0918, Safety Research Studies, Iowa Dept of Transportation. This study reviewed Iowa crash data for rural paved roadways with an unpaved shoulder. They found that 1.6% of the 4,310 crashes had edge drop off as a probable cause and 22.8% had edge drop off as a possible cause. Possible and probable edge drop off crashes were three times more likely to be fatal and more than twice as likely to result in major injury. The report includes a good summary of other edge drop off studies and gives references.
- A Survey of State Practices with Respect to Pavement Edge Drop-Offs Summary of practices for managing pavement edge drop-offs by different state DOTs. A number use 2” as the trigger point for maintenance. (One DOT uses 3” and one uses 1½”)

Research reports from the Wisconsin Highway Research Program on pavements, soils and structures at: www.whrp.org/Research/publications.htm.

Research Brief: Improving Subgrades with Byproducts and Geosynthetics, a brief summary of several projects and results is on WisDOT’s research Web sites: www.dot.state.wi.us/library/research/reports/newreports.htm

Other detailed research reports that are available:
- Equivalency of Crushed Rock with Industrial By-Products and Geosynthetic-Reinforced Aggregates Used for Working Platforms during Pavement Construction, SPR# 0092-00-12
- Effectiveness of Geosynthetics in Stabilizing Soft Subgrades, SPR# 0092-45-15
- Field Performance of Subbases Constructed with Industrial By-products SPR# 0092-45-18
- Strength Contribution of Select Subgrade Reinforcement Materials SPR# 0092-03-12

Videotapes/Multimedia

Forest Roads and the Environment Series (DVD), USDA Forest Service, 2006, 116 min. #18828

A six-part series on rural gravel and dirt road maintenance. The settings are in federal forests but the basic information is helpful for all rural low volume roads. Segments are available individually.
- Forest Roads and the Environment, 18 min. #18554
  General environmental impact of road on its surroundings.
- Reading the Traveled Way 16 min. #18560
  Shows how to understand defects in the traveled way.
- Reading Beyond the Traveled Way, 17 min. #18559
  Problems off the traveled way including erosion and slides.
- Smoothing and Reshaping the Traveled Way, 18 min. #18561
  Road grading techniques.
- Maintaining the Ditch and Surface Cross Drains 16 min. #18556
  Ditch and culvert maintenance.
- Dangerous Travelers, 26 min. #18818
  Problems and maintenance of roadside plants.

CROSSROADS provides information on roads and bridges for local officials. Published quarterly by the Wisconsin Transportation Information Center (TIC)—part of the nationwide Local Technical Assistance Program (LTAP)—with assistance from the Federal Highway Administration, WisDOT, and the University of Wisconsin—Extension. For permission to reproduce articles or graphics, please contact us.

Don Walker  DIRECTOR
donald@epd.engr.wisc.edu
Steve Pudloski  STAFF
pudloski@epd.engr.wisc.edu
Ben Jordan  STAFF
jordan@epd.engr.wisc.edu
Susanna Fuerstenberg  PROGRAM ASSISTANT
tic@epd.engr.wisc.edu
Lynn Entine  WRITER/EDITOR, ENTINE & ASSOCIATES
Susan Kummer  GRAPHICS, ART/FAX

PHONE 800.442.4615
FAX 608.263.3160
EMAIL tic@epd.engr.wisc.edu
WEB SITE http://tic.engr.wisc.edu

Wisconsin LTAP
WINTER 2007 11
TIC Workshops
Details, locations and registration forms are sent to all CROSSROADS recipients prior to each workshop. Registration begins after announcements are sent.

Work Zone and Flagger Safety
For road supervisors and maintenance personnel who plan and set up work zones. This workshop covers traffic control devices, the parts of a work zone, and a variety of work zone set ups including mobile operations and flagging operations. Participants will set up work zones using the Wisconsin Pocket Guide to Workzone Safety and the Flagger's Handbook. Fee: $45

Jan 23  Tomah  
Jan 24  Barneveld  
Jan 25  Waukesha  
Jan 30  Eau Claire  
Jan 31  Cable  
Feb 1  Rhinelander  
Feb 2  De Pere

Road Maintenance
Workshop covers maintenance, repair and reconstruction options for local roads and streets as well as best practices for maintaining and improving drainage and extending pavement life. You'll get information to help you decide which maintenance techniques are best for particular pavement conditions. Fee: $45

Feb 2  Oconomowoc  
Feb 5  Eau Claire  
Feb 6  Wausau  
Feb 7  De Pere

Safe Routes to School (SRTS)
Learn how to develop an SRTS plan using the four main strategies:

Engineering, Education, Encouragement, and Enforcement. Representatives from school districts, regional planning, law enforcement, and public works departments — the essential planning partners — are invited. Also includes: a case study presentation from a nearby community with a developed SRTS plan; and a review of how to apply for SRTS grants and other funding. Fee: $45

Feb 2  Oconomowoc  
Feb 5  Eau Claire  
Feb 6  Wausau  
Feb 7  De Pere

Jan 23  Tomah  
Jan 24  Barneveld  
Jan 25  Waukesha  
Jan 30  Eau Claire  
Jan 31  Cable  
Feb 1  Rhinelander  
Feb 2  De Pere

Mar 14  Hayward  
Mar 15  Tomahawk  
Mar 16  De Pere  
Mar 22  Barneveld  
Mar 23  Pewaukee

On site Workshops
Save time and travel costs by bringing instruction to your shop or office. Schedule training for the time and place most convenient for you and ask the instructors to tailor content to your specific needs. On-site workshops let you train more people for the same or less cost — including staff from other municipal departments, from nearby communities, and from businesses you contract with. Some workshops the TIC can offer at your location include:

• Basic Surveying for Local Highway Departments
• Basic Work Zone Traffic Control
• Flagger Training
Contact the TIC early to ensure you get the program you need on the date you want.

Jan 23  Tomah  
Jan 24  Barneveld  
Jan 25  Waukesha  
Jan 30  Eau Claire  
Jan 31  Cable  
Feb 1  Rhinelander  
Feb 2  De Pere

Mar 12  Tomah  
Mar 13  Eau Claire

UW–Madison Seminars
Local government officials can request a scholarship for the following Engineering Professional Development courses. See details at http://epd.engr.wisc.edu or call 800-462-0876. Courses are held in Madison unless otherwise noted.

JANUARY 2007
8-9  Improving Public Works Construction Inspection Skills
10-11  Maintaining Asphalt Pavements

FEBRUARY 2007
1-2  Implementing a Sidewalk Management System

MARCH 2007
8-9  Preparing an Effective Municipal Capital Improvements Plan
19-20  Improving Intersection Safety and Efficiency

Continues on page 10