

Crossroads

Winter 2000



TRANSPORTATION Information Center — LTAP

University of Wisconsin—Madison

Time to fix roadside safety hazards

Keeping roadways safe and free of hazards is a local agency's continuing task. Roadway hazards often seem to sprout overnight, like the weeds that leap up in ditches the minute your back is turned.

There are many different types of hazards to be looking for—from guardrail problems to unsafe mail boxes, edge dropoffs to culvert headwalls. Each has the potential to make a driver's mistake a costly one. Some also can turn a snow

plowing operation into a demolition derby.

The T.I.C.'s *SAFER Manual* can help you spot safety problems. Dozens of photographs illustrate hazards in a variety of categories. Using the SAFER ranking system you can identify which ones need immediate action and then plan when and how to correct others. A sampling of some common hazards seen on Wisconsin roadsides in the past year are shown here.



Top row, from left: **Edge dropoffs** over 1½ inches can turn a driver's steering error into a serious crash. Give them year round maintenance attention. **Trees** close to the road edge at curves or intersections are candidates for removal. Be selective to avoid negative public reaction. **Hazardous rail**, like this useless short piece with a projecting blunt end, should be removed, along with the trees it is failing to protect. **Mailboxes** on non-standard supports and multiple boxes on planks are hazards found much too frequently along roads.

Left: **Driveway posts** on the right-of-way decrease the clear zone and also make snow removal more difficult.

Bottom, from left: **Guard rail** should meet safety standards. This wood plank is not strong enough. The connection to the bridge railing is also unsafe. **Culvert headwalls** extending above the shoulder are a hazard and serve no purpose.

Refresh your memory about common roadside hazards and learn to recognize others. Attend the T.I.C.'s January Safety Workshops. See the Calendar on page 4.

Inside

Idea Exchange: Signs, mirrors and lights help plow drivers; Tips from winter workshops	2
Winter is a good time to inspect signs	4
Calendar	4
Resources	5
Pavement cuts cost more than you think	6
Good sampling and testing make better roads	7
Many advantages to flowable fill	8

Idea Exchange

Signs, mirrors and lights help plow drivers

Onalaska has added accessories to their plow trucks to improve safety. New large signs, as shown in this photo, warn motorists to be careful behind trucks. The city has mounted the signs on all their tailgate and V-box spreaders. "They cost about \$500 all together," says John Marcou of the Onalaska Streets Department. "We figure that if we can prevent one backing accident they are more than paid for."



They use 7-foot and 10-foot wing plows for clearing snow from their city streets. It's a safe and effective method, made easier by adding extra mirrors and a set of flood lights to help the driver see the plow's operation. "Without them the mid-mount wings are blind to our drivers," says Marcou. "With them we use our wings in town, center to curb, with ease."

For more information, contact John Marcou, 608/781-9539.

Do you have a good idea that has made your work easier, safer, or more efficient. Please share it with other **Crossroads** readers. Tell us about it using the form on page 7. Send photos if you can.



Tips from Winter Maintenance Workshops

The T.I.C.'s seven Winter Maintenance Workshops in September were well-attended. In addition to covering basics and new techniques, they gave people from local agencies an opportunity to share ideas and concerns. **Crossroads** reports here on some of the issues discussed.

Liability Local government employees and elected officials are sometimes named in liability suits against agencies. Under Wisconsin statutes, the agency (and its insurance company) must provide legal defense services and pay any financial judgements. Employees and elected officials do not need additional personal liability coverage for actions within the scope of employment or service. Agency responsibility does not cover non-work-related actions, however.

Safety Suggestions from participants addressed snowplow driver fatigue and boredom. One was to keep the truck cab at a cooler temperature and dress appropriately. Warm temperatures tend to make the driver more drowsy. Others reported snacking on vegetables and fruit to help fight boredom and fatigue. Keeping the cab clean and clear of non-essential items was recommended.

Snowplow driver fatigue becomes a critical issue after extended hours of plowing under difficult conditions. The national Commercial Drivers License requirements do not limit hours of operation for municipal employees, who are exempted, as they do for over the road drivers.

Agencies are encouraged to provide safety equipment and comfort options for snow plow trucks. Among those suggested are: heated exterior mirrors, electric windows to allow the single operator to open the passenger window for additional ventilation. Provide the best driver seat available. Agencies are now also including AM/FM radios and weather channel radios to supply additional information and help reduce driver fatigue and monotony.

continued on page 3

Crossroads

This newsletter provides information on roads and bridges to local officials and is published quarterly by the Wisconsin Transportation Information Center, part of the nationwide Local Technical Assistance Program (LTAP). **Crossroads** is produced with assistance from the Federal Highway Administration, the Wisconsin Department of Transportation, and the University of Wisconsin-Extension.

Non-profit organizations are welcome to reproduce articles appearing here. Please contact us first for any updates or corrections.

Wisconsin Transportation Information Center, UW-Madison Department of Engineering Professional Development, 432 N. Lake St., Madison, WI 53706
Phone: 800/442-4615 Fax: 608/263-3160, or e-mail to individuals below.

Don Walker, *director*
Steve Pudloski, *staff*
Jane Sauer, *program assistant*
Lynn Entine, *writer and editor*
Susan Kummer, *graphic artist*

donald@engr.wisc.edu
pudloski@engr.wisc.edu
sauer@engr.wisc.edu
Lynn Entine Writing & Editing
Artifax

Tips from Winter Maintenance Workshops *from page 2*

Some participants commented that new operators tend to drive too fast. While no specific speed guidelines will fit all conditions, operators must drive at a speed at which they are comfortable and confident to handle the equipment under diverse conditions.

Plowing private driveways An informal survey of workshop participants revealed a wide range of policies and approaches to plowing private driveways. Many towns do no private plowing whatsoever. This seems to be especially true in the southern part of the state.



Up north, many towns do provide full or limited plowing services on request. Almost all towns that do this have a reimbursement system, and many require a waiver of liability for plowing on private property.

There are some interesting exceptions. Some governments are willing to clear vision corners of private driveways during unusually heavy snow conditions. Others limit driveway plowing to persons with special needs, such as volunteer fire department personnel and the elderly or handicapped.

Winter preparation In addition to the checklist provided in the handouts, participants suggested a late fall shoulder maintenance program to ensure shoulders do not have hazardous drop-offs. This can be conducted just before freeze-up. Some agencies maintain a small stockpile of shoulder gravel with added salt that can be used for emergency shoulder repairs during the winter.

Snowplowing Using shoes on plows for gravel roads was suggested. They are particularly helpful early and late in the season to avoid plowing off excess gravel. Interest seems to be growing in using underbody blades for ice and snow pack removal. These blades are finding applications in urban as well as rural areas.

Urban streets need to be inspected, however, for protruding manholes and valve covers. These must be adjusted or the pavement patched so plows do not damage them. Some cities are now doing manhole repairs with infrared heaters to prevent plow damage during the winter.

Plows Wing plows continue to grow in popularity in both rural and urban areas. They make a significant improvement in efficiency with their ability to clean a wider lane than front mounted plows alone. They must be raised and lowered to avoid digging in the front edge. (Raise the front first, then the rear; lower the rear first and then the front.)



Wing plows can be fitted with chains to prevent the front edge from digging into the shoulder. Some agencies have put shoes on their wings to reduce shoulder damage.

Visibility for wing plows is important. Drivers may tend to pass the vehicle and not realize the wing plow extends into their lane. Agencies are using flags, reflectors and lights to highlight the location of the wing plow.

Reversible plows are now available with a flared moldboard to replicate a one-way plow in both directions. One agency has even mounted their one-way plow on a reversing frame to be able to use it in unusual situations for clean up.



Spreaders Ground speed control spreaders continue to grow in popularity, particularly for agencies spreading straight salt. Tarps are being used to cover straight salt, and even salt/sand mixtures, to minimize lost material and formation of frozen chunks.

Many agencies are using dump box vibrators to help remove salt or abrasive materials. Stainless steel dump bodies and spreaders are growing in popularity. Plastic liners inserted in dump bodies are helping improve flow of salt and salt/sand mixtures.

Several agencies have purchased spreaders with special belts to deliver material to the side of the truck rather than the rear. This could be done with spinners on both sides of the vehicle. Discharge on the right side can be useful for summer shoulder maintenance as well.

Winter is a good time to inspect signs

Effective, visible signs contribute to making local roads and streets safer. Checking for reflectivity in the dark is one very important sign maintenance task, says WisDOT District 2 safety engineer Tom Heydel. Signs that look good during the day can be nearly invisible at night because they have lost their reflectivity. Heydel is an instructor in the

T.I.C. **Highway Safety Workshops** being offered in January. (See the Calendar for dates and locations.)

Dark winter days make inspection easier. Staff can inspect signs during the first hour or two of the morning shift when it is still dark.

Start with the most critical signs: *Stop, Do Not Enter*, and other warning signs. Signs can also be spot-checked based on their installation date.



Although different conditions cause signs to age at different rates, any sign older than seven years is a good candidate for inspection.

Frequently, all signs in a segment or corridor are the same age and can all be inspected on one trip. Stenciling dates on the backs of signs also helps track aging.

Use a systematic review, based on your sign inventory if you have one, to plan for replacements and to estimate budget costs for spring town meetings.

On the next page are answers to some other signing questions commonly asked of Heydel.

continued on page 5

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.

Highway Safety A workshop on sensible signing and pavement marking for local roads, sign maintenance, and safer driveways, intersections and roadsides.

Jan 5	Green Bay	Jan 19	Cable
Jan 6	Brookfield	Jan 21	Tomah
Jan 7	Barneveld	Jan 20	Eau Claire
Jan 18	Rhineland		

Local Transportation Issues ETN Series The UW Local Government Center and the T.I.C. address transportation issues in workshops on ETN (100+ Wisconsin sites). Thursdays from 10:30 am to 12:20 pm. \$10 per session. Call 608/262-9960 for a brochure.

Local Transportation Aids and Other Local Roads Issues (ETN, Jan 20) Learn about funding and qualifying for WisDOT local transportation improvement and assistance programs. Also covers new WISLR local road database software, and other Local Roads Advisory Committee recommendations.

Liability for Local Road Agencies (ETN, Feb 9) Review your responsibilities for managing and limiting local road liability. Topics include local government immunity, negligence, ice removal, and traffic control standards and expectations.

Bidding and Inspecting Local Road Projects (ETN, Mar 9) Review sample bid documents for local road paving projects. Learn how SUPERPAVE technology may be applied to local road projects. Discuss how to inspect and manage quality on small paving projects.

Basic Work Zone Traffic Control For road supervisors and maintenance personnel who plan and set up work zones. This workshop covers traffic control devices, the parts of a workzone, and a variety of work zone setups, including mobile operations. It also covers pedestrian, worker, and flagger safety. Participants receive the Wisconsin pocket guide to *Work Zone Safety*.

Feb 7	Tomah	Feb 14	Green Bay
Feb 8	Eau Claire	Feb 15	Brookfield
Feb 9	Cable	Feb 16	Brookfield
Feb 10	Rhineland	Feb 17	Barneveld

Roadway Maintenance Learn how to improve your street and road maintenance operations. Topics will include how to rate the condition of your local roads, how to plan your maintenance program, and techniques for preventive maintenance and rehabilitation.

March 13	Rhineland	March 20	Green Bay
March 14	Cable	March 21	Brookfield
March 15	Eau Claire	March 22	Barneveld
March 16	Tomah		

UW-Madison Seminars

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

- GIS for Public Works*, Feb 7-8
- Managing Urban Forestry Programs*, Feb 21-22
- Maintaining Asphalt Pavements*, Mar 27-28
- Neighborhood Design and Traffic Calming*, Mar 27-29
- Improving Public Works Construction Inspection Skills*, Mar 29-30
- Development Review and Access Management*, April 10-12
- Managing Street and Highway Design Projects*, April 13-14

Other Training Opportunities

Pesticide Applicator Training for Right-of-Ways Fee \$45/person. Preregister through your County Extension Office or call 608/262-7588 by the date indicated. Course runs from 8:30 am to 2:00 pm.

January 26	Milwaukee	Preregister by January 12
January 27	Wausau	Preregister by January 13

Public Works Supervisory Academy A certificate program in supervisory skills consisting of 10 one-day courses offered by UW-Madison at many state locations on an ongoing basis. Contact Gregg Miller, Professional Development and Applied Studies, (608) 263-8256.

Q. Are fluorescent yellow-green signs required for all pedestrian, bicycle and school signing applications?



A. No. According to FHWA guidelines, as of June 19, 1998, they are allowed as an optional use for pedestrian, bicycle and school signs. WisDOT will use them just for School Crossing and advance warning signs on state highways, replacing the old yellow signs as they wear out over the next five years. It is important not to overuse the color so it doesn't lose its effect.

Q. When must I use an advance warning for a School Crossing sign?

A. Any time you use a School Crossing sign (the school-house shaped sign placed right at the school crossing), you are required to have a school advance sign prior to that. In urban areas it is tempting to think that lower speeds make the advance warning unnecessary. That is not the case. The placement is based on prevailing speed. Tables in the MUTCD give the distance needed to come to a stop for different speeds.

Q. When do I need a School Bus Stop Ahead sign?

A. School Bus Stop Ahead signs are intended for use at locations where a school bus stopping to pickup/discharge children is not visible to a driver for 500 feet in advance. Something that is often

overlooked is taking down signs where buses no longer make stops. This helps ensure that motorists respect the signs that mark active pickup sites.

Q. Do I need to make all my street name signs with the larger six-inch upper case letters and four-and-a-half-inch lower case letters?

A. No. Larger letters are recommended but not required, according to the January 1997 *Federal Register*. The only requirement right now for street name signs is to be reflective. They can be any color except red, and a logo is acceptable. However, I highly recommend these larger letters to assist the driver.

When replacing street name signs you may want to consider using larger letter sizes because they are easier for drivers to read. Studies show that in rural areas sign lettering should be one inch high for every 50 feet of distance. At 50 mph it takes at least 300 feet to recognize a street name and make the turn. That translates to six inch high letters.

Q. Can I mount stop signs and street name signs on the same post?

A. Yes, as long as the shape of the stop sign is not compromised and drivers can still see and recognize it (Jan. 1997 *Federal Register*). Both WisDOT and FHWA recommend that the signs be separated by six inches vertically so the shape of the stop sign can be



recognized. According to WisDOT policy, any stop sign approaching a state highway must be on a separate post from the street name sign unless that is impossible because of lack of space. The stop sign is very important, though, so it is best to mount it separately from street name signs.

Q. When are Stop Ahead signs required?

A. Stop Ahead signs are required any time a county highway approaches a state highway, according to the *Wisconsin Supplement to the MUTCD*. They should also be erected on any town road approaching a state highway where the stop sign is not readily visible.

In other locations, a stop ahead sign should be erected where a stop sign is not visible from far enough away to come to a stop. There are charts in the *Wisconsin Supplement* showing proper distances for various speeds. As a rule of thumb place them 300-400 feet ahead for speeds 40 mph and under, and 700-750 feet for 45 mph and up.

Advance distances are generally based on the posted speed, but if you know that people actually travel faster despite enforcement, consider the actual speed in placing the advance warning. For example, if the posted speed is 30 but traffic is actually going 50, install the sign farther away from the intersection.

In some cases the Stop Ahead sign may be used for emphasis where there is poor observance of the stop sign.



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.

The SAFER Manual (Safety Evaluation for Roadways), T.I.C., 1997. Using a hazard rating scale, demonstrated with many pictures and brief text, the *SAFER Manual* can help you identify potential hazards along roadsides, at intersections and railroad crossings, and associated with roadway geometrics. It will also help you rate safety needs, address immediate problems, and budget for longer term safety improvements. Use the *SAFER Manual* to plan your work for next year.

Utility Accommodation Policies To help your agency review, update or draft a new utility accommodation or street occupancy policy, the T.I.C. offers two samples. The Marathon Co. Town Utility Policy is based on the WisDOT Utility Accommodation Policy. It offers a consistent approach and permit process for state, county, and town roads. The City of Madison Street Occupancy Ordinance and Permit, adopted Feb. 1999, includes a degradation fee.

Snow Fence Guide, Strategic Highway Research Program, 1991, 60 pp. Control of blowing snow has safety and cost saving benefits. This technical booklet describes how to design and install effective snow fence. It is intended for highway engineers and public works staff. Limited supply.

Manual of Practice for an Effective Anti-icing Program, Federal Highway Administration, 1996. This publication is a summary of recommended practice for using liquid chemicals in pre-storm roadway treatment. The work is based on studies in several states. Intended for maintenance personnel responsible for managing anti-icing programs. Limited supply

Controlled Low-Strength Materials (CLSM), American Concrete Institute ACI 229R-99, 1999, 15 pp. Basic information on CLSM (flowable fill) technology, emphasizing CLSM material characteristics and advantages over conventional compacted fill. Addresses applications, material properties, mix proportioning, construction, and quality-control procedures.

Pavement cuts cost more than you think

Utility trenches and other pavement cuts cause damage beyond the immediate cut area and significantly shorten pavement life. As a result, some municipalities are revising their specs, enforcing permit requirements, and upping their pavement cut fees.

Excavations damage subgrade and weaken pavement three feet outside the cut edge, according to a 1991-94 study in Cincinnati. Cuts closer together than eight feet caused even more damage.

A Transportation Research Board study found damage even further out: more than an inch of settlement seven feet away from the cut edge. The cause was weakened soils and compression by excavation equipment. This level of damage occurred in granular soils adjacent to 5-foot-deep trenches with no sidewall support. More cohesive soils like clays showed less damage.



Pavement life goes down drastically around utility cuts—by five years according to a study in California; by seven to eight years according to a Vermont study. And, the best pavements suffer the greatest loss of useful life.

More damage comes from excavations made without pre-cutting the pavement. Jagged edges and stress cracks made by opening the pavement with a backhoe often produce poor patches and deteriorating pavement.

Degradation fees

Given these recent findings, some communities are charging pavement cut fees that better reflect the actual damage costs of the excavations. These degradation fees are in addition to the administration and inspection fee charged for the permit and the required proper repair.

One fee formula suggested by a study done for the Wisconsin Alliance of Cities, Inc., considers age of street, overlay and sealcoat using a straight-line depreciation schedule. The study also recommends a patch that is two feet wider than the cut on all sides.

Here is a sample degradation fee developed using this formula. It assumes a 20 year life for streets, a 12 year life for overlays, and a 5 year life for sealcoats. Average costs per sq. yard are based on a 1997 survey of Wisconsin cities.

Area of cut = 3x5 feet

	Cost	Age	Depreciation	\$/sq. yd.	Patch area	Fee
Street	\$36	16	25%	\$9	7x9 ft.	\$63
Overlay	\$15	5	67%	\$10	7x9 ft.	\$70
Sealcoat	\$ 5	1	100%	\$5	7x9 ft.	\$35
Total fee						\$168

Degradation fees, which are new to Wisconsin, were implemented by the City of Madison last February. Madison uses longer life cycles, varies depreciation according to the street's traffic load, and assumes that most depreciation occurs in the first few years of the street's life. So, for example, a 16-year-old arterial would be at 33%, while a same-age local street would be at 47%.

At the request of utilities, degradation fees and formulas are being reviewed by the Public Service Commission. Its findings are likely to affect them. **Crossroads** will report the outcome of these deliberations in a future issue.

Technical recommendations

A variety of remedies are recommended as a result of the recent extent-of-damage studies. Wider overcuts, extra depth of asphalt, and shape of patch all can help compensate for the weaknesses caused by pavement cuts. Some of these are:

- Establish standard location, cover, and clearance requirements.
- Require pavement be saw cut before excavation.
- Minimize excavation size. Use trenchless methods if possible.
- Require proper bedding for pipes.
- Set specific backfilling and compaction requirements, and test to see they are met. Consider requiring flowable fill (see story on page 8).
- Require greater patch depth on asphalt, T-shaped patches on concrete.
- Set and enforce safety requirement for both workers and traffic.
- Inspect. Inspect. Inspect.

Policies and communications

You cannot ensure that proper techniques are used or recover fees for street deterioration without a right-of-way occupancy policy. Your municipality should establish a permitting process, prepare written technical specifications, and enforce them. The T.I.C. has sample policies you can use as a starting point. (See *Resources* on page 5.)

Nothing is more disheartening than watching utilities or others cut into brand new pavement. Except for emergencies, most utilities plan repairs and replacements up to two years ahead. As a result, effective communication can coordinate utility work with reconstruction and overlay plans. Dane County, for example, has a meeting each February with representatives of municipalities and utilities to discuss and adjust plans before the construction season begins.

Get started on right-of-way and utility cut policies soon. The life you save may be your pavement's.

Use the form on page 7 to get copies of bulletin No. 17, **Managing Utility Cuts**, and sample ordinances and policies for cities/towns.

Good sampling and testing make better roads

“Everybody should be sampling and testing on a regular basis to ensure they’re getting what they’re paying for,” says Keith Lundin, Director of the Highway Technician Certification Program (HTCP) based at the UW Platteville. “That process is easier these days because of Wisconsin’s quality control and assurance leadership.”

The state is a national leader in establishing a strategy for addressing quality control and assurance with highway contractors. WisDOT has given contractors responsibility for quality control using revised specifications and contractual practices for contracted work. This involves routinely sampling and analyzing the materials and the work.

The HTCP assists in this process by offering programs that train and certify individuals who do sampling and testing, process control/ troubleshooting, and mix design in aggregate, hot-mix asphalt and Portland Cement Concrete. Between January and June, HTCP is offering more than 30 classes in Eau Claire, Green Bay, Wisconsin Rapids, Madison, and Platteville.

Local agencies can take advantage of Wisconsin’s leadership in quality management by requiring certified testing in all bid specs. Larger agencies and those operating their own gravel quarries and asphalt and PCC plants can benefit by training and certifying staff through the HTCP.

Testing aggregate is fundamental to managing road construction quality. Aggregates are the main ingredient in all phases from base construction and pavement mixes, to granular shoulders, granular surfacing, and erosion control. A proposed new HTCP class will teach specific aggregate testing for PCC mixes. This will allow contractors to test their own aggregates to assure they are using good materials.

“Materials represent approximately 60 percent of a road construction project’s cost,” says Lundin. “You have to use good materials.”



Good aggregates make better roads.

One of the newest classes teaches mix design and testing for SUPERPAVE, the new superior-performance asphalt pavement. Beginning in 2000, Wisconsin’s goal is to implement using SUPERPAVE on all high volume roads. This new design system requires a better aggregate matrix and properties for better load transfer and greater durability.

A new Federal mandate requires that any project using Federal Aid funds, must also use qualified sampling and testing personnel and laboratories. WisDOT has arranged informational meetings for January and February 2000 on this new mandate. Contact the HTCP office for more information and to attend these sessions.

For more information contact Keith Lundin at 608/342-1545, or lundin@uwplatt.edu.

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:

Crossroads
Transportation Information Center
University of Wisconsin–Madison
432 North Lake Street
Madison, WI 53706

Or call, fax, or e-mail us:

phone 800/442-4615
fax 608/263-3160
e-mail sauer@engr.wisc.edu

- Please put me on your **Crossroads** mailing list.
- Please send me information on _____

- My idea, comment or question is _____

(We'll contact you to get more details or answer your question.)

Name _____ Title/Agency _____

Address _____ City _____ State _____ Zip _____

Phone () _____ fax () _____ e-mail _____



Many advantages to flowable fill

Flowable fill, which goes by the formal name of Controlled Low-Strength Materials (CLSM), offers numerous advantages over standard backfill materials. It does not settle, for one. It is self-leveling, generally needs no compaction, and establishes load carrying capacity within a few hours.



Asphalt fill flowing around corner of trench

Flowable fill allows all-weather construction—especially important in winter. It will displace water in a trench from rain or melting snow, and it can be heated like other ready-mix concretes and placed in cold

weather. Due to these advantages, it often has a lower in-place cost than other backfill materials despite generally costing more per cubic yard.

Utility trenches can be smaller because they don't have to accommodate compaction equipment. When closed with flowable fill the site can be covered with a permanent pavement patch and opened to traffic the same day. The patch remains solid because the fill doesn't settle. If

necessary, flowable fill, which generally is designed with a long-term compressive strength of 50-150 psi, can be excavated again with conventional digging equipment.

Although it is about as permeable as compacted granular fill, flowable fill effectively resists erosion. It has been used under culverts and other pipes to prevent water from eroding the support, and to fill voids under pavements, sidewalks, bridges and other structures where natural soil or granular fill has eroded away.

Flowable fill is readily available from local concrete suppliers. It is a mixture of water, Portland cement, aggregates, and sometimes fly ash. Proportions are determined by the application and necessary characteristics like flowability, strength, excavatability, density, etc. There are ASTM standards for flowable fill mixtures, but it is not always necessary to use standardized materials. Native sandy soils, quarry waste products, and pea gravel have all been used successfully as aggregates.

Fly ash is sometimes used in flowable fill to improve flowability. It can also increase strength and reduce bleeding, shrinkage and permeability. Flowable fill with fly ash is available in Wisconsin from WEPCO and other electric utilities. It is produced under agreement with the Wisconsin Department of Natural Resources.

For more information on flowable fill, contact the T.I.C. for a copy of **Controlled Low-Strength Materials**. Use the form on page 7.

Please call or write us with the correct information

Address incorrect?

Route To

Do not use for return mail

Nonprofit Organization	
U.S. Postage	
PAID	
Madison, Wisconsin	
Permit No. 658	

TRANSPORTATION Information Center — LTAP
University of Wisconsin—Madison
432 North Lake Street
Madison, WI 53706



phone 800/442-4615 • fax 608/263-3160 • e-mail sauer@engr.wisc.edu Local Technical Assistance Program (LTAP)

