September–October 2006

Technology NEWS

Iowa LTAP
Local Technical Assistance Program

Providing transportation technology transfer for Iowa's cities and counties

Inside this issue

Iowa State University's Center for Transportation Research and Education (CTRE) is the umbrella organization for the following centers and programs:

Bridge Engineering Center
Center for Weather Impacts on Mobility and Safety
Construction Management & Technology
Iowa Local Technical Assistance Program
Iowa Statewide Urban Design and Specifications
Iowa Traffic Safety Data Service
Midwest Transportation Consortium
National Concrete Pavement Technology Center
Partnership for Geotechnical Advancement
Roadway Infrastructure Management & Operations Systems
Traffic Safety and Operations

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Making school zones safer

More parents choose to drive their children to school these days than ever before. As a result, many schools across Iowa are experiencing traffic and safety problems. However, not only schools are affected.

Increases in the number of trips to and from schools affect traffic on adjacent streets as well. It's been estimated that 20–25 percent of morning congestion is due to parents driving their children to school. As a result, traffic operations often break down near school zones during pick-up and drop-off times, resulting in queuing and other operational problems.

ISU associate professor of civil, construction, and environmental engineering Shauna Hallmark was especially familiar with this issue, having school-age children and observing safety problems in school zones first-hand for several years. She and graduate student Hillary Isebrands decided to conduct a study funded by the Iowa DOT Office of Traffic and Safety to identify transportation safety and operational issues at elementary and middle school sites in Iowa. They visited twenty schools in eleven Iowa school districts during the 2004–2005 school year, focusing on sixteen elementary and four middle schools. They made observations both during the morning drop-off and afternoon pick-up periods.

Researchers documented the findings of their research and recommendations for improving safety in school zones in the *Toolbox to Address Safety and Operations on School Grounds and Public Streets Adjacent to Elementary and Middle Schools in Iowa.*

School parking lots are not ready for increased vehicle volumes

More than 50 percent of students are now picked up and dropped off by private vehicles. For comparison, in 1969, 49 percent of elementary school children walked or biked to school, 36 percent rode the school bus, and only 12 percent traveled by passenger vehicle. Existing school driveways and parking lots were not designed to handle large numbers of vehicles picking up and dropping off students, either in terms of circulation or parking.

When picking up children from school, parents often compete for space with buses, bicycles, and

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Queuing on school grounds.

Acronyms in *Technology News*

AASHTO	American Association of State Highway and Transportation Officials
APWA	American Public Works Association
CTRE	Center for Transportation Research and Education (at Iowa State University)
FHWA	Federal Highway Administration
Iowa DOT	Iowa Department of Transportation
ISU	Iowa State University
LTAP	Local Technical Assistance Program
MUTCD	Manual on Uniform Traffic Control Devices
NACE	National Association of County Engineers

U.S. Department of Transportation
Federal Highway Administration

Iowa Department of Transportation

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pedestrians. Additionally, poorly supervised loading and unloading zones and lack of structured arrival and dismissal procedures are common at elementary schools across Iowa. Schools often don't have appropriate pavement markings and signing to help guide parents through the school zones. This all contributes to unsafe school zones.

Parents and students contribute to unsafe conditions

Parents and students also contribute to unsafe conditions in school zones. Parents drop off children randomly, double-park, speed, ignore turn restrictions, etc. Often, parents drop off children midblock, on the side of the street opposite to the school, and drive away, leaving the child to cross several lanes of traffic.

Children walking to school often ignore or don't understand traffic control so they cross streets and parking lots wherever it is convenient. They often do not check for an appropriate gap or for the right of way when crossing streets.

How can you help?

Schools can take a number of steps to improve safety in school zones, such as establishing a school transportation safety committee, ensuring teachers and/or staff supervision during arrival and dismissal periods, communicating effectively with students and parents, etc. However, traffic engineers also can help make school zones safer.

Traffic engineers can help schools develop a school route plan. This plan should be designed so that it takes advantage of existing traffic control devices, minimizes the number of crossings in major traffic roadways, maximizes the use of existing sidewalks and roadways that have wide shoulders, etc. The National Highway Traffic Safety Administration has published the Safe Routes to School toolkit (www.nhtsa.dot.gov/people/injury/pedbimot/bike/Safe-Routes-2002/) to aid communities in developing safe routes to school. This handbook can provide good guidance on how to establish a school route plan.

Traffic engineers could observe the traffic patterns, as well as behavior of parents and students, around schools and try to identify existing problems. If they notice significant problems, engineers could suggest involving law enforcement officials to help encourage driver compliance with traffic control devices and traffic laws.

It is also important to make sure that traffic control on school grounds is consistent with traffic control on streets. The message that traffic engineers intend to send should be clear to the drivers. Additional signing installed along the roadways, such as NO STOPPING, STANDING, or PARKING signs, could help traffic circulation in school zones, as long as people understand how to interpret the signs.

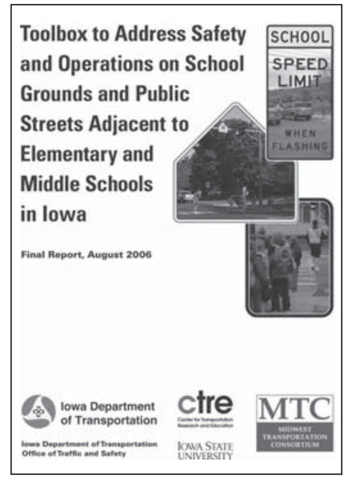
For more information

See the report, *Toolbox to Address Safety and Operations on School grounds and Public Streets Adjacent to Elementary and Middle Schools in Iowa,* on CTRE's website, www.ctre.iastate.edu/reports/school_zone.pdf. If you have specific questions, contact Shauna Hallmark, 515-294-5249, shallmar@iastate.edu. ■

Parents encourage unsafe behavior by selecting poor pick-up location mid-block on a major collector.

About the school zone toolbox

- It was written for school officials, traffic engineers, law enforcement officials, parents, and others involved in managing traffic operations and safety around school zones.
- The authors discuss the current situation at 20 elementary and middle schools in Iowa, list typical problems that schools have, highlight good practices, and suggest possible changes, solutions, and enhancements.
- Two chapters are devoted to discussion of common transportation safety issues and solutions, both on-site and on-street. Activity that occurs on the school grounds, or on-site, is typically the responsibility of the school. Activity that occurs on public streets, or on-street, is typically the responsibility of traffic engineers and local law enforcement. ■



Iowa's first high-performance steel bridge

Des Moines' East 12th Street Bridge over I-235 may offer a glimpse into the future of bridge design and maintenance in Iowa. The new span not only marks the first bridge constructed in Iowa using high-performance steel (HPS) girders, but also features a structural health monitoring (SHM) system that provides remote, continuous data on the bridge's condition.

Both innovations—the HPS girders and the SHM system—have the potential to increase life spans and reduce life-cycle costs for many of Iowa's 25,000 bridges. About 7,000 bridges in Iowa, roughly one in four, have been classified as functionally obsolete, structurally deficient, or both. Most of these require repair or replacement.

The advantage of high-performance steel

The advantage of using HPS lies in its unique alloy, which lends HPS greater weldability, weathering capabilities, and fracture toughness than conventional structural steel. These properties can reduce the frequency and cost of maintenance and extend the useful life of a bridge. Already, numerous bridges throughout the United States have been built using HPS girders, and many have been constructed economically.

Though HPS costs roughly twice as much per pound as conventional steel, HPS reinforcement reduces the amount of steel required and allows faster and more efficient construction and maintenance. The net savings are estimated to be between 10 and 15 percent.

Structural health monitoring

Traditional SHM has relied on manual inspections to determine repair or replacement schedules. However, the East 12th Street Bridge crosses heavily trafficked I-235. The bridge's girders are also largely inaccessible to inspection personnel.

To skirt these data gathering difficulties, Terry Wipf and his research team from ISU's Bridge Engineering Center (BEC) designed a remote, continuous SHM system. The new system was built using off-the-shelf technologies, making its design accessible to local agencies. Using remote bridge sensors, a live video feed of the bridge, and a wireless internet connection, inspection personnel can determine the bridge's structural health without setting foot near the structure. A website displaying the bridge performance data is available, www.bec.iastate.edu/structural_health/e12thst_dsm.cfm.

Benefits

According to the SHM system, the East 12th Street Bridge is performing well. The SHM system itself experienced a few setbacks early on, but it has provided a baseline image of the bridge. This image can then be used to gauge bridge performance over time.

For more information

The project report, *Remote Continuous Evaluation of a Bridge Constructed Using High-Performance Steel*, and a technology transfer summary are available at the BEC's website, www.bec.iastate.edu/research/detail.cfm?projectID=560. If you have specific questions, contact Terry Wipf, 515-294-6979, tfwipf@iastate.edu. ■

Graduate student Derek Hemphill prepares the bridge for continuous remote monitoring.

SAFETEA-LU highlights: Safety programs for Iowa's local transportation agencies

A sweeping five-year, $244.1 billion transportation funding bill—Safe, Accountable, Flexible, and Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU)—was signed into law in August 2005. Over the next five years, roughly $2.2 billion will go to projects and programs specifically for Iowa.

Much of the new legislation focuses on improving safety programs, with special attention to the hazards of low-volume rural roads. The four programs listed below reflect the most significant developments in safety funding for Iowa's local transportation agencies.

Highway Safety Improvement Program (HSIP)

One of the broadest changes under SAFETEA-LU is to replace the Surface Transportation Program's set-aside for safety with a new core federal-aid funding program, the HSIP. HSIP programming will focus on reducing fatal and major injury crashes, with special emphasis on lane-departure crashes. The new program nearly triples Iowa's overall safety budget, providing the state an annual average of $13 million per year plus another $1.2 million specifically set aside for high-risk rural roads (more on this in the following section).

On top of the set-aside for high-risk rural roads, local safety projects will be affected by the new program in a few ways. Perhaps most significantly, Iowa's Comprehensive Highway Safety Plan (CHSP), which includes local roads as one of its eight main target areas, will guide the new safety programs. To develop this data-driven plan, the Iowa DOT has conducted a statewide systems crash analysis to identify critical safety projects, including both state and local improvements. Local roads can also be considered for federal funding in Iowa's annual report to the U.S. secretary of transportation, which must describe at least five percent of Iowa's public road locations exhibiting the most severe safety needs.

Additionally, local agencies will continue to be included in the project planning and implementation process. While Iowa has had a good record of state-local collaboration in implementing projects, the HSIP now mandates interagency collaboration. Local agencies should expect to work more closely with the Iowa DOT while implementing the new federal safety programs.

High-risk rural roads set-aside

A specific set-aside for high-risk rural roads has been created to help local agencies compete for federal safety dollars. While any amount of the HSIP funds can be spent on rural roads, the $1.2 million annual set-aside specifically targets safety problems on rural roads with disproportionate crash, fatality, and incapacitating injury rates. According to Rod Halverson, design technician at the Iowa DOT, all of Iowa's 99 counties are likely to have local roads eligible for this funding.

The Iowa DOT plans to implement the set-aside in two phases. Phase 1 will put the fiscal year 2006–2007 funding into warning signs shown to have safety benefits, especially those that reduce run-off-road crashes. About $23,000 per county will be available to pay for signs, posts, and associated hardware. Counties must provide the labor.

Requests for Phase 1 funding will be accepted as soon as the program details are finalized.

Phase 2 will invest the remaining funding, plus any leftover Phase 1 funding, in rural highway construction projects that improve safety. Until the available funds are spent, funding will be awarded on a competitive basis. Applications will be scored according to the estimated cost/benefit ratio, crash density, and crash rate.

Requests for Phase 2 applications are expected to be sent out in November 2006.

Safe Routes to Schools program (SRTS)

The new SRTS program, which gives Iowa an average of $1.2 million per year, is designed to enable and encourage children to walk and bicycle to school. Eligible infrastructure projects include, among others, sidewalk improvements, traffic calming and speed reduction, street crossing improvements, and traffic diversions near schools. All projects must be within two miles of schools. States must use between 10 and 30 percent of their funding for non-infrastructure projects, such as public awareness campaigns, traffic education and enforcement near schools, and pedestrian and bicycle safety sessions.

Iowa distributes its SRTS funding via competitive grants. Local officials should identify community needs and partnerships, form SRTS teams, and define specific projects before applying online, www.dot.state.ia.us/saferoutes/. The deadline is October 1.

Work zone safety

Iowa's program of work zone safety training, provided through LTAP and the Iowa DOT, will remain relatively unchanged. However, local agencies may expect a couple new regulations to ensure safer work zones.

(1) A new regulation, in the rulemaking process at the moment, will require workers on federal-aid highway projects to wear high-visibility safety apparel. This could apply to anyone in the right-of-way—construction crews, surveyors, law enforcement, etc.

(2) Another set of regulations, written into SAFETEA-LU but not yet acted upon, will improve the existing temporary traffic control measures used on all federal-aid highway projects. Measures being examined include making certain temporary traffic control devices separate pay items when provided by the contractor, requiring concrete barriers between workers and motorized traffic in certain situations, and increasing the use of uniformed law enforcement officers in work zones.

Anyone familiar with the 2003 *Manual on Uniform Traffic Control Devices* (MUTCD) will recognize these regulations; SAFETEA-LU is making some of the manual's guidelines into policies. However, these policies will not be enacted until fall 2006, at the earliest. Check the Federal Register (http://wzsafety.tamu.edu/legal/laws_federal.stm; www.gpoaccess.gov/fr/) for updates to these work zone safety regulations.

For more information

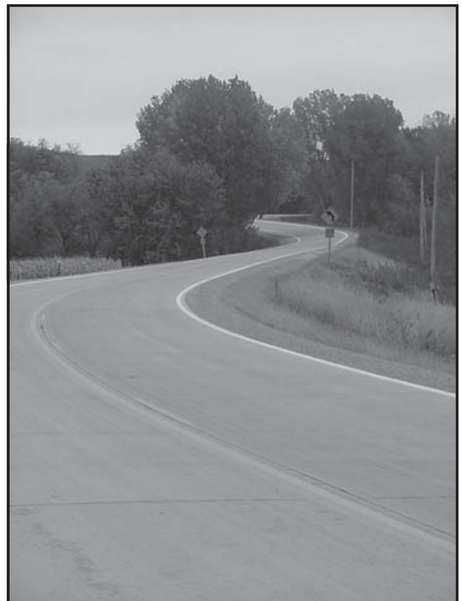
Regarding the Highway Safety Improvement Program, contact Tom Welch, Iowa DOT Office of Traffic and Safety, 515-239-1267, tom.welch@dot.iowa.gov.

Regarding high-risk rural roads, contact Rod Halverson, Iowa DOT Office of Local Systems, 515-239-1147, rodney.halverson@dot.iowa.gov.

Regarding the Safe Routes to Schools program, contact Kathy Ridnour, Iowa SRTS coordinator, 515-239-1713, kathy.ridnour@dot.iowa.gov.

Regarding work zone safety, contact Jerry Roche, FHWA Iowa Division, 515-233-7323, jerry.roche@fhwa.dot.gov. ■

Editor's note: *This is the first installment of a series describing the various impacts of SAFETEA-LU on Iowa's local transportation agencies. This first article describes developments in safety programs under the new legislation.*



A $1.2 million annual set-aside specifically targets safety problems on rural roads with disproportionate crash, fatality, and incapacitating injury rates. Photo courtesy of Charlie Purcell, Office of Local Systems, Iowa DOT.

Work zone safety workshops for 2007

Brochures will be mailed in December 2006. See CTRE's calendar of events online, www.ctre.iastate.edu/calendar.

Feb. 5	Ames, Scheman Building, ISU
Feb. 6	Ames, Scheman Building, ISU
Feb. 13	Calmar, Northeast Iowa Community College
Feb. 14	Iowa City, Quality Inn & Suites
Feb. 15	Iowa City, Quality Inn & Suites
Feb. 16	Ottumwa, Indian Hills Community College
March 7	Mason City, North Iowa Area Community College
March 8	Mason City, North Iowa Area Community College
March 9	Creston, Southwestern Community College
March 27	Council Bluffs, Iowa Western Community College
March 28	Sioux City, Western Iowa Technical Community College
March 29	Storm Lake, Buena Vista University
March 30	Ames, Scheman Building, ISU

Pavement edge drop-off

Is pavement edge drop-off (PEDO) a significant safety issue on Iowa's rural roadways?

Shauna Hallmark, associate professor of civil engineering at ISU, and Tom McDonald, safety circuit rider at CTRE, recently studied the extent of edge drop-offs on Iowa's rural, two-lane paved roads with unpaved shoulders. They determined the number of crashes and the severity of crashes in which pavement edge drop-off may have been a contributing factor (2002–2004).

Based on the results of this and other studies, the team recommended actions for local road agencies.

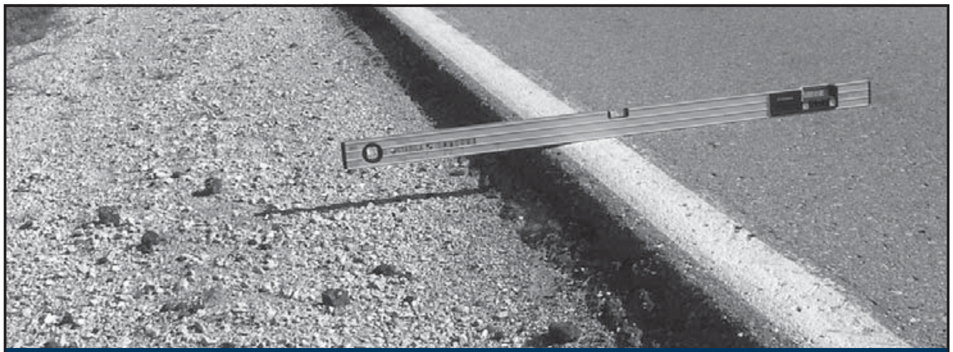


Figure 1. The ISU study focused on edge drop-off between a paved roadway and unpaved shoulder.

What is PEDO?

Pavement edge drop-off is the difference in elevation between two adjacent roadway surfaces. This study focused on the difference between paved travel lanes and unpaved shoulders, where at least some difference in elevation is common. See figure 1.

Drop-offs can result from a variety of situations:

- If an unpaved shoulder is not well maintained, the shoulder material can migrate away from the pavement due to erosion, tire wear, and other environmental factors.
- When an overlay is placed on an existing pavement, the shoulder may not be subsequently raised to the new pavement height.

What's the safety impact of PEDO?

When a vehicle's right front tire drops off the pavement edge, the driver usually attempts to return immediately to the pavement. As the driver attempts to return to the travel lane, the pavement edge can rub against the tire(s) ("scrubbing"), preventing the car from re-entering the roadway. To compensate, the driver oversteers. Oversteering may cause the vehicle to sideswipe a passing car, veer into the opposite lane of traffic, and/or roll over. See figure 2.

The level to which a driver may lose control depends on many factors:

- Height and shape of the drop-off. See figure 3 (Zimmer and Ivey, 1982).
- Cross-section of the shoulder.
- Vehicle's size and speed.
- Driver's steering and braking response.
- Angle that the vehicle departs and/or returns to the pavement.

Note that only the first two of these factors—drop-off height/shape and shoulder cross-section—can be controlled by roadway agencies.

Iowa's data

Pavement edge drop-off was sampled in 21 Iowa counties. More than 12 percent of the sampled drop-off was 2.0 inches or greater. Only one percent was 3.0 inches or greater, and less than one percent was 4.0 inches or greater.

A sampling of crash reports was analyzed. Less than three percent of the crashes was determined to have been "probably" or "possibly" related to edge drop-off. This is a relatively small fraction of total crashes.

However, edge drop-off-related crashes are usually run-off-road crashes, which in general are likely to be more severe than other crash types. Crashes which were likely to have been edge drop-off related were more likely to be fatal or major-injury crashes than other run-off-road crashes on similar roadways.

The study found that, in Iowa, drop-offs of 2.5 inches or more correlated to an increased risk of potential edge drop-off–related crashes.

The study also indicated that the Iowa DOT has an aggressive maintenance policy.

Recommendations for local agencies

- Train all staff, especially maintenance and construction staff who will operate agency vehicles, about the following:
  - The dangers of pavement edge drop-offs.
  - How to recover safely when a tire drops off the edge of the pavement (see the sidebar on the next page).
  - Leaving adequate space between vehicles on the road.
- Adopt a policy for pavement edge maintenance if one does not exist. Such a policy may include the following:
  - Routine, comprehensive sampling, or inventorying, of edge drop-off heights in your jurisdiction.
  - A minimum drop-off height to be repaired or remediated. (Current practice in several states suggests 2.0 inches as a conservative threshold. This was consistent with Hallmark's and McDonald's findings.)
  - A toolbox of pavement edge maintenance strategies.

Implementing a thorough maintenance policy is one of your best defenses against tort liability claims that might result from potential pavement edge drop-off–related crashes.

Addressing edge drop-off

Edge drop-off should be addressed in a timely manner.

There are several maintenance strategies:

- Upgrade unpaved shoulders by paving them a minimum of two feet, when practicable.

- Resurface shoulders (or otherwise restore the shoulders so that the original roadway slope is maintained) at the same time the driving lanes are resurfaced.
- Paint the pavement edgeline at 11 feet on a 12-foot lane. This strategy has been shown to prevent motorists from driving too near the pavement edge. (See "'Narrower' road lanes may improve traffic safety" in the Mar–Apr 2005 issue of *Technology News*, www.ctre.iastate.edu/tech_news/2005/mar-apr/narrower_lanes.htm.)
- Construct a beveled edge between the pavement and shoulder. See the sidebar below.

For more information

This study was sponsored by the AAA Foundation for Traffic Safety. The final report and a short summary are online, www.ctre.iastate.edu/Research/detail.cfm?projectID=2073651291.

In addition to Hallmark and McDonald, the research team consisted of ISU doctoral student, David Veneziano, and Jerry Graham and other staff from the Midwest Research Institute in Kansas City, MO. Contact Hallmark, 515-294-5249, shallmar@iastate.edu. ■

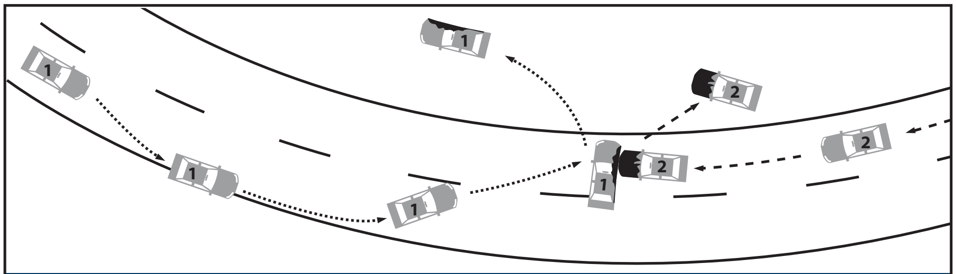


Figure 2. Crash diagram illustrates vehicle 1 dropping off the edge of the pavement, then oversteering into the opposite lane.

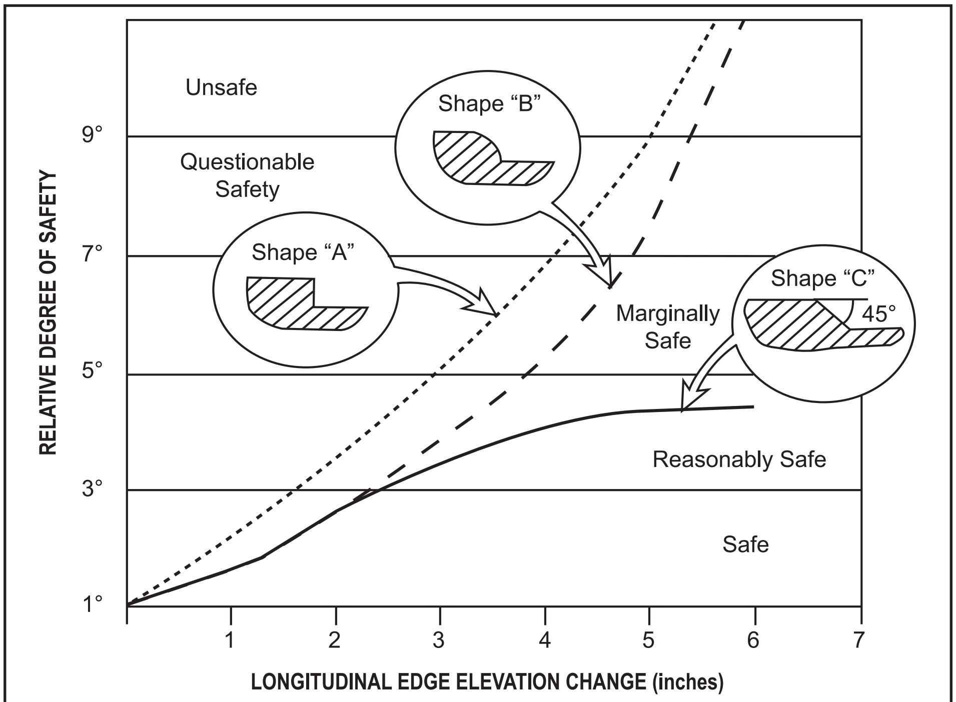


Figure 3. The shape of edge drop-off affects safety. A drop-off at a tapered angle is reasonably safe compared to 90-degree or rounded drop-offs.

Recovering safely if you drive off the edge

If your wheels drop off the pavement, stay calm and react gently:

1. Do not immediately steer back onto the pavement.
2. Slow down gradually to 30 mph or less.
   - Take your foot off the accelerator.
   - If braking is necessary, use a gentle braking action. (Different surfaces on pavement and shoulder will result in different skid resistances, which could cause you to lose control if you brake too forcefully).
   - Be careful not to be rear-ended.
3. Straddle the pavement edge while slowing.
4. When traffic is clear in both directions, turn the steering wheel one-quarter turn toward the pavement (that's a fairly sharp turn angle) and remount the pavement.
5. Carefully counter-steer to prevent veering into the opposite lane.
6. As soon as you've fully recovered, accelerate to normal traffic speed.

Note: If traffic is heavy, you may have to pull off onto the shoulder and stop.

Constructing a "safety edge"

Constructing a tapered transition—a safety edge—between the driving lane and the shoulder can significantly reduce the safety impact of edge drop-offs. Such a transition makes it easier to remount the pavement without oversteering. The safety edge is recommended by FHWA.

At a minimum, construct a 45-degree taper; a 30-degree transition is preferred. See figure 4 (FHWA).

Figure 4. 30-degree "safety edge.

Proprietary devices are available that can be mounted to the screed during asphalt construction or resurfacing to form the appropriate wedge.

See the FHWA's pamphlet "The Safety Edge," FHWA-SA-05-004, http://safety.fhwa.dog.gov/roadway_dept/docs/sa05004.htm.

Just for street and road workers

Asphalt pavement maintenance: Selecting the right treatment

Editor's note: *The two articles about asphalt pavement maintenance on pages 8 to 10 are the second part of a series based on information in Iowa's new* Local Roads Maintenance Workers' Manual. *The manual was developed by CTRE and sponsored by the Iowa Highway Research Board (TR-514).*

To borrow a copy of the manual, contact Jim Hogan, Iowa LTAP librarian, 515-294-9481, hoganj@iastate.edu. You can download a printable copy, www.ctre.iastate.edu/pubs/maint_worker.

The key to effective asphalt pavement maintenance is to identify pavement distresses, then determine the most effective treatment. See table 1.

Asphalt pavement distresses

Distresses on asphalt pavements may include rutting, cracking (several types), washboards, and potholes.

Rutting. Ruts (figure 1) are surface depressions located in the wheel path.

Causes vary. If the pavement has risen around the edges of the rut, the rut is most likely caused by a poor mix. The uplift is a result of traffic pushing the asphalt to the edges of the wheel paths.

If there are longitudinal cracks in the rut, the rut is most likely caused by structural failure of the subbase. The pavement is being pushed down onto the base or subbase.

Other ruts are generally the result of poor compaction during construction and subsequent vehicle loading compacting the asphalt.

Progressive rutting (rutting that continues to grow deeper and wider) is a result of poor subbase, very poor mix, or road design that is inadequate for actual loads. If possible, delay treatment until the ruts become dormant or no longer grow.

Cracking. Cracks develop over time due to flexing pavement and temperature changes that cause expansion and contraction. Cracks allow water to move through the pavement and infiltrate the pavement base and subbase. Infiltrated water decreases the load-carrying capacity of the base and subbase. If not repaired or prevented, this cracking effect will grow, leading to deformation of the pavement, potholes, and ultimately degradation of the pavement surface.

Cracking can take several forms.

Fatigue cracks (figure 2) are a series of interconnected cracks in early stages of development. They occur in areas subjected to repeated traffic loadings, like the wheel paths.

Block cracking (figure 3) is a pattern of cracks that divides the pavement into approximately rectangular pieces. Rectangular blocks range in size from approximately 1 to 100 square feet.

Alligator cracks (figure 4) are interconnected cracks that have the appearance of alligator scales. They are typically found in wheel paths and often accompany rutting.

Reflection cracks (figure 5) are cracks in an overlay that have "reflected" upward from cracks or joints in the pavement below.

Table 1. Distresses and maintenance activities for asphalt pavements

Distresses	Asphalt Maintenance Activities				
	Routine Maintenance				
	Crack Sealing	Surface Patching	Full-Depth Repair	Seal Coat Repair	HMA Overlay
Ruts			X		X
Cracks	X			X	X
Washboards			X		X
Potholes		X	X		

Figure 1. Rutting

Washboards. Washboards are a series of ruts in the road running transverse to the road edge.

Potholes. Potholes are bowl-shaped holes of various sizes in the pavement surface, with a minimum width of three inches.

Potholes generally form when water becomes trapped beneath the pavement surface. In the winter, the sub-surface water freezes and expands upward against the pavement. This action creates a void under the pavement, and vehicle loads are not transferred to the base and subbase. Vehicles add more stress until the pavement surface collapses into a hole. The hole grows as traffic breaks the edges of it.

Figure 2. Fatigue cracking. Photo courtesy of CCEE Department, ISU.

Figure 3. Block cracking. Photo courtesy of CCEE Department, ISU.

Maintenance activities

Maintenance options for asphalt pavements generally include routine maintenance (street sweeping and crack sealing), surface patching, full-depth repair, seal coats, and hot-mix overlays.

Crack sealing. Crack sealing prevents water from infiltrating through the pavement into the base and subbase. Typically the public works or secondary road department rents equipment for crack sealing every other year or as needed. Seal cracks in the spring or fall when temperatures are moderately cool and the pavement cracks are open. The work can usually be accomplished within a month's time.

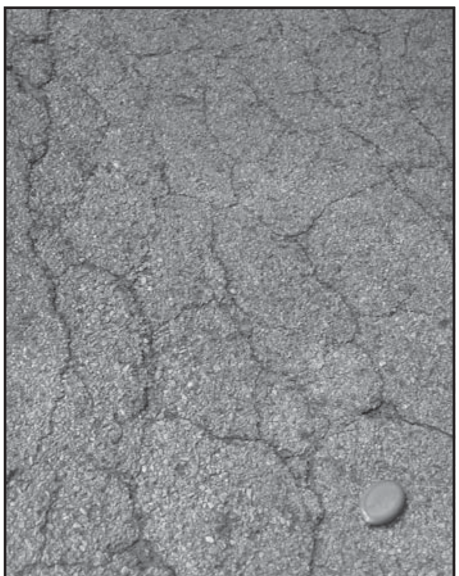


Figure 4. Alligator cracking. Photo courtesy of CCEE Department, ISU.

Figure 5. Reflection cracking. Photo courtesy of CCEE Department, ISU.

Surface patching. Surface patching is an interim repair using all-weather asphalt materials.

Full-depth repair. This is a permanent repair for distresses larger and/or deeper than surface degradation. It involves removing and replacing the distressed section of the slab, from top to bottom.

Surface patch or full-depth repair?

If deterioration is 25 percent or less of the total pavement thickness, apply a surface patch.

If deterioration is more than 25 percent of the total pavement thickness, apply a full-depth repair.

Seal coat. A seal coat is an application of an asphalt binder followed by an application of aggregate. A seal coat fills cracks and low spots, waterproofs the surface, and provides a wearing course for traffic. Seal coats are also known as chip seals, tar and rock (informal description), oil and rock, and surface seal.

Hot-mix asphalt overlay. A hot-mix asphalt overlay is a new layer of asphalt over an existing asphalt pavement or prepared stone base. Overlays can protect and add some strength to the existing pavement structure, reduce the rate of deterioration, and reduce deficiencies like ride quality. Overlays should not be applied to seriously distressed pavement systems.

Selecting treatment continued on page 10

Just for street and road workers

Selecting treatment continued from page 9

Selecting a maintenance activity

Selecting the most effective maintenance activity involves several factors:

1. Type and extent of distress
2. Roadway classification and traffic volumes
3. Cost of treatment
4. Availability of qualified staff and/or contractors
5. Availability of quality materials
6. Time of year

Reviewing the records of the road will also aid in selecting the most effective maintenance activity. Records should include the following:

1. Dates of routine maintenance activities
2. Pavement base and subbase design
3. Pavement section boundaries
4. Pavement age
5. Types, dates, and extent of previous maintenance treatments
6. Traffic volumes
7. Environmental impacts ■

SAFETY

In addition to wearing appropriate safety gear, workers doing asphalt repair should know emergency treatment for burns from hot asphalt.

Routine asphalt pavement maintenance

The goal of routine maintenance is to prevent or delay pavement distresses. Routine maintenance includes regular street sweeping and crack sealing.

Street sweeping

Sweeping removes dried, caked mud, abrasives, and other debris from the road surface. Clean road surfaces help keep drains clean, make travel safer for bicyclists, and ensure good surface drainage.

Crack sealing

The following instructions are general guidelines. Check with your supervisor, and follow your local policy.

Preparing for sealing. Follow these preparation guidelines:

1. Rout or saw-cut cracks to provide clean, uniform surfaces for sealant to adhere to and a reservoir for sealant.
2. Use an air compressor and an air wand to clean cracks of dirt, dust, and remnants from sawing or routing. Contamination in a pavement crack will cause poor sealant bonding.

Applying the sealant. After all cracks are blown clean, seal the cracks:

1. Apply sealant at a temperature of 350°F–410°F with the delivery hose and wand of the melter applicator. Take appropriate safety precautions when handling this hot material.
2. Pour an even bead of sealant into the crack no higher than ½ inch above the pavement surface. If it's higher, it could be damaged by snow plows or street cleaning equipment, and it may flow over the pavement surface.
3. To remove excess sealant, run a U-shaped squeegee or sealing shoe over the bead to flatten the sealant over the crack, move the sealant to the bottom of the crack, and remove excess sealant. The squeegee creates a U-shaped seal (figure 6), allowing for contraction and expansion of the pavement during pavement temperature changes.
4. Keep traffic off the newly crack sealed surface. This will minimize tracking of material and allow for maximum adhesion to the surface. On occasions where this is not feasible, a light coating of sand spread over the sealant will act as a blotter and allow opening the street to traffic sooner. ■

Figure 6. Crack sealing squeegee. Photo courtesy of CCEE Department, ISU.

Conference calendar

October 2006

24	Intersection Safety Workshop (rural agencies)	Mason City	Tom McDonald 515-294-6384 mcdonal@iastate.edu
24	Iowa Snow and Ice Conference	Burlington	Duane Smith 515-294-8103 desmith@iastate.edu
25	Iowa Snow and Ice Conference	Cedar Rapids	Duane Smith 515-294-8103 desmith@iastate.edu
26	Snow Plow Roadeo	Cedar Rapids	Duane Smith 515-294-8103 desmith@iastate.edu
31	Intersection Safety Workshop (rural agencies)	Carroll	Tom McDonald 515-294-6384 tmcdonal@iastate.edu

November 2006

7	SUDAS District 4 Meeting	Atlantic	Beth Richards 515-294-2869 brich@iastate.edu
9	SUDAS District 3 Meeting	Storm Lake	Beth Richards 515-294-2869 brich@iastate.edu
15	SUDAS District 1 Meeting	Ankeny	Beth Richards 515-294-2869 brich@iastate.edu
16	SUDAS District 2 Meeting	Charles City	Beth Richards 515-294-2869 brich@iastate.edu
28	SUDAS District 6 Meeting	Cedar Rapids	Beth Richards 515-294-2869 brich@iastate.edu
30	SUDAS District 5 Meeting	Fairfield	Beth Richards 515-294-2869 brich@iastate.edu

December 2006

4	Traffic and Safety Forum	West Des Moines	Mary Stahlhut 515-239-1169 mary.stahlhut@dot.iowa.gov
13–14	Asphalt Pavement Recycling Technologies in Iowa	Fayette	Duane Smith 515-294-8103 desmith@iastate.edu
18–19	Asphalt Pavement Recycling Technologies in Iowa	Ames	Duane Smith 515-294-8103 desmith@iastate.edu
20–21	Asphalt Pavement Recycling Technologies in Iowa	Creston	Duane Smith 515-294-8103 desmith@iastate.edu

Getting teens excited about careers in transportation

Career fairs, field trips, and job shadowing are a few ways private and public agencies try to interest young people in transportation careers.

CTRE is planning another way—an online magazine. Initially targeted to Iowa teens, the online magazine will cover a range of careers in transportation, especially those in building and maintaining Iowa's infrastructure. These jobs especially are invisible to most teens.

To fund this publication, CTRE is seeking grants and other donations from organizations that have a stake in Iowa's transportation workforce.

We'd like to thank the AGC of Iowa Foundation, our first gold-level sponsor, and the Iowa Laborers/Employers Cooperation and Education Trust Fund for their donations. CTRE has also won a grant from Iowa State University.

For more information about this project, see www.ctre.iastate.edu/go/ or contact Michele Regenold, 515-296-0835, mregenol@iastate.edu.

Get more information and/or register online for these events at www.ctre.iastate.edu/calendar/.

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