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Shop focus: Ditch drainage

Water that accumulates on or under roadways can lead to serious roadway damage, including rutting, potholes, heaving, and pavement failure.

In rural areas, roadside ditches play a key role in draining this potentially harmful water from the roadway. Properly functioning ditches provide a collection area for stormwater runoff and a controlled path for water to move away from the road.

To do their job, ditches must be well-maintained, properly graded, and free-flowing. In a flat-graded or clogged ditch, pools of slow-draining water may seep back into the roadway or erode an uncontrolled path outside the ditch area. In the colder months, snow drifts may collect in shallow or overgrown ditches and spill onto the road, making winter maintenance an uphill battle.

A properly functioning ditch will be properly graded and free of sediment, debris, heavy vegetation (e.g., tall grass, cattails, or trees), and standing water.

Here are some key tips for maintaining good drainage ditches.

Timing inspections

Ditch inspections should be scheduled regularly, but they can also be opportunistic:

- Generally, ditches should be inspected routinely according to a schedule set by your local road maintenance agency. Be sure to record the results in a database to help plan maintenance activities.
- In addition to routine inspections, major storm events provide a good opportunity to examine ditches because, LTAP Director Duane Smith notes, "That's when the water's running." After a heavy rainfall, be sure that stormwater is flowing smoothly and is channeled away from the roadway in the controlled ditch area. Pools of standing water or irregular drainage paths indicate an obstruction, inadequate grade, or erosion.

Planning maintenance

Like inspection timing, ditch maintenance normally follows a regular schedule, often semi-

Ditch drainage continued on page 2



An example of a ditch with good drainage.

Acronyms in Technology News

AASHTO	American Association of State Highway and Transportation Officials
APWA	American Public Works Association
FHWA	Federal Highway Administration
InTrans	Institute for Transportation (at ISU)
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
TRB	Transportation Research Board



U.S. Department of Transportation
Federal Highway Administration



Iowa Department
of Transportation

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Institute for Transportation
ISU Research Park
2711 S. Loop Drive, Suite 4700
Ames, Iowa 50010-8664
Telephone: 515-294-8103
Fax: 515-294-0467
www.intrans.iastate.edu/

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For brief, e-mail reminders about upcoming workshops and other LTAP news, subscribe to Iowa LTAP's free service: Tech E-News. Send an email to Marcia Brink, mbrink@iastate.edu. Type "Subscribe Tech E-News" in the subject line.

Ditch drainage continued from page 1

annually or at the same time as roadway or drainage system improvements. Here are some additional considerations when planning ditch maintenance:

- Consider large-scale ditch cleaning operations as a type of excavation. This means that Iowa law may require you to contact the Iowa One Call notification system (1-800-292-8989) at least 48 hours before starting work so that utilities can be located and marked. Consult your supervisor before any ditch cleaning activity to determine whether the operation is covered by the One Call regulation.
- If you plan to divert drainage flow in a way that may affect local property owners, be sure that the affected owners have signed a release and that the likelihood of any property damage is minimal. The *Iowa Drainage Law Manual* (Iowa Highway Research Board Project TR-497) can provide more information about state regulations regarding rural drainage systems. For a copy of the manual, contact LTAP librarian Jim Hogan, 515-294-2981, hoganj@iastate.edu or download an electronic version at www.intrans.iastate.edu/pubs/drainage_law/index.htm.
- Perform maintenance activities when there is minimal risk of damage to the ditch banks. After a severe storm, for example, wait until most of the runoff dissipates before cleaning the ditch. This will help prevent the banks' collapse and ensure that the soil is sufficiently stable to support the weight of any equipment.

Performing maintenance

Ditches are commonly cleaned using motor graders and excavators. When cleaning ditches, be careful to maintain a proper grade for the ditch. If the grade is too steep, runoff water may accelerate and seriously erode the ditch. If the grade is too flat, the water will not drain properly and may flood the roadway.

Observing safety

As with any roadway maintenance operation, make safety a priority by observing the following guidelines:

- Before beginning work, ensure that you and other workers understand excavation safety and are thoroughly familiar with the equipment. During the operation, make sure that a competent person trained in excavation safety is available at the work site.
- Have an up-to-date first-aid kit, emergency contact information, and handheld radios or cell phones available on-site.
- Ensure that all workers use appropriate personal safety equipment, including hard hats, safety glasses, heavy gloves, hard-toed boots, and highly visible apparel.
- If the road is open to traffic, use the proper temporary traffic control measures described in the *Iowa Traffic Control Devices and Pavement Markings: A Manual for Cities and Counties*; the *Manual on Uniform Traffic Control Devices*, part 6; and your local agency's policies and procedures.
- Do not enter a ditch or other excavation over four feet deep without proper shoring and/or sloping.
- Be alert for abandoned materials from methamphetamine manufacturing labs. These hazardous materials require special handling, and you should consult your supervisor and follow your agency's policy for disposal.
- After maintenance operations, immediately remove all temporary traffic control.

For more information

Consult the *Local Roads Maintenance Workers' Manual* (IHRB Project TR-514), available for download at http://www.intrans.iastate.edu/pubs/maint_worker/ or from LTAP librarian Jim Hogan, 515-294-2981, hoganj@iastate.edu. For other questions, contact LTAP Director Duane Smith, 515-294-8817, desmith@iastate.edu. ■

Two-lift concrete paving

Editor's note: This article was adapted from a January 2009 Roads and Bridges article written by Sabrina Shields-Cook and Peter C. Taylor.

With budget shortfalls and environmental concerns affecting nearly every transportation agency in the country, agencies and contractors are searching for pavement solutions that are economically efficient, environmentally friendly, and beneficial to society.

Two-lift concrete paving is one potential solution.

What is two-lift paving?

Two-lift concrete paving involves the placement of two wet-on-wet pavement layers instead of the homogenous single layer commonly placed in concrete paving.

The bottom layer is thick—typically 80–90 percent of the total pavement thickness. The bottom lift generally contains locally available or recycled aggregates that may not be suitable as a wearing surface. These aggregates can be obtained at a lower cost than aggregates used in a traditional paving project.

The top layer, on the other hand, is relatively thin and contains dense, wear-resistant aggregates that provide enhanced durability, reduced noise, and increased friction. While these aggregates are more costly and frequently have to be imported, the overall cost and environmental impact of the pavement system is reduced because only a small amount of high-quality aggregates is required.

Reducing environmental impacts

Two-lift paving provides an optimal opportunity for using recycled aggregates.

Since the bottom lift is not subjected to as harsh an environment as the top lift, a variety of recycled aggregates—including concrete and asphalt pavements—can be used in the bottom lift without sacrificing durability. So the existing pavement can be crushed and reused, which reduces the need for using new materials and extends the original public investment in the existing pavement.

Two-lift paving can also be optimized to reduce the environmental impact caused by cement production by reducing the amount of cement in concrete mixtures.

“One way to reduce the cement content of concrete is to use supplementary cementitious materials, such as fly ash,” says Peter Taylor, associate director of ISU’s National Concrete Pavement Technology Center. “This strategy is commonly used in concrete paving projects and can be used in higher quantities in two-lift paving.”

Quieter, safer pavements

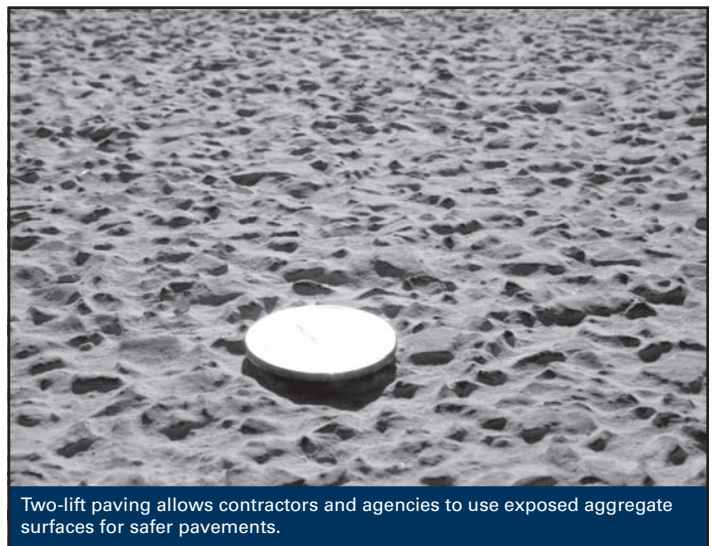
Two-lift paving also allows contractors and agencies to maximize the top lift for enhanced surface characteristics to provide quieter, safer pavements.

In the U.S., agencies and contractors are experimenting with the use of exposed aggregate surfaces as one way to maximize the top lift.

Creating an exposed aggregate surface requires using extra-hard, wear-resistant small aggregates. When small aggregates are used, more cement paste must be used, which increases both the cost of the concrete mix and the energy and CO₂ footprint of the pavement. However, the



Two-lift paving involves the placement of two wet-on-wet layers of concrete.



Two-lift paving allows contractors and agencies to use exposed aggregate surfaces for safer pavements.

thin top lift of a two-lift pavement needs only a relatively small amount of concrete, making exposed aggregate surfaces a possibility without increasing cost or the environmental impact.

Results from Europe, where exposed aggregate surfaces are commonly used, suggest that these surfaces reduce tire-pavement noise, leading to quieter pavements. The team also hopes that exposed aggregate surfaces will increase skid resistance, potentially making the pavement safer.

For more information

For more information about two-lift concrete paving, contact Peter Taylor, National Concrete Pavement Technology Center, 515-294-9333, ptaylor@iastate.edu. ■

Iowa LTAP Mission

To foster a safe, efficient, and environmentally sound transportation system by improving skills and knowledge of local transportation providers through training, technical assistance, and technology transfer, thus improving the quality of life for Iowans.

Staff

Shashi Nambisan
Director of InTrans
shashi@iastate.edu

Duane Smith
Director of Iowa LTAP
desmith@iastate.edu

Tom McDonald
Safety Circuit Rider
tmcdonal@iastate.edu

Bob Sperry
Local Roads Safety
Liaison
rsperry@iastate.edu

Georgia Parham
Secretary
gparham@iastate.edu

Marcia Brink
Communications
Manager and Editor
mbrink@iastate.edu

Michele Regenold
Issue Editor

Alison Weidemann
Designer

Peter Hunsinger
Sabrina Shields-Cook
Contributing Writers

Advisory Board

The professionals listed below help guide the policies and activities of Iowa LTAP. Contact any of the advisory board members to comment, make suggestions, or ask questions about any aspect of LTAP.

Donna Buchwald
Iowa DOT, Office of Local Systems
515-239-1051
donna.buchwald@dot.iowa.gov

Royce Fichtner
Marshall County Engineer
641-754-6343
rfichtner@co.marshall.ia.us

Gary Fox
Transportation Director, City of Des Moines
515-283-4973
glfox@dmgov.org

Neil Guess
Howard R. Green Company
515-278-2913
nguess@hrgreen.com

Bret Hodne
City of West Des Moines
515-222-3480
bret.hodne@wdm-ia.com

Joe Jurasic
Operations Engineer, FHWA–Iowa Division
515-233-7321
joe.jurasic@fhwa.dot.gov

Wally Mook
Director of Public Works, City of Bettendorf
319-344-4128
wmook@bettendorf.org

Charlie Purcell
Iowa DOT, Office of Local Systems
515-239-1532
charlie.purcell@dot.iowa.gov

Greg Parker
Johnson County Engineer
319-356-6046
gparker@co.johnson.ia.us

Christy VanBuskirk
Keokuk County Engineer
641-622-2610
cvanbuskirk@keokukcountyia.gov

Roger Schletzbaum
Marion County Engineer
641-828-2225
marcoeng@co.marion.ia.us

Dan Waid
Hamilton County Engineer
515-832-9520
dwaid@hamiltoncounty.org



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CTRE becomes an Institute

The Center for Transportation Research and Education, a Regents-approved center at Iowa State University (ISU) since 1996, was recently designated an ISU institute effective March 31, 2009. This designation leads to a name change to the Institute for Transportation (shorthand: InTrans).

The organization's change in status from a center to an institute reflects its growth in scope, scale, and influence, both at ISU and nationally, with the strategic emergence of new centers and programs over the past decade. InTrans currently houses and administers eight centers and several long-term funded programs, including the Iowa LTAP.

The change also represents more accurately the organization's administrative and operational structure, which is similar to other institutes at ISU.

Dr. Shashi Nambisan, director of InTrans and professor of civil, construction, and environmental engineering, emphasizes that InTrans will continue to build on its organizational mission. The mission is to develop and implement innovative and sustainable methods, materials, and

technologies for improving transportation efficiency, safety, and reliability while improving the learning environment of students, faculty, and staff in transportation-related fields.

"We will continue to partner with a broad range of stakeholders to effectively address current needs as well as long-term challenges related to transportation infrastructure and systems," says Dr. Nambisan.

For more information about InTrans, visit the new website at www.intrans.iastate.edu/ or contact Shashi Nambisan, 515-294-5209, shashi@iastate.edu or Marcia Brink, 515-294-9480, mbrink@iastate.edu. ■

The screenshot shows the homepage of the Institute for Transportation at Iowa State University. The header includes the university name and a search bar. The main content area is divided into several sections: 'Centers' listing various research centers, 'What's New' featuring a recent news item about Omar Smadi's appointment as CTRE director, 'Research' with project listings, 'Publications', 'Education/Training', 'Services', and 'Traffic Safety'. A 'Calendar of events' section lists upcoming workshops and symposiums. The footer contains a note about PDF files and a link to the new website.

The new InTrans website.

Free web-based training for a rainy day

When the weather keeps you or your staff inside, check out some of these free web-based training opportunities to refresh your skills or learn about some of the newest technologies.

Title	What	Link
FHWA-NHI-134096 Basics of Cement Hydration	This course covers how a concrete mixture changes from a plastic state to become a solid concrete slab in a relatively short period of time. Central to this transformation is a complex process called hydration, an irreversible series of chemical reactions between water and cement.	http://www.nhi.fhwa.dot.gov/training/course_detail.aspx?num=FHWA-NHI-134096&cat=&key=&num=&loc=&tit=&sta=%25&typ=3&lev=%25&ava=1&str=&end=&drl=
FHWA-NHI-134070 SpecRisk Quality Assurance Specification Development and Validation	This course will provide an introduction to statistical analysis and the development of statistically valid quality assurance specifications; introduce the general guidelines established and put forth by the Federal Government and Federal Highway Administration policy; and provide participants with instruction on SpecRisk, a program used to stimulate and successfully develop statistically valid specifications.	http://www.nhi.fhwa.dot.gov/training/course_detail.aspx?num=FHWA-NHI-134070&cat=&key=SpecRisk+Quality+Assurance+Spe&num=&loc=&sta=%25&tit=&typ=&lev=&ava=&str=&end=&drl=
FHWA-NHI-134087 TCCC Mix Design Principles	This course discusses theoretical, laboratory, and field testing to determine the portland cement concrete mix that will achieve the best possible durability, strength, constructability, economy, and uniformity.	http://www.nhi.fhwa.dot.gov/training/course_detail.aspx?num=FHWA-NHI-134087&cat=&key=Mix+Design+Principles+&num=&loc=&sta=%25&tit=&typ=&lev=&ava=&str=&end=&drl=
FHWA-NHI-134085 TCCC Incompatibility in Concrete Pavement Systems	This training covers the incompatibilities of materials used in portland cement concrete.	http://www.nhi.fhwa.dot.gov/training/course_detail.aspx?num=FHWA-NHI-134085&cat=&key=Incompatibility+in+Concrete+Pa&num=&loc=&sta=%25&tit=&typ=&lev=&ava=&str=&end=&drl=
FHWA-NHI-131110 TCCC Pavement Preservation Treatment Construction	The guide covers basic pavement preservation concepts, as well as information on specific treatments to extend the life of asphalt pavements. This course is designed to provide participants with an introduction to the Pavement Preservation Treatment Construction Guide, so that they can better use it to familiarize themselves with general information on pavement preservation concepts and techniques.	http://www.nhi.fhwa.dot.gov/training/course_detail.aspx?num=FHWA-NHI-131110&cat=&key=Pavement+Preservation+Treatmen&num=&loc=&sta=%25&tit=&typ=&lev=&ava=&str=&end=&drl=
FHWA-NHI-131117 TCCC Basic Materials for Highway and Structure Construction and Maintenance	Although there are a number of materials used in the construction and maintenance process for both highways and structures, this course is focused on the three basic materials: aggregate, portland cement concrete, and hot mix asphalt.	http://www.nhi.fhwa.dot.gov/training/course_detail.aspx?num=FHWA-NHI-131117&cat=&key=Basic+Materials+fo+Highway+an&num=&loc=&sta=%25&tit=&typ=&lev=&ava=&str=&end=&drl=
FHWA-NHI-134069 TCCC Ethics Awareness for the Transportation Industry	This training contains good practices from various agencies. The topics of discussion in this training include the following: conflict of interest, safety, fraud, falsification of documentation, reporting ethical concerns, gifts and favors, fairness, personal use of agency property, and consequences.	http://www.nhi.fhwa.dot.gov/training/course_detail.aspx?num=FHWA-NHI-134069&cat=&key=Ethics+Awareness+for+the+Trans&num=&loc=&sta=%25&tit=&typ=&lev=&ava=&str=&end=&drl=
FHWA-NHI-134071 TCCC Basic Construction and Maintenance Documentation—Improving the Daily Diary	This training is intended to assist with proper documentation on a construction or maintenance project.	http://www.nhi.fhwa.dot.gov/training/course_detail.aspx?num=FHWA-NHI-134071&cat=&key=Basic+Construction+and+Mainten&num=&loc=&sta=%25&tit=&typ=&lev=&ava=&str=&end=&drl=
FHWA-NHI-134072 TCCC Math Module	This training was prepared to review math basics, such as math functions, algebra, and geometry.	http://www.nhi.fhwa.dot.gov/training/course_detail.aspx?num=FHWA-NHI-134072&cat=&key=Math+Module+&num=&loc=&sta=%25&tit=&typ=&lev=&ava=&str=&end=&drl=
FHWA-NHI-134075 TCCC Hardened Concrete Properties—Durability	This workshop discusses factors that contribute to durable concrete and covers permeability, frost resistance, sulfate resistance, alkali silica attack, and a brief look at abrasion resistance.	http://www.nhi.fhwa.dot.gov/training/course_detail.aspx?num=FHWA-NHI-134075&cat=&key=Hardened+Concrete+Properties+&num=&loc=&sta=%25&tit=&typ=&lev=&ava=&str=&end=&drl=
FHWA-NHI-134078 TCCC GPS Technology	This course will provide the participant with a general understanding of GPS and the accuracy that can be obtained with this new technology.	http://www.nhi.fhwa.dot.gov/training/course_detail.aspx?num=FHWA-NHI-134078&cat=&key=GPS+Technology+&num=&loc=&sta=%25&tit=&typ=&lev=&ava=&str=&end=&drl=
Title: FWHA-NHI-134081 TCCC Plan Reading	This course contains modules covering both basic plan reading instructions, as well as providing a more in-depth level of instruction for anyone seeking more information and/or a review of plan reading.	http://www.nhi.fhwa.dot.gov/training/course_detail.aspx?num=FHWA-NHI-134081&cat=&key=Plan+Reading+&num=&loc=&sta=%25&tit=&typ=&lev=&ava=&str=&end=&drl=
FWHA-NHI-134084 TCCC Fundamentals of Materials Used for Concrete Pavements	This training covers both the non-reactive and reactive materials used in portland cement concrete. This would include the aggregates, curing compound, reinforcement, and the materials that are chemically reactive.	http://www.nhi.fhwa.dot.gov/training/course_detail.aspx?num=FHWA-NHI-134084&cat=&key=Fundamentals+of+Materials+Used&num=&loc=&sta=%25&tit=&typ=&lev=&ava=&str=&end=&drl=
FHWA-NHI-134095 TCCC Early Age Cracking	This training provides information about early-age cracking, including why it occurs and how it can be prevented or minimized.	http://www.nhi.fhwa.dot.gov/training/course_detail.aspx?num=FHWA-NHI-134095&cat=&key=&num=&loc=&tit=&sta=%25&typ=3&lev=%25&ava=1&str=&end=&drl=

Design Guidance for Improved Quality of Roadway Subgrades and Subbases (TR-525)

An effective and long-lasting pavement system rests on a high-quality foundation, including a stable subgrade layer and a properly drained subbase layer. Based on state-of-the-art and well-established research, Iowa's Statewide Urban Design and Specifications (SUDAS) has developed guidance to help roadway engineers design, construct, and test a pavement's subgrade and subbase layers in ways that will, ultimately, extend pavement life.

The guidance is in the form of a geotechnical design chapter, proposed as Chapter 6 (Geotechnical) of the SUDAS design manual. The chapter may be incorporated into the SUDAS design manual as early as fall 2009.

The performance of a pavement depends on the quality of its foundation layers. The lower foundation layer is the subgrade, the processed soil on which the pavement system rests. The subgrade supports the pavement and helps the strata above endure traffic stresses. The other foundation layer is the subbase, the aggregate material placed immediately below the pavement. The subbase drains water from the pavement (to prevent freeze-thaw damage) but also

interrupts rapidly flowing water (to prevent pumping of fines from the foundation).

The new guidance emphasizes three important new developments for constructing pavement foundations:

- Strive for a California bearing ratio (CBR) value of 10 or greater by selecting proper materials and stabilizing the soil.
- Construct uniform, permeable subbases with longitudinal subdrains to accommodate Iowa's relatively wet freeze-thaw climate.
- Use the dynamic cone penetrometer (DCP) to test the foundation layers' CBR values rapidly and accurately.

The guidance also covers topics such as Iowa soil characteristics, constructing and testing embankments, potential subgrade problems and geotechnical treatments, cost-effective drainage systems, and field evaluation tools.

For more Information

A draft of the design guidance is available on the SUDAS website: www.intrans.iastate.edu/reports/subgrade_subbase_tr525.pdf. For more information, contact Beth Richards, 515-294-2869, brich@iastate.edu. ■

Best Practices for Low-Cost Safety Improvements on Iowa's Local Roads

Local transportation agencies routinely develop, use, and modify many effective, low-cost maintenance practices to ensure safe travel on their low-volume local roads.

In December 2008 the Iowa LTAP released a practical, easy-to-reference handbook that catalogues many of the maintenance and safety improvement strategies used by local Iowa agencies. To supplement this compilation of Iowa's local practices, the publication also includes some strategies used by the State of Iowa or agencies in other states, as well as strategies that are currently being researched.

The 65 strategies are grouped into cat-

egories such as "Signing and Delineation," "Lighting, Pavements, and Shoulders," and "Bridges and Culverts." To help describe each practice, the publication offers photos and narratives and cites the local agencies that have used the technique. The compilation of techniques will continue to be updated and expanded periodically as other practices are identified or new practices are developed.

For more Information

Download the publication at www.intrans.iastate.edu/reports/low-cost-safety-practices.pdf. For more information, contact Bob Sperry, 515-294-7311, rsperry@iastate.edu. ■

Stanley L. Ring Memorial Library: New acquisitions

Note about delivery of materials: The library now sends orders through the U.S. Postal Service. This change is resulting in important savings for LTAP, but ordered materials do not arrive as quickly. If you have an urgent need for library materials, let us know when you place your order and we will arrange faster delivery.

Three ways to order LTAP library materials

- Use the online catalog, www.intrans.iastate.edu/ltap/library/search.cfm.
- Contact Jim Hogan, library coordinator, 515-294-9481, hoganj@iastate.edu, fax 515-294-0467.
- Mail or fax the order form on the back cover of *Technology News*.

Publications

P-1738 Environmentally Sensitive Maintenance for Dirt and Gravel Roads

This manual provides insight into using natural systems and innovative technologies to reduce erosion sediment and dust pollution while more effectively and efficiently maintaining dirt and gravel roads. It addresses the environment of forests, mountainous terrain, and rolling hills.

P-1739 Countermeasures That Work: A Highway Safety Countermeasure Guide for State Highway Safety Offices

This guide is a basic reference to assist in selecting effective science-based traffic safety countermeasures for major highway safety problem areas. It describes major relevant strategies and countermeasures; summarizes their use, effectiveness, costs, and implementation time; and provides references to the most important research summaries and individual studies.

P-1740 Vegetation Control for Safety

The purpose of this guide is to help local road agency maintenance workers identify locations where vegetation control is needed to improve traffic and pedestrian safety, to provide guidance for maintenance crews, and to make them aware of safe ways to mow, cut brush, and otherwise control roadside vegetation. ■

Conference calendar

May 2009

21	Work Zone Safety	Iowa City	Tom McDonald 515-294-6384 tmcdonal@iastate.edu
27	Motor Grader Operator Workshop	Ames	Duane Smith 515-294-8103 desmith@iastate.edu

June 2009

16	Motor Grader Operator Workshop	Ft. Dodge	Duane Smith 515-294-8103 desmith@iastate.edu
18	Motor Grader Operator Workshop	Boone	Duane Smith 515-294-8103 desmith@iastate.edu

July 2009

7	Motor Grader Operator Workshop	Cherokee	Duane Smith 515-294-8103 desmith@iastate.edu
14	Motor Grader Operator Workshop	New Hampton	Duane Smith 515-294-8103 desmith@iastate.edu
16	Motor Grader Operator Workshop	Pella	Duane Smith 515-294-8103 desmith@iastate.edu

August 2009

4	Motor Grader Operator Workshop	Mt. Pleasant	Duane Smith 515-294-8103 desmith@iastate.edu
6	Motor Grader Operator Workshop	Cedar Rapids	Duane Smith 515-294-8103 desmith@iastate.edu
20-21	Mid-Continent Transportation Research Symposium	Ames	Judy Thomas 515-294-1866 jathomas@iastate.edu

September 2009

16	Snow Rodeo	Des Moines	Duane Smith 515-294-8103 desmith@iastate.edu
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October 2009

120-22	Iowa Streets and Roads Conference	Ames	Duane Smith 515-294-8103 desmith@iastate.edu
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Motor Grader Operator Workshops

The Motor Grader Operator (MoGO) Workshop is a one-day training program with an optional second day that uses experienced operators to teach others efficient and safe operating practices.

- Day one is a classroom session with lunch and refreshment breaks. It involves participants from several different cities or counties to promote discussion and to exchange ideas. There is no written work or test required.
- Day two is an optional field day. Instructors travel to local sites to observe and advise participants who operate their own equipment on location. Participants may attend the classroom session without attending the field day.

Who should attend?

Motor grader operators and supervisors who manage motor grader operators.

New operators find the training helpful, and experienced operators feel it is a good refresher course. Supervisors who attend will stay abreast of new developments and operating techniques.

Course participants should be familiar with basic equipment operations prior to attending.

Dates and locations

For current dates and locations, see the calendar or contact Georgia Parham at InTrans, 515-294-2267, gparham@iastate.edu.

Registration and fees

- One-day program registration fee is \$80 per person.
- Two-day program registration fee is \$80 per person.

The fee includes lunch, breaks, and course materials.

Questions?

If you have questions about content of the class, contact Tom McDonald, Safety Circuit Rider, 515-294-6384, tmcdonal@iastate.edu. Or if you have questions about registration, contact Georgia Parham, 515-294-2267, gparham@iastate.edu. ■

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