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### Iowa Local Technical Assistance Program

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IOWA STATE UNIVERSITY  
Institute for Transportation

## Complying with new retroreflectivity standards for roadway signs

by Tom McDonald, safety circuit rider

In December 2007, the FHWA published a rule in the Federal Register requiring all agencies with responsibilities for streets and roads to comply with minimum retroreflectivity standards for most signs installed on facilities open to public travel.

The new rule, which became effective on January 22, 2008, was adopted as Revision #2 to the 2003 Manual on Uniform Traffic Control Devices (MUTCD) and is now contained in the current (2009) edition, Section 2A.08, Maintaining Minimum Retroreflectivity. Table 2A-3 lists minimum retroreflectivity requirements for different colors of signs, varying by sheeting type, sign size, and mounting location.

The following brief discussion highlights important MUTCD requirements regarding sign retroreflectivity.

### Compliance dates

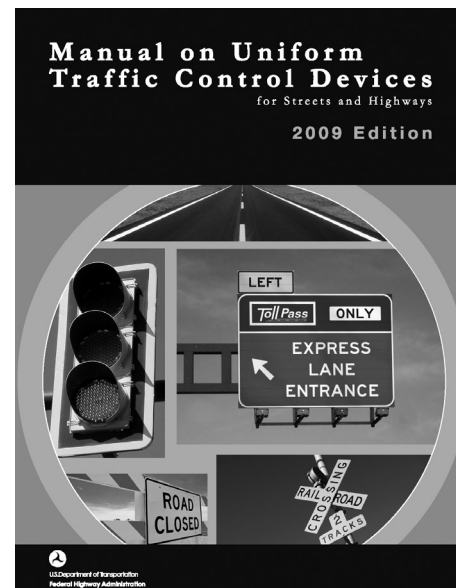
Agencies should pay attention to three key compliance dates:

By January 22, 2012, all agencies must adopt and implement an assessment or management method that is designed to ensure maintenance of sign retroreflectivity levels at or above the minimum levels.

By January 22, 2015, all regulatory, warning, and post-mounted guide signs (excluding street name signs) not meeting the minimum retroreflectivity levels as identified by the selected assessment or management method must be replaced.

By January 22, 2018, all street name and overhead mounted guide signs not meeting the minimum retroreflectivity requirements must be replaced.

Note: For information about potential impacts of a proposed amendment to eliminate or



revise many of the compliance dates in the MUTCD (2009 edition), including those related to retroreflectivity standards, see the article beginning on page 4.

### Options

Agencies can employ one or more assessment or management methods to ensure compliance with minimum standards. Assessment options include the following:

- Visual nighttime inspection (three types)
  - ✓ Calibration signs
  - ✓ Comparison panels
  - ✓ Consistent parameters
- Measured sign retroreflectivity using a retroreflectometer

Management options include the following:

- Expected sign life
- Blanket replacement
- Control signs

*continued on page 3*

## Acronyms in Technology News

AASHTO	American Association of State Highway and Transportation Officials
APWA	American Public Works Association
FHWA	Federal Highway Administration
IHRB	Iowa Highway Research Board
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

LTAP is a national program of the FHWA. Iowa LTAP, which produces this newsletter, is financed by the FHWA and the Iowa DOT and administered by the Institute for Transportation.

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# Message from the director: Change is the one constant



by Keith Knapp, LTAP director

Fall really fell this past week. The temperature during our Snow Plow Operator Training and Snow Rodeo went from near 90 degrees to a high just above 60 degrees. Soon the snow will be flying once again. This year we were honored to have the new Iowa DOT director try his hand at our plow truck rodeo course. I think a good time and some skill training was had by all during the week. At the end of the month we'll host the Streets and Roads Workshop and conference and a workshop.

Fall is always a busy time for Iowa LTAP and this year we are offering several new opportunities.

We've collaborated with DMACC – Boone to advertise a Route Survey Fundamentals training course. One class is already full and another is available the last week of



(l to r) Paul Trombino, director, Iowa DOT; Lubin Quinones, administrator, FHWA, Iowa division; Keith Knapp, director, Iowa LTAP, at 2011 rodeo

October. Road Scholars credit will be provided for attendance at this course.

We are also testing the feasibility of organizing and offering National Highway Institute (NHI) bridge inspection courses. Minimum and maximum attendance requirements are placed on these courses by NHI, so we'll need to determine demand. Keep an eye out for an electronic "bridge inspection" course demand survey.

We are also offering two events this fall that are available at no cost to attendees. First, our annual Iowa Local Agency Safety workshops will again be offered in at least five locations. Second, the Iowa DOT has developed new standards on sidewalk and curb ramp design, and we are working with the Iowa DOT to offer a ½ day training at six locations or more. One site is actually already at capacity, and a waiting list has begun.

We are also planning two or three more locations for the 2009 MUTCD training we offered this spring.

Finally, this fall also seems to be the season for public comments on proposed federal rules. In this newsletter (beginning on page 4) you will see a short article on a proposal related to MUTCD compliance dates. Now is your chance to comment on this proposal (the deadline is October 31, 2011). A link to comment can be found on the homepage of <http://mutcd.fhwa.dot.gov/>.

The comment stage to clarify the definition of a standard statement in the MUTCD and the use of engineering judgment and studies ends October 3, 2011. Lastly, comments have also been invited with respect to proposed accessibility guidelines for pedestrian facilities in the public right-of-way. The deadline for comments on this proposed rulemaking is November 23, 2011. The guidelines can be viewed and comments provided at [www.regulations.gov](http://www.regulations.gov) (search for the following ID: ATBCB-2011-0004-0008).

Be safe.

  
Keith

## Retroreflectivity compliance

*continued from page 1*

A combination of any of these options is allowed, or another method shown by an engineering study to be adequate.

### Option considerations

All of the allowable methods would seem to have advantages and disadvantages, so agencies will need to assess carefully which option would be the most feasible to meet their needs and match their available resources. However, as stated earlier, a method must be selected and implemented by January 22, 2012, to comply with the MUTCD requirements.

In Iowa, most agencies have indicated a preference for the assessment option of visual nighttime inspection, using calibration signs. Because Section 2A.22 of the MUTCD recommends that periodic inspections of signs be conducted and many agencies already do this, a visual inspection method would require minimum changes from current practice.

A few agencies have indicated they intend to employ a consistent parameter approach; however, this option requires an inspector who is at least 60 years old, a larger vehicle, and specific headlamps.

Many agencies are considering measuring sign retroreflectivity values with a retroreflectometer. This option offers the advantage of obtaining an actual numerical value to compare with established minimum requirements, and does not require extensive reliance on the judgment of an inspector or manager. It entails, however, the acquisition and maintenance of expensive equipment (up to \$10,000 for a retroreflectometer, plus the cost of an extension pole if desired) and considerable time investment in collecting measurement data.

For management options, the use of control signs to judge the condition of similar devices in service might prove advantageous, as would expected sign life (using the manufacturer's recommendations as a guide). For both of these alternatives, however, the orientation of the signs must be considered because exposure to direct sunlight over an extended time will hasten sheeting deterioration.

Blanket replacement could be an effective choice if signs are all of similar age and condition. An example might be street name signs that were installed at approximately the same time and may need to be replaced at the same time to comply with additional requirements, such as minimum lettering size.

### Related issues

Selecting the most appropriate assessment or management method is only one of the decisions an agency must make regarding nighttime visibility of signs. Another involves the quality of sign sheeting to utilize.

Historically, some agencies have specified engineering grade sheeting, which is the least costly but also exhibits the shortest service life. The higher grade prismatics provide a much longer length of service, but the initial cost is also much higher. A feasible compromise might be high-intensity sheeting, which many agencies rely on today.

An agency should perform a benefit-cost analysis for several sheeting types to determine which type would provide the most economical solution to employ. Decisions will also be required regarding the following questions:

- How often should inspections or retroreflectivity measurements be made—biannually, once a year, biennially, other?
- Who will be responsible for conducting inspections—a single individual, small group, or a large number of staff on an alternating basis?

- What level of training will be provided for the inspectors?
- How will inspection or measurement results be documented, and who will be responsible for that task?
- If not already in use, will a formal inventory of agency signs be established? Will it be composed of paper or electronic files? If electronic, what software will be acquired?

After all these questions have been addressed, an agency may want to develop and adopt a policy to document the sign retroreflectivity management program. Such documentation could prove valuable in guiding future activities, training employees, and providing a defense in potential litigation.

### Enhancing nighttime conspicuity

The minimum retroreflectivity standards for signs were adopted to improve nighttime conspicuity of signs. Although good night visibility is especially critical for the safety of older drivers, it benefits all drivers; the rates for fatal and serious injury crashes at night are consistently much higher than during the day. The commitment of transportation agencies will be essential for this program to achieve the desired level of success.

### For more information

For additional information on this topic or assistance in developing an agency policy, or to schedule a multi-county workshop on this topic, contact Tom McDonald, safety circuit rider, 515-294-6384, [tmcdonal@iastate.edu](mailto:tmcdonal@iastate.edu), or Bob Sperry, safety liaison, 515-294-7311, [rsperry@iastate.edu](mailto:rsperry@iastate.edu). ■



Retroreflective signs on US 52 in Iowa help drivers anticipate an upcoming curve at night

## 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.

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# Don't be fooled by the headlines:

## Proposed changes to MUTCD compliance dates are not a done deal

by Bob Sperry, local agency safety liaison

Agencies should not be misled by recent news releases suggesting that many MUTCD compliance deadlines are being eliminated. Potential revisions, extensions, or elimination of many of the 58 compliance deadlines in MUTCD 2009 (listed in Table I-2 in the Introduction) are still in the proposal stage.

Even if proposed changes are adopted, agencies will still be required to comply with MUTCD 2009 standards; only the deadlines would be eliminated or changed.

### The proposed amendment

On August 31, 2011, the FHWA published a Notice of Proposed Amendment. The 60-day comment period ends October 31. (Note: Comment period dates for several proposed changes to the MUTCD are included in LTAP Director Keith Knapp's column on page 2.)

Following the comment period for this proposed amendment, action may be taken to adopt all or part of the amendment. It is also possible that none of the proposed changes will be adopted, in which case agencies will need to meet the existing compliance deadlines.

If adopted, the proposed amendment would accomplish the following:

- Eliminate compliance deadlines (but not the requirements) for 46 items in the MUTCD.
- Extend and/or revise compliance deadlines (but not the requirements) for four items (including the requirement to implement an assessment/management method or program for complying with minimum retroreflectivity standards).
- Not change compliance deadlines for eight items.

For a detailed list of specific proposed changes to compliance dates, see [http://mutcd.fhwa.dot.gov/knowledge/09mutcdproposedrev/compliance\\_dates/index.htm](http://mutcd.fhwa.dot.gov/knowledge/09mutcdproposedrev/compliance_dates/index.htm).

### What is the impact on agencies?

Compliance dates do not dictate if MUTCD standards must be followed; they affect only how soon all deficient in-service traffic control devices (TCDs) must be replaced with devices that meet MUTCD standards.

Therefore, whether or not the proposed amendment is adopted, agencies must continue to comply with the latest MUTCD standards when installing or replacing TCDs.

Traffic control devices installed on new federal-aid highway or bikeway construction projects must comply with the latest standards before the road is opened (or re-opened) (Standard 21 in the MUTCD Introduction).

Any replacement TCDs must comply with the latest MUTCD standards. That is, "... non-compliant devices on existing highways and bikeways shall be brought into compliance with the current edition of the National MUTCD as part of the systematic upgrading of substandard traffic control devices ..." (Standard 22 in the MUTCD Introduction).

If some or all of the proposed changes are adopted, agencies will just have more flexibility in replacing substandard (non-compliant) TCDs as their budgets and other resources allow.

### About retroreflectivity

MUTCD Section 2A-08 standards and guidance regarding minimum retroreflectivity have not changed and will not change, even if the proposed amendment is adopted. All signs addressed in 2009 MUTCD Table 2A-3 must meet the minimum established retroreflectivity levels (see cover story).

That is, all new or replacement signs must comply when installed, and all deficient in-service signs must be upgraded to meet minimum levels "as part of the systematic upgrading of substandard traffic control devices."

continued on page 6

# Intelligent technology for stop-controlled intersections

More fatal crashes occur at stop-controlled intersections than at intersections with signals. Two-thirds of these crashes involve right-angle collisions. A new technology—the Intersection Conflict Warning System (ICWS)—deployed at multiple intersections across the country (including two in Iowa) is showing greater potential for decreasing crashes than traditional sign and marking enhancements alone.

## System operation

An ICWS can be configured to warn mainline vehicles about the presence of traffic on the cross road. In general, when detectors identify approaching or stopped vehicles on an intersection cross road, flashing beacons are activated that signal to traffic on the through approach, or mainline, that a vehicle may enter the intersection. Similarly, a system can be configured to warn the side-road traffic, or both the mainline and the side-road traffic.

Such warning systems have been deployed at stop-controlled intersections with either a history of crash experience or limited sight distance.

## States' experiences

Several states, including Iowa, Missouri, Minnesota, North Carolina, Pennsylvania, and Virginia, have deployed these systems or variations of them. Missouri and North Carolina have the most experience with ICWS. Although no rigorous crash reduction evaluations have been completed in either state, simple before-and-after crash comparisons in Missouri indicate that, overall, crashes are reduced by an average of 51 percent and severe angle crashes are reduced by 77 percent. (North Carolina is currently conducting a crash analysis, which should be published in spring 2012.)

Both Missouri and North Carolina are satisfied with the operation, safety performance, and reliability of the systems. System maintenance has been minimal. Unsolicited feedback from drivers and local governments in both states has been overwhelmingly positive.

Iowa is experimenting with applications of the technology, one of which is pictured at right. Willy Sorenson and

Dave Matulac from the Iowa DOT Office of Traffic and Safety recently attended a workshop in Minnesota for organizations that have deployed ICWS. Sponsored by the Enterprise pooled-fund public-private partnership that promotes the accelerated deployment and evaluation of intelligent transportation systems (ITSs), the workshop was part of a project to promote the consistent evaluation of intersection warning systems and recommend preliminary standards for MUTCD consideration.

## Implementation considerations

**Candidate locations.** An ICWS may be appropriate in the following situations:

- Rural stop-controlled intersections with a history of crash experience and/or limited sight distance that either cannot be readily mitigated or is too costly to correct.
- Areas where the through route speed limit is 45 mph or greater.
- Isolated stop-controlled intersections on multi-lane divided high-speed at-grade arterials that have the potential for or a history of severe angle crashes, and where j-turn (restricted-crossing U-turn) treatments are not appropriate solutions.

Intersections are *not* suitable candidates for this system if they are at or near one or more of the warrants used to consider

traffic signals, or if they are appropriate for a roundabout application.

**Cost.** Implementation cost for the systems evaluated was relatively low, ranging from \$15,000 to \$50,000 per intersection.

## Learn more

The ICWS is one of several newer technologies and techniques that the FHWA has identified as showing promise for improving intersection safety but for which comprehensive evaluations are not yet available.

Design, placement, and maintenance details, plus additional information about experience to date with this technology, are in the report, *Stop-Controlled Intersection Safety: Through Route Activated Warning System*, FHWA-SA-11-15, available at <http://safety.fhwa.dot.gov/intersection/resources/>. The information in this article was derived from the FHWA report and from a technical summary available at the same location.

For information about Iowa's experience to date, contact Willy Sorenson at the Iowa DOT, 515-239-1212, [willy.sorenson@dot.iowa.gov](mailto:willy.sorenson@dot.iowa.gov).

For information about ENTERPRISE-sponsored activities related to automated intersection warning systems, see [http://enterprise.prog.org/Projects/2010\\_Present/developingconsistency.html](http://enterprise.prog.org/Projects/2010_Present/developingconsistency.html). ■



Installation of ICWS in Dyersville, IA (photo courtesy of Willy Sorenson, Iowa DOT)

# Stanley L. Ring Memorial Library: Current materials

## Publications

### P-1766 New MUTCD Sign Retroreflectivity Requirements

This *free*, four-page brochure describes basic new MUTCD retroreflectivity requirements. (US DOT-FHWA)

### P-1767 Safety Evaluation of the Safety Edge Treatment: Summary Report

This eight-page report summarizes a multi-year evaluation of the FHWA's safety edge treatment in three states. (US DOT-FHWA) (loan)

### P-1768 (also CR-108) Road Safety Information Analysis: A Manual for Local Rural Road Owners

This document (and CD) describes data collection and analysis techniques as well as other processes to help improve the safety of local rural roads. (US DOT-FHWA) (loan)

### P-1769 (also CR-108) Roadway Departure Safety: A Manual for Local Rural Road Owners

This document (and CD) provides information on effectively identifying roadway departure safety issues, choosing appropriate countermeasures, and evaluating the benefits of implemented treatments. (US DOT-FHWA) (loan)

### P-1770 (also CR-108) Intersection Safety: A Manual for Local Rural Road Owners

This document (and CD) provides information on effectively identifying intersection safety issues, choosing the countermeasures that address them, and evaluating the benefits of those treatments. (US DOT-FHWA) (loan)

### P-1771 Guidelines for Temporary Traffic Control

This *free* pocket-sized handbook describes the basic principles of temporary traffic control, standard devices, and typical applications. (US DOT-FHWA)

## CDs and DVDs

### DVD-281 Rural Road Crashes: They're Preventable

This 10-minute video contains valuable information for drivers of all ages. It can be useful in driver education training, company or community presentations, or for anyone wanting to improve their driving skills on rural roads. (Iowa DOT) (loan)

**CR-108 Manuals for Local Road Owners: Intersection Safety, Roadway Departure Safety, and Road Safety Information Analysis (also P-1768, P-1769, and P-1770; see those descriptions, above)** (loan)

## Three ways to order LTAP library materials

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

*Note about delivery of materials: The library sends orders through the U.S. Postal Service. If you have an urgent need for library materials, let us know when you place your order and we will arrange faster delivery.*

### DVD-279 Median Barriers: A Solution to Cross-Median Crashes; Rumble Strips: A Sound Investment

This DVD introduces two topics: (1) the various options available to help mitigate cross-median collisions and (2) rumble strips as cost-effective treatments with proven results in saving lives. (US DOT-FHWA) (loan) ■

## MUTCD compliance dates *continued from page 4*

The proposed amendment would eliminate January 2015 and January 2018 compliance deadlines for replacing deficient in-service signs that do not meet established minimum retroreflectivity levels. If the amendment is adopted, such deficient signs will still need to be replaced, but agencies will be able to exercise some flexibility in making those upgrades.

Currently, the compliance deadline for agencies to implement an assessment/management method or program for maintaining sign retroreflectivity at or above the minimum level is January 22, 2012. The proposed amendment would extend the compliance deadline two years for the management of regulatory and warning signs. It would also eliminate the compliance deadline for upgrading guide and other signs to meet MUTCD 2009 requirements, allowing

agencies to replace those types of signs as resources and priorities permit.

## Summary

The bottom line is fairly straightforward:

- The proposed amendment to eliminate or revise most MUTCD compliance deadlines has not been adopted yet.
- Agencies must still meet minimum 2009 MUTCD requirements, even if no compliance deadlines exist.

## For more information

Contact Tom McDonald, safety circuit rider, 515-294-6384, [tmcdonal@iastate.edu](mailto:tmcdonal@iastate.edu), or Bob Sperry, local roads safety liaison, 515-294-7311, [rsperry@iastate.edu](mailto:rsperry@iastate.edu). ■

# Conference calendar: Training season heats up!

	Event	Location	Contact
<b>October 2011</b>			
3	Accessible Sidewalks and Curb Ramps: Design to Installation	Ames, IA	Kris Angaran 515-294-8103, <a href="mailto:krisa@iastate.edu">krisa@iastate.edu</a>
5	Iowa Local Agency Safety Workshop: A Multidisciplinary Approach to Safety	Denison, IA	Tom McDonald 515-294-6384, <a href="mailto:tmcdonal@iastate.edu">tmcdonal@iastate.edu</a>
6	Iowa Local Agency Safety Workshop: A Multidisciplinary Approach to Safety	Cherokee, IA	Tom McDonald 515-294-6384, <a href="mailto:tmcdonal@iastate.edu">tmcdonal@iastate.edu</a>
13	Traffic and Safety Forum	Des Moines, IA	Judy Thomas 515-294-1866, <a href="mailto:jathomas@iastate.edu">jathomas@iastate.edu</a>
17–18	Project Management Strategies for Complex Projects	Orlando, FL	Judy Thomas 515-294-1866, <a href="mailto:jathomas@iastate.edu">jathomas@iastate.edu</a>
17	Accessible Sidewalks and Curb Ramps Design to Installation	Storm Lake, IA	Kris Angaran 515-294-8103, <a href="mailto:krisa@iastate.edu">krisa@iastate.edu</a>
18	Iowa Local Agency Safety Workshop: A Multidisciplinary Approach to Safety	Mason City, IA	Tom McDonald 515-294-6384, <a href="mailto:tmcdonal@iastate.edu">tmcdonal@iastate.edu</a>
19	Iowa Local Agency Safety Workshop: A Multidisciplinary Approach to Safety	Solon, IA	Tom McDonald 515-294-6384, <a href="mailto:tmcdonal@iastate.edu">tmcdonal@iastate.edu</a>
21	Accessible Sidewalks and Curb Ramps Design to Installation	Ottumwa, IA	Kris Angaran 515-294-8103, <a href="mailto:krisa@iastate.edu">krisa@iastate.edu</a>
25	Iowa Local Agency Safety Workshop: A Multidisciplinary Approach to Safety	Ames, IA	Tom McDonald 515-294-6384, <a href="mailto:tmcdonal@iastate.edu">tmcdonal@iastate.edu</a>
27	Accessible Sidewalks and Curb Ramps Design to Installation	Ames, IA	Kris Angaran 515-294-8103, <a href="mailto:krisa@iastate.edu">krisa@iastate.edu</a>
<b>November 2011</b>			
1	Changes You Need to Know: MUTCD 2009	Mason City, IA	Kris Angaran 515-294-8103, <a href="mailto:krisa@iastate.edu">krisa@iastate.edu</a>
3–4	Project Management Strategies for Complex Projects	Troy, NY	Judy Thomas 515-294-1866, <a href="mailto:jathomas@iastate.edu">jathomas@iastate.edu</a>
4	Accessible Sidewalks and Curb Ramps Design to Installation	Harlan, IA	Kris Angaran 515-294-8103, <a href="mailto:krisa@iastate.edu">krisa@iastate.edu</a>
8	Accessible Sidewalks and Curb Ramps Design to Installation	Coralville, IA	Kris Angaran 515-294-8103, <a href="mailto:krisa@iastate.edu">krisa@iastate.edu</a>
22	Changes You Need to Know: MUTCD 2009	Spencer, IA	Kris Angaran 515-294-8103, <a href="mailto:krisa@iastate.edu">krisa@iastate.edu</a>
29	Changes You Need to Know: MUTCD 2009	Red Oak, IA	Kris Angaran 515-294-8103, <a href="mailto:krisa@iastate.edu">krisa@iastate.edu</a>
<b>December 2011</b>			
6–8	Iowa County Engineers Association Annual Meeting	Ames, IA	Keith Knapp 515-294-8817, <a href="mailto:kknapp@iastate.edu">kknapp@iastate.edu</a>

**Note:** ISU's National Concrete Pavement Technology Center is conducting several district "Lunch and Learn" presentations this fall: **Joint Performance in Concrete Pavements**; see the schedule below. For more information, contact Anne Leopold, 515-964-2020, [aleopold@snyder-associates.com](mailto:aleopold@snyder-associates.com).

October 14, Council Bluffs, IA  
October 21, Ottumwa, IA

October 28, Iowa City, IA  
November 10, Dubuque, IA

## Online Registration

Information and registration details about events sponsored by LTAP, InTrans, or other ISU organizations are available via the online calendar, [www.intrans.iastate.edu/calendar/index.cfm](http://www.intrans.iastate.edu/calendar/index.cfm).

## Online Leadership Institute update

All 14 courses in the Public Employees Leadership Institute (formerly called the Iowa Public Employees Leadership Academy) are now online. In addition, the institute is now accredited by the American Public Works Association.

See detailed course descriptions, information about the instructors, and registration instructions on the institute's new website, [www.intrans.iastate.edu/ltap/leadershipinstitute/](http://www.intrans.iastate.edu/ltap/leadershipinstitute/).

Other informational resources include the following:

- An online brochure for potential course participants, [www.intrans.iastate.edu/ltap/leadershipinstitute/images/participantbrochure.pdf](http://www.intrans.iastate.edu/ltap/leadershipinstitute/images/participantbrochure.pdf).
- An online brochure for employers describing the value of the institute for their employees and the overall organization, [www.intrans.iastate.edu/ltap/leadershipinstitute/images/agencybrochure.pdf](http://www.intrans.iastate.edu/ltap/leadershipinstitute/images/agencybrochure.pdf).

For more information, contact Bob Sperry, Leadership Institute coordinator, 515-294-8103, [rsperry@iastate.edu](mailto:rsperry@iastate.edu). ■

P 486-0524

## July–September 2011 *Technology News*

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