

Inside this issue

- 2 From the director: This wonderful “true sphere”
- 3 Temporary Traffic Control Handbook is portable, new
- 4 New pilot service: Online streaming videos
- 5 Updated Gravel Roads Construction & Maintenance Guide available
- 6 Trenching and excavation safety
- 7 Iowa LTAP Tech Corner—The Slope Calculator
- 7 Conference calendar

Iowa Local Technical Assistance Program

2711 S. Loop Drive, Suite 4700
Ames, IA 50010-8664

Phone: 515-294-8103
FAX: 515-294-0467

www.intrans.iastate.edu/ltap

IOWA STATE UNIVERSITY
Institute for Transportation

Dealing with frost boils and heaves

For many Iowa counties, spring frost boils and frost heaves are inevitable, especially in counties that have received more snow and/or experienced colder temperatures. Such damage can occur in paved roadways, but the following overview focuses on gravel- or aggregate-surfaced roads.

What causes frost boils and heaves?

Although they are not the same, the terms frost boils and frost heaves are often used interchangeably. Both forms of damage involve the breaking up of a section of roadway surface where moisture from spring thaws and/or precipitation cannot drain adequately. The damage from both frost boils and heaves is often large and deep enough to make a roadway impassable. The potential for damage is increased after a severe winter, which deepens the frost layer, and/or where significant late-winter or early-spring precipitation further saturates the soil.

As temperatures begin to rise in the spring, frozen moisture in roadway surfaces and supporting layers start thawing from the top down. Depending on the amount of frozen moisture in the ground, melting winter snow, and spring rain, and the extent to which drainage is inhibited, the result is a saturated, muddy roadway surface, which is a problem in itself.

The bigger problems occur in the support

layers, as far down as the frost line. During the cold, winter months, moisture in these layers freeze and expand. As spring temperatures warm the support layers, the melting frost may produce a fluid subgrade condition that provides little or no support. Under traffic, the pressure is relieved through the point of least resistance—up through the roadway surface—producing a mound of mud, or boil. The boil is a visual indication that the roadway is not stable.

During the spring, the ground is subjected to repeated freeze-thaw cycles. When drainage is inadequate and soils are frost-susceptible, ice lenses form that destabilize and heave the soil, causing an upheaval of the roadway surface. Frost heaves are most prevalent where there are silt and clay subgrades.

How can damage be repaired?

The only sure cure for frost boils and heaves is a sustained period of wind, sun, and dry weather to dry the roadway and allow for thorough road repairs and enhancement of drainage.

In the meantime, check for blockages in the ditch that can be removed to improve drainage immediately, which may prevent further damage.

Stopgap-only measures to allow traffic on the

Frost boils continued on page 3



As freezing temperatures begin to climb, roads thaw and frost boils begin to appear

Acronyms and Abbreviations 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



About LTAP

LTAP is a national program of the FHWA. Iowa LTAP, which produces *Technology News*, is financed by the FHWA and the Iowa DOT and administered by the Institute for Transportation at Iowa State University:

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/

Disclaimers

Any reference to a commercial organization or product in this newsletter is intended for informational purposes only and not as an endorsement.

The opinions, findings, or recommendations expressed herein do not necessarily reflect the views of LTAP sponsors. All materials herein are provided for general information, and neither LTAP nor its sponsors represent that these materials are adequate for the purposes of the user without appropriate expert advice.

Iowa State University makes no representations or warranties, expressed or implied, as to the accuracy of any information herein and disclaims liability for any inaccuracies.

Nondiscrimination

Iowa State University does not discriminate on the basis of race, color, age, religion, national origin, sexual orientation, gender identity, genetic information, sex, marital status, disability, or status as a U.S. veteran. Inquiries can be directed to ISU's Director of Equal Opportunity and Compliance, 3810 Beardshear Hall, 515-294-7612.

Subscribe to *Technology News*

Subscriptions to *Technology News* are free. Subscribe online (www.intrans.iastate.edu/pubs/Newsletter_Request/mailform.cfm) or by contacting the editor (see page 4).

To obtain permission to reprint articles, contact the editor (see page 4). Readers' comments and article topic suggestions are welcome.

Printed with soy ink



From the director: This wonderful “true sphere”

In the last quarterly newsletter, I said my director's columns were going to become more philosophical and possibly a little more personal. Well, as they say, “Hold on to your hat.”

I've been thinking a lot lately about the “true sphere” of people that work together here in Iowa to accomplish professional development. There are the different organizations and programs, of course, which include professional development as part or as all of their objective. But then there are all those volunteers. They include anyone that is going above and beyond their regular job to assist the profession and with a “noble heart” strive to make us all more efficient and effective at what we do. This group also includes those within our partner organizations and programs that go outside their “position description” or “working hours” to do the same. The point, of course, of all this is in the “striving” to help. What occurs in Iowa would not be possible without all of these people. It is truly a wonderful and incredible thing. I would just like to say “thank you,” as this does not occur everywhere and is a great environment to work in.

In an attempt to reduce the amount of “striving” that needs to occur, for those that help in the area of professional development, I've decided to focus some of my upcoming columns on the characteristics of presenting or “teaching” that lead to effective learning. There are many approaches that can be taken, but I'll

focus on those that seem to work best for technical people. For example, we all learn through various modes, but a lot of us technical folk tend to be visual or “hands-on” learners. We also know that, in general, people tend to learn more when they hear, see, and then do. But, in our busy world, for various reasons, the doing and digestion of the subject often have to be done back at the shop or through additional conversations. I may try to cover why this often occurs in a future column. Overall, success in training, I think, is if someone walks out with one bit of knowledge that helps him or her become more effective or efficient. If it's more than one bit, the training introduced new material and was really needed.

Wrapping up, keep an eye out for some training that has/will soon be advertised. These include our Motor Grader Operator training, Accessible Sidewalks and Curb Ramps: Design to Installation workshop, and some dates piloting a roadside safety course. Thanks for helping us develop these and other courses/events and attending and/or sending people to them.

And remember, next time you are in a committee meeting or at a training—turn to the person next to you and thank them for their service (including yourself). Everyone deserves that recognition, because they are part of the “true sphere” of professional development in Iowa. ■

Keith

Frost boils continued from page 1

affected roadway generally involve temporarily reinforcing heaved or soft spots. This is generally accomplished by spreading rock on the affected areas.

Focus first on soft spots in the worst places and on priority trouble spots like bridge approaches and intersections with paved roads.

Timing is critical: Don't start randomly hauling rock, but plan to work when the frozen roadway will support the load, such as early in the day while the road is still stiff from low nighttime temperatures.

If possible, remove water-soaked material and/or pull in the roadway edges and build up the crown to help moisture drain off the road. Then spread and compact the rock.

What are some preventive measures?

The common denominator for preventive measures is improving drainage. In the spring, notice new or severe problem areas and put them at the top of your list for good-weather repairs and drainage improvements. Options include the following:

- Lowering or otherwise improving the side ditches. This lowers the water table beneath the roadway. It also helps keep the grade from becoming saturated by promoting drainage.

- Tiling.
- Bridging over the problem area. Remove the roadway surface to a depth of two feet, then place stone and engineering fabric below a final top layer of aggregate or gravel.
- Coring down below the frost line in the center of the road and filling the bore hole with calcium chloride. The chloride helps to melt the ice lens, and the bore hole allows moisture to drain.
- Maximizing spring drainage by following good maintenance practices during the summer season. Clean ditches. Correct secondary ditches created by vegetation or windrows that obstruct water drainage from the roadway. Grade the crown for a four to six percent slope. Ensure a uniform layer of well-graded granular material for a dense crust.
- As budgets allow, improve spring drainage during the winter by removing snow and ice from the roadway and push snow banks away from the roadway.

For more information

Contact the Iowa LTAP Technical Training Coordinator, Paul Albritton, at palbritt@iastate.edu or 515-294-1231. ■

Temporary Traffic Control Handbook is portable, new

By Beth Richards, SUDAS Program Coordinator

It had been a long-term goal of Tom McDonald, who led Iowa's award-winning circuit rider program for 15 years before his death in October 2013, to revise what is now known as the *Temporary Traffic Control Handbook*.

The original handbook, called *Work Zone Safety for Iowa*, was first published approximately 20 years ago and was later revised in 2000 and again in 2005. However, with current state specifications for Iowa based on the 2009 edition of the MUTCD, the 2005 version was out of date, as it was based on the 2003 version of the MUTCD.

SUDAS (Statewide Urban Design and Specifications) program staff initiated a review of the 2005 handbook to identify what updates were needed, starting with the differences between the 2003 and 2009 MUTCD editions.

A technical advisory committee composed of city, county, Iowa DOT, Iowa LTAP, and utility representatives was formed to assist in the review of the handbook. An IHRB project was procured to cover the costs of developing new drawings and printing and distributing the final handbook.

Now, the newly available, *Temporary Traffic Control Handbook* provides local agencies with uniform examples for temporary traffic control. The handbook includes sample layouts that can be used on various projects. Having sample layouts provides cost savings to agencies because the designer or contractor will not have to develop new plans for each situation. Following uniform procedures increases safety in the work zones. Providing uniformity among communities will also help the public safely traverse through work zones.



Temporary Traffic Control Handbook, updated 2016

One pocket-sized handbook was mailed to all county engineers and to all cities with a population above 1,000 citizens. The Iowa LTAP is currently distributing copies at their Work Zone Safety training workshops, and SUDAS staff are distributing copies at their six district committee meetings. The handbooks were so well received that many communities are requesting additional copies.

What's next? The Iowa LTAP will continue to use the *Temporary Traffic Control Handbook* in their trainings and workshops. SUDAS staff will also work to incorporate many of the drawings into a new section on temporary traffic control in the SUDAS Standard Specifications.

An electronic copy of the handbook as well as a link to an order form to request hard copies are posted on the SUDAS website (www.iowasudas.org). At this time, hard copies of the handbook are free!

Questions about the handbook can be directed to the SUDAS Program Coordinator, Beth Richards, at brich@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

Keith Knapp
Director of Iowa LTAP
kknapp@iastate.edu

Brandy Haenlein
Editor
babraham@iastate.edu

Paul Albritton
Technical Training Coordinator
palbritt@iastate.edu

Devin Happe
Administrative Event Coordinator
dmhappe@iastate.edu

Theresa Litteral
Statewide MDST Facilitator
litteral@iastate.edu

David Veneziano
Safety Circuit Rider
dvenez@iastate.edu

Advisory Board

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

Adam Clemons
Wright County Engineer
515-532-3597
aclemmons@co.wright.ia.us

Paul Geilenfeldt
Marshall County Engineer
641-754-6343
pgeilenfeldt@co.marshall.ia.us

Shauna Hallmark
Director, InTrans
515-294-5249
shallmar@iastate.edu

Tim Herrstrom
Road Foreman, Boone County
515-795-2825
bctjh@iowatelecom.net

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

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

Ron Knoche
City Engineer, City of Iowa City
319-356-5138
ron-knoche@iowa-city.org

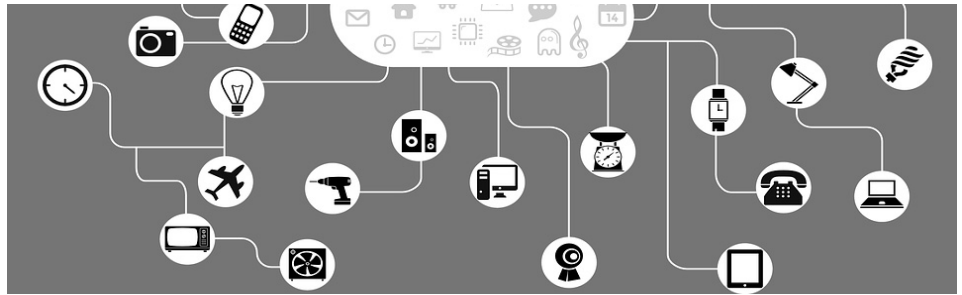
Corey Mellies
Operations Manager, City of Ames Public Works
515-239-5276
cmellies@city.ames.ia.us

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

Brad Skinner
Montgomery County Engineer
712-623-5197
bskinner@montgomerycoia.us

Wade Weiss
Greene County Engineer
515-386-5650
wweiss@co.greene.ia.us

New pilot service: Online streaming videos



The Iowa LTAP has acquired limited access to a new, free, online streaming video service, and is now providing it to cities and counties across Iowa.

These videos focus on general safety, job training, and compliance, and, with a run time of 15 to 25 minutes, they are perfect for regularly scheduled safety meetings. Access can be obtained anywhere, anytime, with a computer connection and access to the internet.

Many videos are available upon request, but Iowa LTAP staff have pre-selected 30 of our most requested topics.

Bloodborne Pathogens

Heat Stress

Portable Fire Extinguishers

Pro-Active Safety Attitudes

Slips Trips and Falls

Indoor Cranes

Back Protection

Driven To Distraction I

Cave-In! Trenching & Shoring Safety

Oxyfuel Gas Cutting

Fire Safety

Forklift Basics

Winter Safety

Housekeeping Safety

Hearing Conservation

Compressed Gas Safety Awareness

Confined Space Entry

Bucket Trucks

HAZCOM Are You GHS Ready?

Employee Wellness

Sexual Harassment

Lockout/Tagout

Installing Trench Boxes

Forklift Case History

Electrical Case History

Hand Protection

Personal Protective Equipment

Construction Trenching and Shoring

Powered Hand Tool Safety

Driven To Distraction II

Contact the Iowa LTAP Technical Training Coordinator, Paul Albritton, at palbritt@iastate.edu or 515-294-1231 for more information. ■

Updated Gravel Roads Construction & Maintenance Guide available

The original *Gravel Roads Construction & Maintenance Guide*, published in 2000, became an invaluable resource for managing gravel surfaced roads throughout the nation.

Now, through a joint effort by the Federal Highway Administration (FHWA) and the South Dakota Local Technical Assistance Program (SDLTAP), a revised guide is available.

Designed for local agency officials, managers, and grader operators responsible for designing and maintaining gravel surfaced roads, the information included in this revised guide is as nontechnical as possible without sacrificing clear guidelines and instructions on how to perform the operation well.

Info on routine maintenance

Good gravel road maintenance or rehabilitation depends on two basic principles: proper use of a motor grader (or other grading device) and use of good surface gravel. The use of the grader to properly shape the road is obvious to almost everyone, but the quality, volume, and size distribution of gravel needed is not as well understood.

It seems that most gravel maintenance or rehabilitation problems are blamed on the grader operator when the actual problem is often material-related. This is particularly true when dealing with the problem of corrugation or “washboarding,” as it is often called in the field. This guide provides information on what

makes a good gravel road surface.

Info on dust control/stabilization

Another important matter to consider is the dramatic change in the vehicles and equipment used on low-volume roads.

Tire pressures have increased to accommodate an ever-expanding fleet of commercial trucks and agricultural equipment increasing in size, weight, and horsepower. The damaging effect of larger and heavier vehicles on paved roads is well understood and requires the construction of stronger bases and pavements.

But, the effect of these vehicles on gravel roads is just as serious and it is often not recognized. The strength of the subgrade and depth of the material needed to carry today’s heavy loads must be considered, along with proper drainage. For these reasons, sections of this guide are focused on construction, drainage, surface gravel, and stabilization of these roads.

Info on innovations

The final section of the guide covers innovations in the gravel road maintenance and rehabilitation industry. Change is constant in almost every aspect of this modern world and new and different methods of maintaining gravel roads is no exception.

There are new ways of stabilizing roads, new methods of dust control, and different kinds of equipment available for maintenance or reha-



Gravel Roads Construction & Maintenance Guide

bilitation of gravel roads. Alternative surface materials such as recycled pavement or blends of recycled and virgin aggregate are being used. Not all of these innovations may be available or practical for every local agency, but everyone is encouraged to take an objective look at each alternative. Then, an informed decision can be made about changing the way gravel roads are designed and maintained within their particular jurisdiction.

Where to get it

Local government agencies may request a complimentary copy by contacting Paul Albritton, the Iowa LTAP Technical Training Coordinator, at palbritt@iastate.edu or 515-294-1231.

A PDF copy is also available free to download under the Iowa LTAP’s “Featured Resources” on the website homepage. ■



Rural road with potholes and corrugation

From Section I: Routine Maintenance & Rehabilitation/ 1.9: Crown (Pg. 11)

“Establishing the proper crown in the gravel surface probably generates more controversy than any other aspect of good maintenance. *How much crown is enough? Can one get too much? What is recommended crown?*”

Supervisors and skilled operators across the country indicate that at or near 1/2 inch of crown per foot (approximately four percent) on the cross slope is highly recommended. While it is virtually impossible for any operator to maintain an absolutely uniform crown, minimal deviation is recommended. It is not good to exceed six percent in any condition.”

When a road lacks adequate crown, potholes and corrugation form as a result, and water is unable to drain from the road surface.

Trenching and excavation safety

Two workers are killed every month in trench collapses. The employer must provide a workplace free of recognized hazards that may cause serious injury or death. The employer must comply with the trenching and excavation requirements of 29 CFR 1926.651 and 1926.652 or comparable Occupational Safety and Health Administration (OSHA)-approved state plan requirements.

An excavation is any man-made cut, cavity, trench, or depression in an earth surface formed by earth removal.

Trench (or trench excavation) means a narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet (4.6 meters).

Dangers of trenching and excavation

Cave-ins pose the greatest risk and are much more likely than other excavation-related accidents to result in worker fatalities. Other potential hazards include falls, falling loads, hazardous atmospheres, and incidents involving mobile equipment. One cubic yard of soil can weigh as much as a car. An unprotected trench is an early grave. Do not enter an unprotected trench.

Trench safety measures

Trenches 5 feet (1.5 meters) deep or greater require a protective system unless the excavation is made entirely in stable rock. If less than 5 feet deep, a competent person may determine that a protective system is not required.

Trenches 20 feet (6.1 meters) deep or greater require that the protective system be designed by a registered professional engineer or be based on tabulated data prepared

and/or approved by a registered professional engineer in accordance with 1926.652(b) and (c).

Competent person

OSHA standards require that employers inspect trenches daily and as conditions change by a competent person before worker entry to ensure elimination of excavation hazards. A competent person is an individual who is capable of identifying existing and predictable hazards or working conditions that are hazardous, unsanitary, or dangerous to workers, soil types, and protective systems required and who is authorized to take prompt corrective measures to eliminate these hazards and conditions.

Access and egress

OSHA standards require safe access and egress to all excavations, including ladders, steps, ramps, or other safe means of exit for employees working in trench excavations 4 feet (1.22 meters) or deeper. These devices must be located within 25 feet (7.6 meters) of all workers.

General trenching and excavation rules

- Keep heavy equipment away from trench edges
- Identify other sources that might affect trench stability
- Keep excavated soil (spoils) and other materials at least 2 feet (0.6 meters) from trench edges
- Know where underground utilities are located before digging
- Test for atmospheric hazards such as low oxygen, hazardous fumes, and toxic gasses when greater than 4 feet deep

- Inspect trenches at the start of each shift
- Inspect trenches following a rainstorm or other water intrusion
- Do not work under suspended or raised loads and materials
- Inspect trenches after any occurrence that could have changed conditions in the trench
- Ensure that personnel wear high visibility or other suitable clothing when exposed to vehicular traffic

Protective systems

There are different types of protective systems.

Benching means a method of protecting workers from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels. Benching cannot be done in Type C soil.

Sloping involves cutting back the trench wall at an angle inclined away from the excavation.

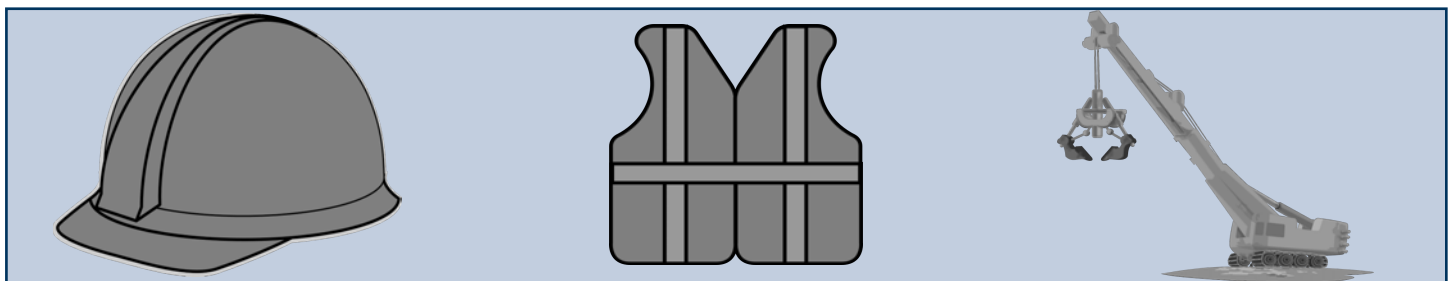
Shoring requires installing aluminum hydraulic or other types of supports to prevent soil movement and cave-ins.

Shielding protects workers by using trench boxes or other types of supports to prevent soil cave-ins. Designing a protective system can be complex, because you must consider many factors: soil classification, depth of cut, water content of soil, changes caused by weather or climate, surcharge loads (e.g., spoil, other materials to be used in the trench), and other operations in the vicinity.

Additional information

Visit OSHA's Safety and Health Topics webpage on trenching and excavation at www.osha.gov/SLTC/trenchingexcavation/index.html.

Reprinted with permission from OSHA. ■



Conference calendar

Date	Event Name	Location	Contact
April 2016			
7-8	APWA/ISOSWO Spring Conference	West Des Moines	Paul Albritton
24-28	NACE Annual Conference	Tacoma, Washington	Keith Knapp
May 2016			
2-13	NHI–Bridge Inspection Refresher Training	Ames	Paul Albritton
3	Motor Grader Operator Training	Iowa City	Paul Albritton
10	Motor Grader Operator Training	Tripoli	Paul Albritton
10	Accessible Sidewalks and Curb Ramps: Design to Installation	Ames	Keith Knapp
17	Motor Grader Operator Training	Ames	Paul Albritton
24	Motor Grader Operator Training	Storm Lake	Paul Albritton
June 2016			
1	Motor Grader Operator Training	Oakland	Paul Albritton
July 2016			
14	ICEA Midyear Meeting	Ames	Keith Knapp
18-21	National LTAP Meeting	Madison, Wisconsin	Keith Knapp

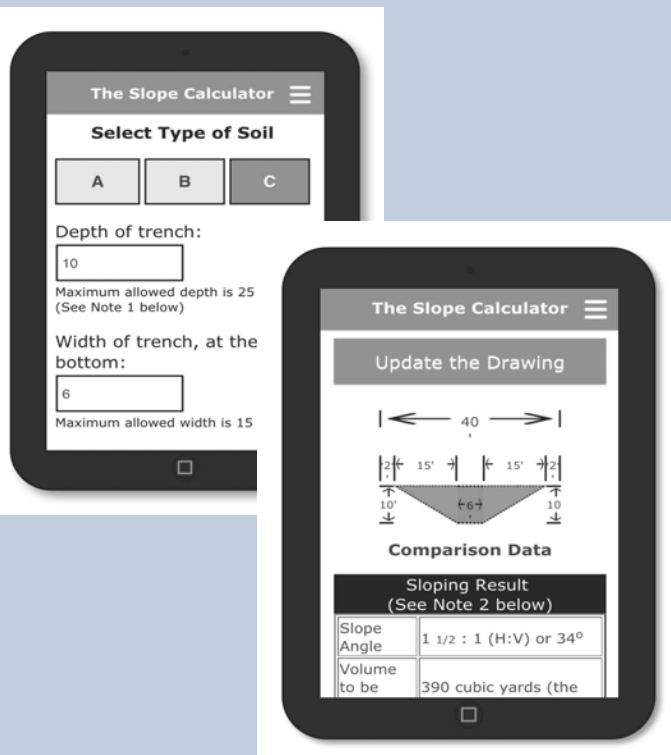
Contact information

Paul Albritton, 515-294-1231, palbritt@iastate.edu
 Keith Knapp, 515-294-8817, kknapp@iastate.edu ■

Event details and online registration

Watch for details and online registration information, by specific dates and events, on the Iowa LTAP Workshops page, www.iowaltap.iastate.edu/workshops/ltap-workshops/. ■

Iowa LTAP Tech Corner—The Slope Calculator



What is it?

TrenchSafety and Supply, Inc. is all about solutions that help contractors and employees working in trench excavations stay safe. Keeping in line with this goal, TrenchSafety developed a handy, easy-to-use, and free online tool that enables users to explore the pros and cons of both sloping and shoring/shielding.

How does it work?

This tool can be pulled up and used on most any electronic device—like smartphones and iPads! Once opened, users can select the soil type they'll be working in and plug in the dimensions of the proposed excavation. Excavation options are instantly calculated and compared, so users can make the decision on the best safety method to use. There's even a drawing to give users a quick visual idea of what will be involved with both methods.

Afterward, users can save their results to their computer or digital device as a PDF that can be printed and emailed.

Users can even plug in "what if" dimensions, to compare their impact, then save each scenario for later review.

Where can I get it?

It is available for free on the TrenchSafety and Supply, Inc. website at www.trenchsafety.com. ■

Institute for Transportation
Iowa State University
ISU Research Park
2711 S. Loop Drive, Suite 4700
Ames, IA 50010-8664

RETURN SERVICE REQUESTED

LTAP Materials

- √ Order library materials
- √ Add a name to our mail list
- √ Correct your mailing information

To make a change to the *Technology News* mail list or to order library materials, please complete the information below and mail or fax this page (including mail label) to the InTrans address below:

Institute for Transportation
2711 S. Loop Drive, Suite 4700
Ames, IA 50010-8664
Fax: 515.294.0467

- Add the name/address below to the *Technology News* mail list.
- Delete the name/address below from the *Technology News* mail list.
- Correct the name and/or address below on the *Technology News* mail list.

New or corrected mailing information:

Name _____

Title _____

Organization _____

Address _____

City _____

State _____ Zip _____

- Send the following library materials to the address above:

Title: _____

P-, V-, DVD or CR-number: _____

Title: _____

P-, V-, DVD or CR-number: _____

Subscribe to Technology News online at
www.intrans.iastate.edu/pubs/Newsletter_Request/mailform.cfm.