

# The science of highway safety Highway Safety Manual is a valuable tool for local agencies

### By John Ryynanen, Editor, Center for Technology & Training

As a civil engineer (or one who works closely with civil engineers) you know that when you're designing an intersection and you have a question about sight distance, you can look in the American Association of State Highway Transportation Officials (AASHTO) A Policy on Geometric Design of Highways and Streets, also known as the AASHTO Green Book, for an answer. Similarly, when you have a question about signs, pavement markings and signals for the same intersection, you know you will find all the

### More inside

Bridge load rating workshop	3
Acquiring right-of-way for fed-funded projects	3
MDOT Bridge Advisories	3
Tech writing for transportation pros (Part 3 of 3)	6
Help for locals from FHWA	7
Safety funding for local agencies	8

answers in your copy of the Manual on Uniform Traffic Control Devices, or MUTCD.

But where do you look when you have a question about traffic safety? For example, what is the safest method for handling left turn movements at a four-way signalized intersection? Until recently, you would have had to sift through multiple sources of information (including, probably, the AASHTO Green Book, the MUTCD, and published research reports) to find an answer to such a question. But there was no guarantee that you would find a definitive answer. The question about left turn movements exposes a dilemma that safety professionals have grappled with for years: What constitutes safety on a road? Must a road simply adhere to established design standards to be considered safe, or does it require something more?

### Standards not enough

Dr. Ezra Hauer, Professor Emeritus in the Department of Civil Engineering at the University of Toronto and internationally-recognized highway safety expert, introduced the adjectives "nominal" and "substantive" to help shed more light on the topic of roadway safety.

Dedicated turn lanes, pedestrian refuge areas, adequate signage, and wide separation between traffic lanes all contribute to the safety of a road. The new Highway Safety Manual provides guidance for determining the best treatments to address safety concerns.





See Science of Safety on Page 4

## The Bridge

### Vol. 24, No. 4

**"Be careful," my wife said** as I headed out the front door. "I will," I promised. An hour later I was in an ambulance beginning to feel the blessed pain-relieving effects of a 2 mg dose of dilaudid as a paramedic pushed the narcotic into a vein in my left arm.

Six hours after that, I was listening to a surgeon explain that the top of my right tibia (the part of my shin bone that holds my thigh bone in place when I'm standing) was shattered. "Your leg is a mess," he said. "You're going to be here for awhile." *Shoot*.

"Here" was the orthopedic trauma unit of the Essentia Health Hospital in Duluth, MN. "Awhile" ended up being 17 days. It took

five surgeries, two titanium plates and 24 screws (X-ray at right) to put my leg back together.

The date was September 6, 2010–Labor Day. I had fallen 12 feet off a ladder that I had haphazardly propped from my low-slope garage roof to my steeply-pitched house roof. The ladder slipped, I fell, and my tibia shattered.

After several weeks of rest and many, many painful sessions of physical therapy, I



was walking with a limp by Thanksgiving. By Christmas I was working out regularly and even skate-skiing. I was pleased with how quickly I had healed. But it wasn't over.

In mid January my knee swelled up and I spiked a high fever. Within days I was back in Duluth. The same surgeon who put my tibia together in September had to undo everything. "Staph infection," he explained. Seven days and two surgeries later, I returned home. After one more surgery later this month, more rest, and more physical therapy, I should be able to walk again by summer. Until then, I'll get around with crutches.

When I stop to think about it, I'm amazed at the impact of that one foolish decision to climb a ladder I knew was not safe. I haven't been able to go full speed at anything since I left the house last Labor Day.

Safety is a big deal. Working in the transportation field I hear about it all time. Now I understand. At best, working in an unsafe manner (or carelessly) can result in a great deal of inconvenience and pain. Worst case, it can be deadly. I'm very thankful that my experience has only been painful and inconvenient.

As construction season ramps up in the coming months, I encourage you to do I as I say, not as I did. And listen to my wife. "Be careful," she says.



## **LTAP Steering Committee**

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The Bridge

Michigan's Local Technical Assistance Program Center for Technology & Training Michigan Technological University 309 Dillman Hall 1400 Townsend Dr. Houghton, MI 49931-1295

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Director	Tim Colling, PhD., P.E.
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Office Manager	Christine Codere
Office Assistant	Devin Seppala
Office Assistant	Tammy Kus
Telephone	
Fax	
E-mail	CTT@mtu.edu
Michigan's LTAP http://www.http	://www.MichiganLTAP.org

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Kurt E. Zachary, P.E. 517-702-1832 FHWA Local Program Engineer, FHWA Bruce Kadzban 517-335-2229 MDOT Local Agency Programs, MDOT Ronald A. Young 989-731-8168 Michigan Counties Engineer/Manager, Alcona County Road Commission

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## Workshop will help local agencies meet new bridge load rating requirements

The sudden, horrific collapse of the I-35W Bridge in Minneapolis on August 1, 2007 focused national attention on the condition of bridges in the United States. In response to this increased attention, the U.S. Department of Transportation (DOT) Office of the Inspector General (OIG) performed an audit of the Nation's bridge inspection and load rating programs, and they found significant problems nationally in the load rating and posting of highway bridges.

In March 2010, the Michigan Division of the Federal Highway Administration (FHWA) completed a National Bridge Inspection Standards (NBIS) program review of Michigan's load rating program and issued a report titled, *Load Rating and Posting of Michigan Bridges*. The report said that "Many local agency bridges may not be load rated in compliance with NBIS requirements, or may not be load rated at all. The number of local agency bridges requiring their load ratings to be revised is between 3,000 to as many as 4,100 or more." As a result of the review, the FHWA required MDOT to develop an action plan for improving bridge load rating needs. This plan will require all bridge owners to review their load rating needs. This plan will require all bridge owners to review their load rating needs in accordance with a set of screening criteria and a prioritized list of bridges that may need new or updated load ratings. Most bridge owners are expected to have many bridges that need to be load rated, and annual performance measures will need to be met to maintain Federal Aid to Highway Program compliance.

MDOT will also implement a new quality control/quality assurance (QC/QA) program that will help improve the overall quality of the state's highway bridge load rating program and will ensure that bridges are load rated in compliance with NBIS requirements.

Chris Gilbertson, P.E. from the Michigan Tech Transportation Institute will team up with Dave Juntunen, P.E., Creightyn McMunn, P.E., and Bob Kelley, P.E. from MDOT to conduct a workshop to educate local agencies on the new bridge load rating requirements. The workshop, which will precede the 2011 Bridge Conference and is sponsored by the Center for Technology & Training (CTT), is scheduled for March 22, 2011 in Big Rapids. It will cover the following general topics:

- Screening criteria for bridges
- Detailed description of MDOT's bridge load rating action plan and time frame
- Overview of load rating, including Allowable Stress Rating (ASR), Load Factor Rating (LFR), and Load and Resistance Factor Rating (LRFR) methods
- Overview of the Virtis program for load rating bridges

Participants in this workshop will receive credit for six hours of refresher training for continuing education. More information regarding documentation will be provided at the workshop.

Promotional material for the workshop will be distributed in early February. If you have questions in the meantime, please call the CTT office at 906-487-2102, or send an Email to CTT@mtu.edu.



### **MDOT Bridge Advisories:**

Your link to the latest and greatest bridge information in Michigan

The MDOT Bridge Operations Section publishes bridge advisories to provide guidance and to share information on bridge safety, bridge inspection, bridge management, and bridge load rating issues. All advisories are available as PDFs on the MDOT web site. For a direct link, go to www.MichiganLTAP. org/pubs, and then select "MDOT Bridge Advisories" from the list.



If you need to acquire right-of-way for a project that uses federal funds, Teresa Vanis, Local Agency Coordinator at MDOT's Real Estate Division, can help.

## Acquiring right-ofway for federallyfunded road projects

**The Federal Highway Administration** (FHWA) recently hosted a webinar entitled "50 Ways to Lose your Money." The presentation was intended for engineers, project managers and right-ofway specialists who are responsible for acquiring and certifying right-of-way for federally-funded projects. The message from the FHWA was clear: when a State DOT or Local Public Agency (LPA) acquires right-of-way for a federally funded project, they must comply with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended. An agency that fails to comply with this Act risks losing federal funds for all phases of the project.

Acquiring federal funding for a road project is difficult. Once you get the funds, you certainly don't want to lose them. Complying with the Uniform Act (and keeping your federal funding) is not terribly difficult, but the process for doing so is strict. If you don't follow the process correctly, you will lose money.

If you need guidance for acquiring right-of-way for a project that uses federal funds, Teresa Vanis, Local Agency Coordinator for MDOT's Real Estate Division, is available to help.

### **Contact Information:**

Teresa Vanis Phone: 517-373-4135 Email: vanist@michigan.gov

### Science of Safety, from Page 1

In a 1999 paper titled Safety in Geometric Design Standards, Hauer wrote, "Nominal safety is judged by compliance with standards, warrants, policies and sanctioned procedures ... substantive safety is measured by expected crash frequency and severity." (Hauer 1999a)

The problem with defining safety as a function of compliance with standards, Hauer asserted, is that "Limit standards do not tell the designer what the safest design is. Rather, they specify the limit of what is permissible." (Hauer 1999b).

Today the Highway Safety Manual (HSM), which is available through AASHTO, is the definitive source of substantive answers to roadway safety questions. The manual was developed and refined by a diverse team of roadway safety stakeholders over the past ten years to provide a single source for safety information and tools in a form that facilitates data-based decision-making.

### Major effort

Creation of the HSM began in May 2000 under the direction of a group of volunteers from eight different subcommittees of the Transportation Research Board (TRB) in Washington DC. Research and development for the effort was funded in large part by the National Cooperative Highway Research Program (NCHRP). The Federal Highway Administration (FHWA) provided supplementary funding and research support.

The problem with defining safety as a function of compliance with standards is that limit standards do not tell the designer what the safest design is. Rather, they specify the limit of what is permissible.

Dr. Ezra Hauer - Professor Emeritus, University of Toronto

In 2006, a decision was made to publish the HSM as an AAS-HTO document, at which point a Joint Task Force was formed with representatives from the AASHTO subcommittees on Design, Traffic Engineering and Safety Management. Over the next three years, the task force examined the HSM to ensure that it would meet the needs of State Departments of Transportation and local agencies. During that time, members of the task force also worked to promote the HSM within their respective subcommittees.

In 2009, after nine years of intensive development and careful refinement, the AASHTO board of directors approved the HSM for distribution.

### Valuable resource, but not a standard

Priscilla Tobias, Bureau Chief of Safety Engineering for the Illinois Department of Transportation (IDOT) serves as Chair of the task force that oversees the maintenance and on-going development of the HSM. She is extremely pleased that such a powerful tool is available for road owning agencies. "This manual represents the best safety-related science of our day," she said. "And it has been thoroughly vetted by safety experts and representatives from all groups involved with roadway safety to make sure it's accurate and relevant for all stakeholders. This is the first time we have had such a resource." Tobias is careful to stress that the HSM is not a standard, like the MUTCD. "The manual is intended as a guide; nothing about it constitutes a legal standard, nor does it mandate responsibilities," she said. "It's simply a great tool for making informed decisions about how to allocate resources to address safety issues most effectively."

### New direction in highway safety

The key to the manual's usefulness lies in its thorough, scientific approach to identifying, analyzing and solving safety problems. First, by accounting for the statistical phenomenon of regression to the mean, many methods of site selection in the HSM help road agencies zero in on the most relevant sites by eliminating from consideration sites that are at a randomly high or low fluctuation in crashes. After a site is identified, the HSM provides a means for analyzing the safety impact of decisions at all stages of the project development process, which enables practitioners to quantify the effectiveness of safety improvements along with other transportation performance measures. Finally, the HSM includes an extensive catalog of proven crash modification factors (CMFs) for a variety of geometric and operational treatment types. Using CMFs, practitioners can predict the safety impact that a potential treatment or design may have on their road system.

Highway safety expert Dr. Hauer is pleased that the manual is available. "Publication of the Highway Safety Manual indicates



**Thirteen states** are participating in the Lead States Initiative, which is sponsored by the National Cooperative Highway Research Program (NCHRP). Objectives of the project are to:

- Provide the participating states with access to experts who are familiar with HSM development and implementation
- Facilitate the exchange of HSM implementation experiences among the lead states
- Develop an HSM user guide to assist other state and local road agencies in implementing the HSM.

For more information on the Web, go to:

For a direct link, go to www.MichiganLTAP.org/pubs, and then select "NCHRP Lead States Initiative" from the list.

wide recognition of the need for approaching safety in some evidence-based manner. With procedures that examine safety quantitatively rather than subjectively, the document is an important first step in the right direction."

### Early adopters lead the way

At three volumes and nearly one thousand pages, the HSM contains a formidable amount of information, especially for those who are not experienced in the practice of analyzing and improving roadway safety. To help disseminate new information in the manual and to encourage road-owning agencies to use it, the NCHRP is sponsoring an effort that involves showcasing different states' experiences with the HSM. The effort, officially titled the *Lead States Initiative for Implementing the Highway Safety Manual*, involves state and local transportation officials in thirteen states (see "Lead States Initiative" on page 4).

### Michigan is a lead state

Tracie Leix, supervising engineer for the Michigan Department of Transportation (MDOT) Safety Programs Unit, is managing MDOT's participation in the Lead States Initiative. Leix is especially excited about the HSM because she expects it to enhance her group's already healthy relationships with local road agencies. She and her team have seen first-hand how engaging with local partners on safety projects can produce great results. In 2004, Leix's group, at the time under the leadership of Dale Lighthizer (retired 2010), established the Local Safety Initiative to help local road agencies in Michigan implement safety improvements (see "MDOT Local Safety Initiative," below).

"Through the local safety initiative, we stress the importance of measuring safety and quantifying the effectiveness of improvements," Leix explained. "The HSM will be a

Nothing about the HSM constitutes a legal standard, nor does it mandate responsibilities. It's simply a great tool for making informed decisions about how to allocate resources to address safety issues most effectively.

Priscilla Tobias - Illinois Department of Transportation

The project manager for the Lead States Initiative is Charles Niessner, senior program officer at NCHRP. To kick the project off, Niessner worked with Tobias' AASHTO task force on the HSM to solicit participants from among State Departments of Transportation (DOTs). He was encouraged by the response. "Thirty DOTs initially expressed interest," Niessner said. "That was encouraging. We didn't expect that kind of response from the states because launching something like this is not a simple thing - it's a major effort." Niessner thinks the willingness to get involved is thanks to the requirement in the transportation bill of 2005 (Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users, or SAFETEA-LU), that required each state DOT to establish a strategic highway safety plan by October 1, 2007. "Requiring strategic highway safety plans really elevated the importance of roadway safety and helped everyone move more purposefully in that direction. I think the response to our invitation shows that our State DOTs see the HSM as another great tool to help refine our collective approach to improving the safety of our roads."

great tool to support these efforts as we continue to work together with our local partners to improve the safety of Michigan roads."

To help local agencies understand and use the HSM in Michigan, Leix and a Local Agency HSM Implementation Team are working with Michigan's Local Technical Assistance Program (LTAP) to produce training materials for various groups of stakeholders that are involved in making roadway safety decisions. "Among our local agency partners, we have metro, urban, and rural agencies. And within each agency we have people dedicated to design, development, safety, and other focus areas," Leix said. "No matter where someone fits in the process of improving roadway safety, certain aspects of the manual apply to them. We're working to make sure the training is relevant to each groups' needs."

### Not just for State DOTs

Tony Giancola, Executive Director of the National Association of County Engineers (NACE) is also excited about the availability and See Science of Safety on page 7



The MDOT Local Safety Initiative provides tools and services that help local road agencies improve the safety of their roads. The LSI is available to local agencies free of charge, on a first-come, first served basis. Available services include:

- Traffic engineering services including crash analysis, field reviews and suggestions for countermeasures;
- Safety training to local agencies for the RoadSoft<sup>®</sup> safety module and safety analysis features;
- Continuous enhancement of the *RoadSoft* safety module for local agency use. For more information, contact:

Tracie Leix, P.E., Engineer-Manager.

LeixT@michigan.gov

Phone: 517-373-8950

# Technical writing for transportation professionalsThe structure of a proposaltion you developed in that analysis to craft<br/>your problem statement. If your readers

By Richard Kronick, freelance technical writer and writing trainer. *Reprinted with permission from Minnesota LTAP, University of Minnesota.* 

# This article is the last in a three-part series. Part 1 was published in Issue 24.2; Part 2 was published Issue 24.3.

My first two articles in this series showed you how to get ready to write a technical document. This article focuses on the structure of proposals. Proposals are arguably the most important documents written by transportation professionals because almost no transportation project gets a go-ahead until a proposal has been accepted.

### A descriptive title

The title of your proposal should not only identify the problem you are addressing; it should also suggest your solution. For example, instead of "Brown County Landfill," make it "Clay Lining to Remediate Leakage of the Brown County Landfill." This will increase your readers' eagerness to dig into your text.

### The three-part structure

Aristotle's advice on how to give a lecture has been summarized as:

- First tell 'em what you're gonna tell 'em. Then tell 'em.
- Then tell 'em what you told 'em.

When I show this idea to people in my writing seminars, it is always greeted with a bit of laughter—and I know why: It seems wrong! It contradicts the saying made famous by architect Ludwig Mies Van der Rohe: "Less is more." Mies's saying certainly applies to your proposal. You should use as few words as possible. But the "Tell 'em...Tell 'em" idea is also valid for proposals because of your readers' psychological needs: First, no one wants to be taken for a ride until the driver says where they're going-hence the need to "Tell 'em what you're gonna tell 'em." Second, because your readers undoubtedly have a few dozen other thoughts bumping around in their minds as they read your proposal, you need to reinforce what you've already said-hence the need to "Tell 'em what you told 'em." But within the "Tell 'em..., Tell 'em..., Tell 'em..." formula, you must 'tell 'em' differently each time.

### The introduction

You may entitle the first part of your proposal "Introduction," "Summary," or "Executive Summary." (Use the last one when you think your readers will be flattered by being referred to as executives!) But no matter what you call it, the beginning of your proposal must answer three questions that will be on your readers' minds:

- What's the background of the situation?
- What's the problem that has grown out of the background?
- What's your solution to the problem?

Here's an example of this three-part structure in a cover letter from a financial planner:

### Dear Mr. and Mrs. Jones:

It was good to see you last night. As we discussed, you would like to open an account to invest some money that has been building up for your kids. This new account will be registered jointly.

We recommend investing these funds in the Capital Income Builder Fund (prospectus enclosed). Please complete the highlighted areas on the enclosed forms

and return them to us along with a check payable to The X Fund. I hope you will call me if you have any questions.

Notice that the first 11 words (through "discussed") are the background statement. Without going into any detail, the writer references what has brought him and his readers to this point. Do the same thing in your proposals. Begin with a statement of the history of the situation, leaving out most of the details.

Next, notice that the financial planner states the problem as seen by his readers: ("... you would like to...invest some money that has been building up..."). That strategy is crucial to the success of a proposal. In the first article in this series, I admonished you to analyze your readers. Now you must use the information you developed in that analysis to craft your problem statement. If your readers conclude that you don't see the situation from their viewpoint, your proposal will be DOA.

Finally, notice that the financial planner concludes by suggesting the solution to the problem—again without much detail. The details are in the enclosed documents.

Here's another example: I'm currently writing a proposal for a county highway engineer to his county commissioners. We are proposing that new highway department facilities be built. In our executive summary, we could have emphasized that the existing facilities are worn out and do not comply with the building code, but that would have been stating the problem from the highway engineer's viewpoint. Instead, we are emphasizing that the existing facilities are not giving county residents a sufficient return on their tax dollars. That states the problem as seen by the county commissioners. Whether they are genuinely altruistic or merely seek re-election, they will see the problem as:

The beginning of your proposal must answer three questions that will be on your readers' minds:

- What's the background of the situation?
- What's the problem that has grown out of the background?
- What's your solution to the problem?

What is the best way to serve the needs of county residents?

### The body

The body of the proposal is where the detailed information belongs. In the first article of this series, I explained that there are only four reasonable ways to organize any information:

- Order of importance
- Time order
- Pro vs. con
- Cause and effect

The first one, order of importance, is a good choice as the overall organizing principle for the body of a proposal. That means you start with the single most important reason why whatever you are proposing should happen—and then continue in order

### Tech Writing from previous page

of lesser importance as seen by your primary audience. Why? Because the primary audience—those who have the power to accept or reject your proposal—are always at the tops of organizations. They are busy people who will only be willing to give your proposal a few minutes to grab their attention. So you must hit them with the most important idea right away—which, again, means most important according to their value system. Do this and you will hook your fish. Don't do it and the project will be one that got away.

### The conclusion

- In your conclusion, do two things:
- Reinforce your readers' memories by restating your most important ideas.
- Define the action that should happen next.

This should be straightforward: Read what you've written in the body of the proposal, pick out the most important points, and restate them as a concise bulleted list. Then write a polite 'call to action.' Define not only what should happen next, but also who should do it. If the method of responding to proposals was defined in the RFP, this could be nothing more than, "Please contact us if you have any questions." But if you are in a position to define what happens next, you might write, "I would like to meet with you to go over this proposal and respond to your questions."

Richard Kronick is a freelance technical writer and writing trainer specializing in transportation, civil engineering, and architecture. He has presented more than 1,000 business writing and technical writing seminars around the world. He can be reached at **www.richardlkronick.com.** 

### Science of Safety from page 5

relevance of the HSM for road-owning agencies across the country. "This is a very useful tool," he said. "It will be a big help for road agencies at state and local levels as they evaluate, design, plan for and implement safety improvements in their respective communities."

Everyone familiar with the HSM agrees that it will be a great tool for improving roadway safety, but some are expecting more-especially those who have experience with implementing safety improvements at the local level. Wayne Schoonover, P.E., County Highway Engineer for Ionia County Road Commission in Michigan, says the HSM could help local road agencies pay for road projects. He has been an enthusiastic participant in the Michigan Department of Transportation's (MDOT) Local Safety Initiative program (see "MDOT Local Safety Initiative," on page 5) since it was created in 2004. "The success we've had in securing federal safety funding for Ionia County road improvements is a great example of the value of a data-driven approach to safety," Schoonover said. "If not for the quantifiable solutions that MDOT's Local Safety Initiative group helped us define, we would not have qualified. The Highway Safety Manual can help any agency define quantifiable solutions to their safety problems, which could help them secure similar funding."

For more information about the Highway Safety Manual, including how to order it, please visit www.highwaysafetymanual.org.

### References

Hauer, E. (1999a). Safety in Geometric Design Standards, p19. Retrieved December 9, 2010,From https://ceprofs.civil.tamu. edu/dlord/CVEN\_635\_Course\_Material/Safety\_in\_Geometric\_ Design\_Standards.pdf

Hauer, E. (1999b). Safety in Geometric Design Standards, p2. Retrieved December 9, 2010,From https://ceprofs.civil.tamu. edu/dlord/CVEN\_635\_Course\_Material/Safety\_in\_Geometric\_ Design\_Standards.pdf.

### Life wide open

Life is not a journey to the grave with the intention of arriving safely in a pretty and well preserved body, but rather to skid in broadside, thoroughly used up, totally worn out, and loudly proclaiming "*Wow! What a ride!*"

# Help from FHWA for local agencies that use federal aid for road projects



Kurt Zachary, P.E. is the new local program engineer for the Michigan division of the Federal Highway Adminstration (FHWA). The FHWA created the new position to help oversee and administer local agency projects that use federal aid in Michigan.

In his new position, Zachary's goal is to enhance relationships with local agencies in the context of FHWA's stewardship agreement with the Michigan Department of Transportation (MDOT). "My main objective is to conduct program oversight and provide stewardship to local agencies," he said. "I'm really looking forward to getting out in the field and meeting the men and women who are translating federal aid funding into road improvements."

Through his work with local agencies, Zachary will also help promote FHWA initiatives like Every Day Counts, and will assist MDOT to develop a Local Program Manual.

Since graduating from Michigan Technological University with a Bachelor of Science degree in Civil Engineering, Zachary has been involved in some level of local agency project delivery for over 21 years. Most recently, he worked for three years as FHWA Michigan Division Area Engineer for MDOT's University and North Regions. Before that he worked for a consulting company as a construction engineer, and before that for MDOT's Construction Division.

**Contact information:** Kurt Zachary, P.E. 517-702-1832 Kurt.Zachary@dot.gov





Local Technical Assistance Program Michigan Technological University 309 Dillman Hall 1400 Townsend Drive Houghton, MI 49931-1295 906-487-2102

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The FY 2013 High Risk Rural Roads (HRRR) and Local Agency Safety (STH) programs include approximately \$15 million in Federal funding for local agencies to implement safety improvements on local roads. Project selection requirements are similar to the safety programs process in past years.

All the details are available on the MDOT web site. For a direct link, go to **www.MichiganLTAP.org/pubs**, and then select **"MDOT Safety/HRRR program"** from the list.



# Events and Resources

## Webinars

**Introduction to RoadSoft** 

Includes the following two-hour sessions: May 2 – Overview / Understanding RoadSoft May 3 – Using the Road Module May 4 – Data Collection / Using the LDC May 5 – Managing your RoadSoft Data

### Workshops and Conferences

**2011 Asset Management Workshop & Conference** May 11-12 – Grand Rapids

PASER Training, on-site sessions March 15 – West Branch; 16 – Saginaw; 17 – Howell; 29 – Kalamazoo; 30 – Lansing April 12 – Gaylord; 13 – Escanaba; 14 – Ishpeming Michigan Bridge Workshop and Conference March 22-23 – Big Rapids Constructing Pedestrian Facilities for Accessibility

April 6 and 12 – Okemos

For more info: www.MichiganLTAP.org/workshop