

IOWA HIGHWAY RESEARCH BOARD (IHRB)

Minutes of July 30, 2010

Regular Board Members Present

A. Abu-Hawash
V. Dumdei
R. Knoche
M. Nahra
D. Schnoebelen

J. Waddingham
W. Weiss
J. Moellering
R. Younie

Alternate Board Members Present

J. May for J. Joiner
K. Mayberry for D. Ahart

Members With No Representation

J. Alleman
J. Berger
B. Moore
C. Schloz

Secretary - M. Dunn

Visitors

Edward Engle
Kyle Hudson
Bart Bergquist

Iowa Department of Transportation
The University of Iowa
University of Northern Iowa

The meeting was held at The University of Iowa's Lucille A. Carver Mississippi Riverside Environmental Research Station (LACMRERS) near Muscatine, Iowa, on July 30, 2010. The meeting was called to order at 9 a.m. by Chairperson Jay Waddingham with an initial number of 11 voting members/alternates at the table.

Agenda

No changes were made to the Agenda.

Motion to approve Minutes from the June 25, 2010, meeting by W. Weiss. 2nd by M. Nahra.

Motion carried with 11 aye, 0 nay, 0 abstaining.

FINAL REPORT TR-551, "Local Agency Pavement Marking Plan," Neal Hawkins, Iowa State University (\$157,081)

BACKGROUND

In April 2010 the Federal Highway Administration published a notice of proposed amendments (NPA) for the *Manual on Uniform Traffic Control Devices* (MUTCD) regarding pavement marking retroreflectivity. The proposed revisions would establish a uniform minimum level of nighttime pavement marking performance based on the visibility needs of nighttime drivers.

This research demonstrates how a pavement marking maintenance method could be developed and used at the local level, addressing common problems in achieving good pavement marking quality. This research also provides recommendations specific to those issues in terms of assessing pavement marking needs, selecting pavement marking materials, contracting out pavement marking services, measuring and monitoring performance, and in developing management tools to visualize pavement marking needs in a GIS format.

OBJECTIVES

The research included five case studies, three counties and two cities where retroreflectivity was measured over a spring and fall season, and then mapped to evaluate pavement marking performance and needs (asphalt and concrete). The research also included over 35 field demonstrations (installation and monitoring) of longitudinal and transverse durable markings in a variety of local agency settings within an intense-snow state.

BENEFITS

The proposed FHWA amendments to the MUTCD will change the way local agencies manage their pavement markings, placing emphasis on pavement marking quality and management methods. This research assists local agencies in developing a pavement marking plan which meets the visibility needs of both daytime and nighttime drivers on the local roadway network. With a national pavement marking minimum performance threshold and tools for local agencies to manage marking thresholds, the goal of promoting safety, enhancing traffic operations, and facilitating the comfort and convenience for all drivers is attainable and will appropriately begin at the local level.

C: Regardless of how we do this, it's going to cost us a lot more money. We've seen a 40% increase from two years ago. Our pavement marking is driven as much by how much money we have as what needs to be done. We pick the worst 30-40% and paint it. That's not going to work anymore.

A: This will help you gauge what you need to get to those benchmarks.

A: Choices need to be made on what to paint. That's where measuring comes into play; it's a big issue. Some are unable to paint at all, and need to let it go another year or use other products.

Q: What is the cost of a meter?

A: The one we have now is about 20K; however, counties and cities could share the cost and use of meters. There are options to do things creatively.

C: For the proposed rulemaking, allowances for Midwestern states are being made because states are saying they can't maintain and measure during snow cover. The bottom line is the service must be provided but the money needs to come from somewhere.

C: This is good work. It's just that there are financing issues we need to deal with.

Motion to Approve by M. Nahra. 2nd by R. Knoche.

Motion carried with 11 aye, 0 nay, 0 abstaining.

BACKGROUND

Studies show that greater longitudinal pavement marking retroreflectivity levels increase visibility and detection distance. However, increased visibility may also make drivers too comfortable during nighttime conditions and as a result, they pay less attention and/or operate at unsafe speeds. Improving the safety of rural roadways is the major motivation behind determining a relationship between pavement marking retroreflectivity and crashes.

It is assumed that lower retroreflectivity values contribute to some crashes (such as nighttime, single vehicle, ROR crashes), however, a statistically significant relationship has not yet been determined. If a statistically reliable relationship can be identified, agencies can improve pavement marking management programs and reduce nighttime crashes where low pavement marking retroreflective values are a contributing factor.

OBJECTIVES

Using Iowa DOT data under nighttime conditions, this research focused on achieving the following objectives:

- Capitalize on current research efforts and develop a systematic method to compare pavement marking and crash data for a given roadway segment.
- Investigate varying levels of pavement marking retro-reflectivity and impacts on crash performance (*minimum retro-reflectivity levels*).
- Use these findings to develop strategies for agencies to determine the investment level needed for pavement markings (*pavement marking management*).

BENEFITS

This research could improve safety through a better understanding of how pavement marking brightness influences nighttime crash performance in Iowa. The research will have national significance because these findings will assist FHWA in rulemaking for minimum levels of pavement marking retro-reflectivity. Agencies can benefit in adjusting thresholds for investment in roadway markings, and gain understanding of pavement marking needs when analyzing differing roadway categories and/or functions.

Q: Does wet reflectivity cost a lot more?

A: About \$4/per square-foot more. There are less expensive alternatives.

Q: Would it be possible to include discussion on some of the legal precedence on management systems in the final report? That would be helpful.

A: Yes. We will definitely include that in the final report.

NOTE: Voting for approval on TR-580 was delayed until conclusions are finalized and researchers add an appendix of legal case histories.

FINAL REPORT TR-610, "On-the-Spot Damage Detection Methodology for Highway Bridges," Salam Rahmatalla, The University of Iowa (Innovative Seed Funding - \$69,092)

BACKGROUND

In Iowa 21% of bridges are structurally deficient and over 1,000 bridges more than 100 years old. The development of technologies related to damage detection and extension of bridge life is crucial.

Through the use of health-monitoring systems, a more accurate understanding of bridge integrity beyond what visual inspection provides is achievable. With this knowledge, designers and maintenance professionals can create a relevant and cost-effective strategy for maximizing the life of the bridge.

Issues that must be addressed by a health-monitoring system generally fall into two categories: 1. Reliability and, 2. Accuracy and efficiency of methods when applied to an actual structure.

OBJECTIVES

The objective of this study is to apply these state-of-the-art damage detection methods, namely VBDI, to laboratory structures and an Iowa DOT bridge to assess the potential of an experimental approach to damage detection methodology as it applies to highway bridges in Iowa. This evaluation method uses FRF curvature (with various curve fitting models), such as the gapped-smooth-method (GSM) to detect damage. The evaluation also considers relative motion due to impact loading and operational loading (in the form of frequency domain animations) to complement damage detection results.

BENEFITS

By animating the response of a field bridge, concrete cracking (in the abutment and deck) was correlated with structural motion and problem frequencies (i.e., those that cause significant torsion or tension-compression at beam ends). Furthermore, a frequency-domain study of operational traffic was used to identify both common and extreme frequencies for a given structure and loading. This novel approach, operational response and waveform analysis (ORWA) may assist bridge engineers in their decision-making with regard to maintenance plans and management.

Q: This focuses on testing superstructure, not on substructure, correct?

A: No. We put some sensors on the substructure as well. This (PowerPoint slide) represents only part of the data; there are support data for substructures, too.

C: I'm not sure this follows the original problem statement, although it is an interesting study.

C: I think there should be something detailing load during a flood event.

C: Usually, other than impact damage from something coming downstream during a flood, the problem is scour, and this isn't going to tell you a whole lot about scour.

A: But scour will change the dynamic characteristics quite significantly; a lot of work has been done verifying how the substructure changes and affects the dynamic response of a bridge. So, if you do have significant scour, your bridge could be responding differently than when under normal traffic loads.

Q: So how do you define the damage? You're not really comparing to a benchmark, you're taking measurements. What's the basis for determining a major scour event? Or more flexibility?

A: There is a proof-of-concept for this methodology. I think normally you need a baseline for comparison.

C: So we need to take baseline data for 4,000 bridges?

A: The baseline is useful but even if you don't have one, there are other benefits gained from using this correlation method.

Q: But can you quantify the damage after an event? Can that be done?

A: Yes. We can collect information from sensors; when this tool is combined with other tools, it proves useful. We're not saying this tool will solve everything.

C: Maybe the confusion is the title of this research project.

A: Our original goal was to detect vibration-based damage. However, once out in the field, we realized how difficult that would be. This research has benefits going back to what the original goal was.

C: It's as though we've stumbled upon another type of non-destructive testing in spotting defects in the bridge; vibration testing gave some interesting results. However, the title includes a reference to crisis.

C: We recommend removing the reference to 'crisis' in the title.

C: Whether you're testing to see what traffic, flooding or an impact is doing, responses are universal and shown in the report. We didn't know at the beginning how universal it would be.

Motion to Approve With Title Revision by A. Abu-Hawash. 2nd by M. Nahra.
Motion carried with 11 aye, 0 nay, 0 abstaining.

PROJECT UPDATE

Edward Engle, Secondary Roads Coordinator, Iowa DOT Research Bureau, gave an update on pooled-fund project **TR-563, "The Effects of Implements of Husbandry Farm Equipment on Pavement Performance"** which the Board is funding in part. Other funding contributions for this project (and involvement) comes from private industry and other states, including Minnesota.

A brief discussion followed.

ADJOURN

Motion to Adjourn by V. Dumdei. 2nd by W. Weiss.
Motion carried with 11 aye, 0 nay, 0 abstaining.

LACMRERS TOUR: Due to inclement weather the river excursion was cancelled. A luncheon was hosted by The University of Iowa and the Board was given a tour of LACMRERS by Director Dr. Douglas Schnoebelen.

The next meeting of the Iowa Highway Research Board will be held on Friday, September 24, 2010, in the East/West Materials Conference Room at the Iowa DOT.

Mark J. Dunn, IHRB Secretary