IOWA HIGHWAY RESEARCH BOARD (IHRB)

Minutes of September 25, 2009

Regular Board Members Present

J. Berger
V. Dumdei
S. Gannon
M. Nahra

Alternate Board Members Present

W. Zitterich for John Adam
K. Mayberry for Dan Ahart
D. Schnoebelen for Keri Hornbuckle
E. Steffensmeier for Brian Moore
J. Moellering for Scott Rinehart
J.D. King for J. Jay Waddingham

Members With No Representation

A. Abu-Hawash
J. Alleman
J. Joiner
J. Krist
W. Weiss

Alternates Present as Guests

None

Secretary - M. Dunn

Visitors

Edward Engle	Iowa Department of Transportation
Mary Starr	Iowa Department of Transportation
George Constantinescu	The University of Iowa
Bart Bergquist	The University of Northern Iowa
Christy Twait	The University of Northern Iowa

The IHRB 2009 Travel Meeting was held at the University of Northern Iowa Business and Community Service Building, Room 30, Cedar Falls, Iowa, on Friday, September 25, 2009. The meeting was called to order at 9 a.m. by Chairperson Jim Berger with an initial number of 9 voting members/alternates at the table.

University of Northern Iowa's (UNI) President Benjamin Allen welcomed the Board, speaking briefly about UNI's commitment to transportation research. Following the business meeting, a box luncheon was generously provided by his office and the following speakers addressed the Board on various topics:

- Sunde Nesbitt - Aggressive Driving Research at UNI
- Tim Strauss - Update on UNI's Midwest Transportation Consortium
- Jeff Nie - WAVE Transportation Technology
- Sugumaran Ramanathan – GeoTREE

After presentations the Board toured UNI's Tallgrass Prairie Center, hosted by Director Dr. Daryl Smith.

Agenda

None

Approval of the Minutes

Motion to approve minutes from the July 31, 2009 meeting by V. Dumdei. 2nd by M. Nahra.
Motion carried with 9 aye, 0 nay, 0 abstaining.

Presentation - Implementation Reports for Selected Recent Projects, Edward Engle, Iowa DOT Secondary Roads Research Coordinator, Research and Technology Bureau

All IHRB funded research projects are required to have a completed Implementation Report (IR) for final approval. The IR assists the Board and Iowa DOT in good stewardship of funding for delivery of valid, substantial, measurable and implementable research through accountability. Policies, procedures and standards affected by research projects need to be re-evaluated. The Technical Advisory Committee (TAC) for final projects completes the IR form and must give specifics concerning valid implementation; after one-to-two years, the IR is reviewed to make certain recommendations have been integrated into processes, standards, etc. Projects with good implementation were presented as examples, including:

TR-520, "Evaluation of Dowel Bar Retrofits for Local Road Pavements"
TR-530, "Development of an Improved Integral Bridge Abutment-to-Approach Slab Connection";
TR-550, "Performance Evaluation of Rubblized Pavements in Iowa";
TR-502, "Evaluation of Long-Term Field Performance of Cold In-Place Recycled Roads"
TR-552, "Field Evaluation of Timber Preservation Treatments for Iowa Highway Applications"

Recently, an Iowa DOT Implementation Committee was formed that will meet quarterly to review projects from the past quarter or year, and evaluate project results and implementation to be shared with upper management. In the future, Implementation Committees will be formed within the counties and cities as well. The goal is to provide 4-5 project appraisals to upper management for dissemination of implementation.

One Member Joined the Table

Final Report TR-458, "Field Testing of Abrasive Delivery Systems in Winter Maintenance," Wilf Nixon, The University of Iowa ($151,920)

BACKGROUND
On snow or ice covered roadways, it is necessary to increase friction levels on the roadway's surface. This improvement in friction is best achieved by a pro-active use of chemicals. However, sometimes the application of chemicals may not be recommended or possible. In such circumstances, abrasives have frequently been used to improve the friction level of the snow or ice covered roadway (temporarily).

OBJECTIVES
To investigate various methods of applying abrasives to roads in winter weather and enhance friction on the road for as long as possible. This research investigated five different ways to deliver abrasives to the road using a snowplow truck, utilizing: 1) A spinner (provided a baseline for comparison); 2) Zero-velocity spreaders; 3) Chutes; 4) Pre-wetting systems; and 5) Thermal systems.

CONCLUSIONS
- Zero-velocity spreaders provide significant improvements in material placement compared to either spinner or chute delivery of material.
- No significant differences were observed in the friction benefits of abrasive placement between a spinner or a chute delivery system. Both provided an initial friction benefit that diminished fairly rapidly over time.
- Thermally enhanced application systems have been developed in Scandinavia and been shown to work well, but it is not clear that such systems are feasible in Iowa.
- Studies have shown clearly that pre-wetting material at rates of approximately 8 gallons of liquid per ton of material provide significant benefits both in terms of initial material placement and subsequent material retention.

C: We've frequently made use of a spreader on a two-lane road because of its ability to apply material on both sides of the center line. That has been an advantage because you can get material out on the roads quickly.
A: All of this is an issue of different benefits under different circumstances. Getting material out onto both sides of the road quickly may outweigh putting down a wind-row of material under certain circumstances. Under other circumstances, another method might be advantageous.

C: The Iowa DOT is using all of these methods. We're pre-wetting and using zero-velocity at the same time; one of the advantages of the zero-velocity is that the material can be aimed specifically and placed where it needs to be. Most districts have a choice of systems to put on their trucks. Central Iowa already has about 50 trucks with zero-velocity spreaders. These are a roughly $7,000 add-on, but they save money because they can specifically place materials. We're investigating using salt money to buy more.
Q: So you're using a standard tail-gate spreader but it's the actual head where materials are dispersed?
A: Yes, but part of what we were looking for was salt savings because of rising costs. With this project, abrasive applications were being evaluated; I think that's two different things. We want the same results as far as the product we're using and how good the roadway's friction-levels are, but we wanted to do it with less salt. Salt is a major portion of Iowa DOT's operating budget.
A: Just as a measure on that point – if you compare pre-wet material with dry material on the road, about 30% of dry material down goes straight into the ditch. Pre-wetting pays for itself, particularly with the high cost of salt. Also, the quality of new zero-velocity spreaders is considerably better and they're less prone to break down.

Q: Does your research look at different strategies for salt placement?
A: We compared the chute with the spinner. The chute windrows salt (puts it in a line) and the tailgate spinner can be adjusted to spread material faster and further and control the direction it goes.
C: The Iowa DOT wants to plow at highway speeds to avoid accidents; this is where the speed of zero-velocity is an advantage.
C: In the county, we're running about 25 mph when plowing two-lanes; we're not running that spreader hard. We're not casting all the way across the road because we expect to get some melting and scatter. The middle is what we're shooting for.
A: The meter we've been using for this isn't measuring variations in friction with locations across the road; it measures the gross affect of friction on the vehicle. There are friction measuring devices to measure friction in a wheel-path; however, they're a great deal more expensive. I don't know that any comparisons have been made between the two types of data.

Motion to Approve by W. Zitterich. 2nd by E. Steffensmeier.
Motion carried with 10 aye, 0 nay, 0 abstaining.

Final Report TR-472, "Investigation of Materials for the Reduction and Prevention of Corrosion on Highway Maintenance Equipment," Wilf Nixon, The University of Iowa ($80,000)

BACKGROUND
Corrosion of winter maintenance equipment is becoming of greater concern because of the increased use of liquid solutions of ice control chemicals, as opposed to their application in solid form. Methods to minimize corrosion may include coatings, additives, cleansing techniques, or doing nothing, and accepting a reduced equipment lifetime as a valid trade off with the enhanced benefits of using liquid ice control chemicals. Some combination of these methods may also be optimal. Whatever solutions are selected, they must be relatively cheap and durable.

OBJECTIVES
To determine how corrosion occurs on maintenance trucks, find methods to minimize corrosion mechanisms, and suggest a mode of analysis to determine the optimal combination of approaches for a given maintenance

situation. The research included three major areas: a literature review, laboratory experiments, and the development of suggested approaches to minimize corrosion.

CONCLUSIONS

- Given uncertainties on the performance (in the field) of corrosion inhibitors, it is recommended that ice control chemicals not be selected on the basis of their potential to reduce corrosion due to inhibitors.
- A detailed field test should be conducted to determine the benefits and costs of different types of vehicle washing systems.
- A working group should be formed to identify simple design changes in trucks that either avoid the potential for corrosion or make subsequent maintenance against corrosion simple.
- Field trials of various coating systems should be conducted over a period of several winters.

C: One of the difficulties in washing trucks also relates to the metal buildings where they are cleaned; the buildings have problems from moisture.
A: In Minneapolis, the Minnesota DOT has a dedicated truck wash facility designed to get salt off the truck; the corrosive, humid environment can be addressed. But it's not cheap.
C: Scott County did that, too.

C: When you wash trucks and that water discharges to a septic tank and drainage field, criteria for chlorides must be considered. The Iowa Department of Natural Resources (DNR) has regulations on wash discharge. To build systems that recycle wash, the cost is $250,000 per building.
A: Yes, and acetates may also be an issue for the water supply.

C: We use stainless steel trucks now and high pressure steam is used to wash them. I'm not sure the washing is a benefit to the longevity of the truck. If you look at the quality of the truck that gets washed after five years, I don't see how you could do worse by only washing it after big events.
A: Different rates of washing is one of the issues that could bear investigation; you never get rid of all the chlorides. The objective is to get most of the chlorides off, especially those in trapped areas.
C: I've observed benefits of getting rid of slide-in spreaders. After we did that, it increased the life of our dump-body significantly. There's no way to get the bed clean with those. Tailgate spreaders made a difference as well; you can actually get in and spray down that type of box. We're also using paintable stainless steel, paying about 1.5% more than for a steel body but we've projected not having to replace it.
C: We're also putting stainless steel in the corners of our boxes and that's a current design that works with steel trucks. Most of the time we don't have to replace the truck box before we sell it.

Q: Did you test a selection of washing additives?
A: We collected information on additives from those working in the field. It was anecdotal evidence, but all of the quotes and surveys are in the report.
Q: What kind of issues did they have with disposing of the wastewater? In Delaware County, we tried to use the recommended soap to avoid suds and foaming problems and issues with the recycling process.
A: None of the information I received indicated problems with that, however, that could simply mean there was a self-selecting group which may not have responded even if there were issues.
C: If there's access to sanitary disposal there's not as much of a problem, but if you have your own shop, there could be issues.

Motion to Approve by M. Nahra. 2nd by D. Schnoebelen.
Motion carried with 10 aye, 0 nay, 0 abstaining.

Final Report TR-491, "Development of Winter Performance Measures for Highway Winter Maintenance," Wilf Nixon, The University of Iowa ($100,000)

BACKGROUND
In any operational activity it is important to evaluate the quality of work completed. In winter maintenance, this is difficult. Different storms pose different challenges. Roads are maintained to different levels of service. Additionally, a performance measure should have both strategic and tactical value–that is, it should allow a review of performance after a storm or a season, and an adjustment of actions during a storm in response to unacceptable performance measures. The challenge is to find a measure that not only captures storm severity and road type, but also can be easily measured and acted upon in real time.

OBJECTIVES
To develop a method for measuring the performance of winter maintenance operations, including: 1) The impacts of winter weather on safety (crash rates) and mobility (average vehicle speeds); 2) A storm severity index; and 3) An expected speed reduction to serve as a performance target for winter maintenance operations for a given road class and storm severity.

CONCLUSIONS
- The impact of winter weather on safety and mobility has been determined. Crash rates increase by 84% in winter weather compared to normal weather, and mobility losses may result in reductions of average speed of as much as 24 mph depending on storm severity and road type.
- Winter storms have been described in a systematic and comprehensive, yet simple, way. This description is such that it can be converted into a storm severity index between 0 and 1. The index has been evaluated by maintenance supervisors, and has been adjusted to reflect their concepts of operational severity.
- By combining road type and storm severity, a target speed reduction can be calculated for any road under any given storm condition. This speed reduction serves as a performance target that can be used both strategically and tactically. Provided speed reduction on a given snow route is less than the performance target, then performance is satisfactory.

Q: How are these measurements being taken?
A: These measurements are a collection of data from the Iowa DOT's traffic and speed sensors.
C: Speed and traffic sensors, volume sensors, cameras and Road Weather Information Systems (RWIS) stations allow us to measure speed related to what is happening on the roadway when measuring the performance of highway winter maintenance measures. There are huge variations of interstate data reflecting speeds, so Iowa DOT is using 10 mph below the speed limit as a threshold. Eastbound/ westbound speeds can vary as well.
Q: Is this over time?
A: Speed data collected on a road over time—a database of speed data—allows measurement of average speeds over, for example, 15 minutes. It can be determined if the target measures were met or not. Was there more or less speed reduction based on the intensity of the storm? A time window is set and average speeds considered.

Q: How will this information be used in a day-to-day basis?
A: An agency could select locations on the road that need to be taken care of and use those as measuring points. Over time, a model of how speed varies during the day on that road is formed. That's your baseline data. When a storm is imminent with a severity of .7 on a priority B road, then a reduction (of up to .7 x 22 mph) can be expected. Performance goals can be determined by the rate of speed during the storm. On the basis of Iowa DOT data utilized, these models were reasonably accurate for storms rated from .2 to .8.

Motion to Approve by W. Zitterich. 2nd by V. Dumdei.
Motion carried with 10 aye, 0 nay, 0 abstaining.

Proposal Continuation of HR-140, "Collection and Analysis of Streamflow Data" Dave Eash and Greg Nalley, U.S. Geological Survey ($239,440)

BACKGROUND
The Office of Bridges & Structures obtains the necessary hydrologic information from several sources; however, roughly 80% of this information is obtained from the Water Resources Division of the United States Geological Survey (USGS), whereas, data concerning specific locations of interest to the Iowa DOT are prepared by the USGS through a continuing, cooperative program between the Iowa DOT and the USGS.

OBJECTIVES
HR-140 was established July 1, 1968, by consolidating three separate research projects under contract between the U.S Geological Survey (USGS) and the Iowa State Highway Commission. For the USGS, Iowa Water Science Center, HR-140 funds three separate programs: 1) Continuous-record streamflow-gaging stations in Iowa, 2) Partial-record (crest-stage) gaging stations in Iowa, and 3) Flood profiles of Iowa streams.

This research will allow USGS personnel to:

- Operate, maintain, and publish streamflow data for 25 continuous-record gaging stations in Iowa
- Operate, maintain, and publish high-flow data for 89 partial-record (crest-stage) gaging stations in Iowa
- Collect and publish water-surface profiles and storm and flood description information for significant flood events of interest to the Iowa DOT; Collect and compile data from the June 2008 flood on the Upper Iowa, Iowa, and Cedar Rivers for over 80 bridge sites and 600 river miles

BENEFITS
Primary products of this study include the USGS annual water resources data report and flood-profile reports. Information from flood-elevation profiles is used by engineers to analyze and design bridges, culverts, and roadways. Water-surface elevations, collected both upstream and downstream of bridges, enable engineers to model the hydraulics of actual flood events. Flood-profile reports provide engineers with information on the magnitude and frequency of flood events.

Q: If there's a storm upstream, can it be predicted when that high water will reach a certain point downstream?
A: We have information from gaging stations; primarily, these stations monitor and record information during flooding and high water levels.
C: The issue I'm referring to happened on the Cedar River at Interstate 80; the first flood gate station is 30 miles upstream, and there's no way of knowing when the high water will go over the road. We're considering using your data for estimating when the water will go over the road. You don't want to close the road any sooner than you have to, however, you need to close it quickly when needed. That information is valuable.
C: What made the flood of 2008 so significant is that the rain moved with the crest, and the crest was continually increasing much higher than any prediction because water was continually added and the time of retention was the same as the crest moving downstream.

Q: Did the gage at Cedar Rapids have to be replaced? Are there other gages that need to be moved?
A: At Cedar Rapids, it went under water. When they have the railroad bridge finalized and all of the debris is moved out of that area, we're going to move the gage toward that location because it didn't go under water. There were 4-5 other gages that went under water and we'll be moving those; replacement costs are included in the operating budget.

Motion to Approve by M. Nahra. 2nd by E. Steffensmeier.
Motion carried with 10 aye, 0 nay, 0 abstaining.

Proposal *Wind Loads on Dynamic Message Cabinets and Behavior of Supporting Trusses*, Asghar Bhatti, The University of Iowa/IIHR ($218,498)

BACKGROUND
Most of the current guidelines for wind design of highway structures are based on wind tunnel studies with some limited field investigation. Recent advances in the computational fluid dynamics (CFD) have made tools available that allow realistic simulations of actual field conditions at a fraction of the cost of wind tunnel studies. In particular, the use of time-accurate simulations can provide not only the time-averaged pressure distribution on the Dynamic Message Sign (DMS) cabinets but also information on the unsteady pressure distributions and forces. Specifically and most importantly, the pressures and forces associated with large scale vortex shedding behind the DMS cabinets.

OBJECTIVES
The CFD component will be conducted by the University of Iowa, while the field study will be conducted by Iowa State University. These analyses will include both the material and the geometric nonlinearities and hence will enable the investigators to thoroughly study the dynamic and fatigue behavior of highway structures subjected to severe wind conditions.

BENEFITS
The primary product of the project will be the final report documenting the findings of the study, including:

- Methodologies (e.g., description of CFD and structural analysis codes; parameters; boundary conditions; assumptions; detail of the test cases considered in the field study; data collected; physical interpretation)
- Simulation results
- Comparison between numerical results and field study
- Design recommendations

The final report will easy to understand and available in electronic and printed format. Several conference papers summarizing the scientific and practical relevance of the study will be prepared.

Q: How will this be cost-shared?
C: It's not really a county issue; and cities have a small budget.

Motion to Approve and Fund 100% With State Funding
by W. Zitterich. 2nd by V. Dundei.
Motion carried with 10 aye, 0 nay, 0 abstaining.

NEW BUSINESS
None

ADJOURN
Motion to Adjourn
Motion by M. Nahra. 2nd by K. Mayberry.
Motion carried with 10 aye, 0 nay, 0 abstaining.

The next meeting of the Iowa Highway Research Board will be held on Friday, October 30, 2009 at 9:00 a.m. in the East/West Materials Conference Room at the Iowa DOT.

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Mark J. Dunn, IHRB Secretary