

IOWA HIGHWAY RESEARCH BOARD (IHRB)

Minutes of February 25, 2011

Regular Board Members Present

A. Abu-Hawash
D. Ahart
J. Alleman
J. Berger
V. Dumdei
J. Joiner

J.D. King
R. Kieffer
R. Knoche
J. Moellering
D. Schnoebelen
R. Younie

Alternate Board Members Present

None

Members With No Representation

M. Nahra
C. Schloz
E. Steffensmeier

Secretary - M. Dunn

Visitors

Brian Keierleber

Buchanan County, Iowa

Gordon Smith

Iowa Concrete Paving Association

Vanessa Goetz

Iowa Department of Transportation

Dale Harrington

Iowa Department of Transportation

Ken Dunker

Iowa Department of Transportation

Mary Starr

Iowa Department of Transportation

Jeremy Ashlock

Iowa State University

Dale Harrington

Iowa State University/CP Tech Center

The meeting was held at the Iowa Department of Transportation Ames Complex, Materials East/West Conference Room, on Friday, February 25, 2011. The meeting was called to order at 9 a.m. by Chairperson Doug Schnoebelen 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 December 9, 2010 meeting by R. Knoche. 2nd by J. Alleman. Motion carried with 11 aye, 0 nay, 0 abstaining.

*** One Member Joined the Table***

FINAL REPORT TR-591, "Stabilization Procedures to Mitigate Edge Rutting for Granular Shoulders," Charles Jahren, Iowa State University/InTrans (\$91,638)

BACKGROUND

Several conditions coincide to cause edge ruts in granular shoulders. Air movements (generated by traffic) blow fine particles away from the pavement edges, which would otherwise serve as binders to hold the shoulder materials together and resist rutting. When vehicles go off-track and drop off the edge of the pavement, they displace the larger, remaining particles. The drainage from the pavement surface is concentrated at the edge, softening the shoulder materials and exacerbating the displacement process. The deeper binding materials that haven't been blown away are compacted by off-tracking vehicles into a hard crust 1-3 inches below the pavement edge.

OBJECTIVES

- Develop a series of strategies for mitigating edge rut problems using various mixtures and gradations of granular materials and various stabilization agents.
- Rate the performance of a subset of the above-mentioned strategies by constructing and observing test sections.
- Recommend strategies based on the results of test section performance.
- Assist the Iowa Department of Transportation (DOT) in implementing the use of the recommended strategies.

BENEFITS

Efforts to eliminate edge ruts are important for several reasons. Granular shoulders with rutting and drop-off may contribute to drivers losing control and running off the road. Possible results are property damage, injuries, and/or fatalities.

Q: Does the salt (Calcium/Magnesium Chloride or $\text{CaCl}_2/\text{MgCl}_2$) dissolve away when it rains?

A: Yes, it does.

Q: How long does Dustlock™ stay there?

A: Typically I believe it acts the same as dust treatments near residences; applications could occur once in the spring and one or two times during the year. It's very inexpensive (Dustlock™).

Q: What is the cost for Dustlock™ per square foot?

A: I believe it will be roughly \$1 per square yard. It is more expensive than the MgCl_2 however it is approaching the cost of putting down a layer of sealcoat.

C: In Iowa, District 2, we were excited about this research because there are a lot of edge rut issues with this in our district. We had real success with this Dustlock™ on a curve that required our attention in the summer more than once a week. After five years and no maintenance it only subsided a small amount. This would have continued if we hadn't rehabilitated the road (it had settled about .5" over time). I believe we placed granular material to fix the edge ruts prior to the Dustlock™ which was sprayed on top. We have been trying to find a way to buy this where it isn't proprietary or contract it out. I was excited about your final report, however, I'm not sure we have enough information to spec the material. It still looks proprietary. We intend to buy the material and write a public interest finding to justify its purchase.

A: Other products we're looking at are binders where fine particles are actually being cemented together. This is more of a membrane you're putting over an existing hard surface; in fact, if you mix it up and make it into something more like a concrete, the material never really sets up. Other materials we've looked at actually harden.

C: You mentioned paved shoulders. The Iowa DOT is considering retrofitting shoulders. A section on US20 is a priority for District 2. It's going to be over \$1M to pave the shoulders. Paving the shoulders is the right answer in a lot of cases, but it is very expensive, especially when you look at what each district has for critical areas. We'd like to find a less expensive solution we can either do ourselves or contract out (or maybe both).

A: On US20, a possible demonstration project might be to put down 5000' of 4' shoulder paved and then in the areas in-between, try using Dustlock™. I looked up the area you're referring to (Garner, Iowa on US18), which has roughly 6500 vehicles per day with a lower speed limit.

A: At the beginning of this project we went out and recovered part of the material. It was still there in 2007 during Phase I of this project. It's amazing how long it lasts.

C: You referred to the shoulder cross slope as contributing to the edge rut problem. New shoulders are built at 4%. We allow 4% to 8% before we look at improving the shoulder. Should we be changing this allowance?

A: No. 4% to 8% is reasonable. Flatter shoulders hold water and can create problems.

Q: If you moved on with this could you develop a specification of some kind so we could contract this out?

A: Yes, I believe it would be possible after speaking with engineers from Minnesota. They've developed a procedure to place the material. It might be something we could look at and then if we focused more on this particular product, maybe find other competitive products. We looked at quite a few polymer-type products, but none seemed to have the characteristics of Dustlock™.

C: It almost seemed that the results of using CaCl₂/MgCl₂ (at least on US20) showed that the issue we have out here isn't fine particulates blown away.

A. Maybe on a low volume gravel road where ruts can develop the process would be different.

Q: Do we need more study on the actual cause of edge-rutting? We know that tracking/off-tracking causes it.

A: Maybe we don't know exactly why it's happening in every case, but I think we know enough about it to begin moving forward with some solutions. Developing a contractive method in order to pave some shorter sections in these chronic areas would help in spreading out paving funding and secondary to reduce the number of maintenance cycles in places where we don't pave would be the most effective.

C: We need to understand the composition of the material for the specs.

Motion to Approve by V. Dumdei. 2nd by J. Alleman.

Motion carried with 12 aye, 0 nay, 0 abstaining.

FINAL REPORT TR-574, "Structural Design, Construction and Evaluation of a Pre-stressed Concrete Bridge Using Ultra High-Performance Concrete Pi Girders," Terry Wipf, Iowa State University/InTrans (\$79,993)

Introduction: Brian Keierleber, Buchanan County engineer, thanked the Iowa Highway Research Board (IHRB) for the opportunity to host this Ultra High Performance Concrete Pi Girder demonstration bridge in his county.

BACKGROUND

In autumn 2008, the Jakway Park Bridge in Buchanan County, Iowa, was North American's first highway bridge constructed using innovative pi-girders cast of Ultra High Performance Concrete (UHPC). The pi-girders were cast with an integral deck and enhanced wearing surface durability. The second-generation pi-girder introduced larger section properties. Using finite element analysis, the bridge design was conceived and completed by the Iowa DOT Office of Bridges and Structures. Total construction time was 52 days, with the bridge opened to traffic on November 26, 2008.

OBJECTIVES

The primary objectives of this research were to quantify the local and global behavior of the bridge and provide guidance for future UHPC pi-girder designs. Through construction monitoring and live load testing, the conservatism of the design approach was quantified and specific parameters such as lateral live load distribution factors, dynamic amplification factors, and maximum span length were determined. Objectives were to:

- Ensure adequate performance of this first-of-its-kind design
- Quantify conservatism in the design approach
- Provide guidance to inform future bridge designs using
- UHPC pi-girders

BENEFITS

The unique UHPC pi-girders used in the construction of the Jakway Park Bridge provide a new and effective option for bridge superstructures, particularly for projects with accelerated construction schedules. This bridge appears to be performing well and within the general design parameters. In addition, testing revealed that over the first year of service, the bridge experienced only minor changes in structural behavior. From the recommendations provided through this study and the continued decrease in cost of UHPC and fiber reinforcement in North America, UHPC pi-girder bridges will become a more cost-effective option.

Q: How long did it take before it started to actually cure on the inside?

A: They steam-cure for about 72 hours, but I don't think there's a clear answer on when that happens. It pours like pancake batter when you mix it, and is extremely energy intensive on mixing. In Canada it was mixed with Ready-Mix trucks.

C: There's a two-stage curing process for these girders.

C: I believe the initial set-up took 40 hours and a little heat.

C: They used open forms and ambient heat, and after the final pre-stressing used full cure steam at 15psi.

C: To incorporate aggregate in the future, they're going to try pouring these upside down. We tried using Chip Seal to bring up high-strength steel fibers (produced only in Europe) and did grinding of the surface afterward.

Q: You wanted to know if the micro-surface would adhere. What was the result of that?

A: Performed excellent and adhered extremely well.

C: Why did you put an asphalt surface on this concrete?

A: To create surface friction.

C: We're actually testing this surface now in the laboratory.

Motion to Approve by A. Abu-Hawash. 2nd by J. Alleman.

Motion carried with 12 aye, 0 nay, 0 abstaining.

PROPOSAL *Automation of DEM Cutting for Hydrologic/Hydraulic Modeling*, Brian Gelder, Associate Scientist, Iowa State University (\$73,873)

BACKGROUND

Hydrologic and hydraulic analysis to estimate discharge is a necessary component of designing water crossing structures to ensure that integrity is maintained across the range of flows expected to be encountered.

In areas of low topographic relief such as the Missouri, Mississippi, or Des Moines River floodplains or the Des Moines Lobe region of north central Iowa, the 10-meter USGS digital elevation models do not reflect important watershed dividing characteristics such as roads because these structures are of a finer scale than the original elevation model. The importance of matching Digital Elevation Models (DEM) resolution with design requirements have been confirmed numerous times. Additional complications in accurately estimating flow result from the inability to account for terrain effects such as the numerous internally drained watersheds that do not contribute to overland flow under most, if not all, design storms. Differing assumptions for dealing with these ambiguities result in widely differing estimates of contributing area in many small watersheds.

Additional efforts at DEM enforcement have entailed outlet breaching, bridge detection, and selective drainage methods based on proximity of lower elevations. Although previous research by the Iowa Institute of Hydraulic Research (IIHR) at the University of Iowa developed an automated methodology to enforce hydrology through removal of bridges, culverts, and vegetation from permanently flowing streams (approximate contributing area of 1 square mile), this proposed research will enhance developed methodology by adding additional algorithms to enforce drainage on ephemeral streams and enable accurate contributing area determinations.

OBJECTIVES

This project entails an overview of the algorithms developed from previous research and will create a summary of those algorithms.

Objectives include:

- Develop and program algorithms to enforce fine scale drainage on LiDAR DEMs for the state
- Accurately enforce drainage on catchments larger than 24 acres in conjunction with Iowa DNR and IHR

BENEFITS

The hydrologic enforcement of 1-meter LiDAR DEMs can improve watershed discharge estimates and speed hydraulic analyses in areas of low relief or small contributing areas by improving delineation of the contributing area and characterization of its hydraulic characteristics. It also enables advanced hydraulic analyses that account for changes in land cover or precipitation intensity.

The deliverables of this project include a software program for ArcGIS and two databases; a hydrologically enforced digital elevation model and a polyline database of possible locations for unmapped bridges and culverts in Iowa (and their contributing area) to speed application of advanced hydraulic analyses using HEC-RAS or similar models. In addition, the use of hydrologic process models can adapt for changing land cover and precipitation. This should result in additional cost savings due to reduce damages due to undersized hydraulic structures and decrease extra costs due to structure over-design.

Q: Is this a formal way to help USGS incorporate DEMS into their information delineator?

A: No. There is no plan at this time to incorporate these datasets into USGS databases. However, after discussions with U.S. Geological Survey Hydrologist David Eash, if this project is funded conclusions will be made regarding what needs to be and relevant processes will be developed.

C: It will be good to have a process in place for interested parties; each stakeholder needs additional data.

Q: This product will basically supplement DEMS with current and permanent stream information on a local level, showing drainage areas and culverts, correct?

A: Yes. Watersheds up to 1 square meter will not appear correctly on current DEMS. We have no idea what structures contribute to them.

Q: Will this provide new DEMS so we can pull down data for our jurisdictions?

A: Yes. The Iowa DOT has the dataset. Hydrologic enforced flows (where roads or rail limit waterflow) can show where establishing culvert or surface intakes will give an estimate of DEM characteristics for a first analysis.

Motion to Approve by A. Abu-Hawash. 2nd by J. Moellering.

Motion carried with 12 aye, 0 nay, 0 abstaining.

NEW BUSINESS

Mark: A handout of priority ranked project topics from last year is onscreen for your consideration. The first four priorities all have projects underway. Ten of the top 12 priorities have been addressed in some fashion or will be by the time we send out the RFPs we're discussing today.

IHRB-10-05 Low Cost Rural Road Surface Alternatives: The RFP will be finalized at this meeting; counties have already reviewed this.

IHRB-10-06 Detection of Voids Below Approach Pavement: The Iowa DOT Office of Materials Special Investigations Unit has recently acquired a ground-penetrating radar unit and will be conducting research this summer that precludes this topic. They'll be looking at how these types of voids can be detected and how this equipment can be used. Therefore, I recommend at this point we table this, allow the Office of Materials to do

in-house work, and then at some point (maybe next autumn after they have preliminary work done), ask Jason Omundson, Special Investigations Engineer, Office of Materials, to present those findings to the Board. We can decide at that point if further investigations are warranted or if this needs to go in another direction. After speaking with Jason I think the new equipment has the capability to do some of these types of tasks. Unless there's objection I'd like to skip this one.

IHRB-10-07 Evaluating Roadway Subsurface Drainage Practices: I'm not sure exactly how I want to proceed with this one; because some of this work has been completed in the past and how this is written, I'd like to wait for further discussion until the end of this discussion.

IHRB-10-08 Evaluate the Need for Washing of Weathering Steel: This project was actually pushed into our SPR funds and has been initiated from that source. We will not need to consider this for IHRB funding.

IHRB-10-09 Investigation into Shrinkage of High Performance Concrete Used for Iowa Bridge Decks and Overlays: This is another RFP ready to be sent out after Board approval.

Discussion on two RFPs:

IHRB 10-05 Low Cost Rural Road Surface Alternatives

Mark: There are a lot of treatment and stabilization options available and we think it's just a matter of doing a literature survey from the response we received back from the review on this.

Motion to Approve RFP for Distribution As Written by D. Ahart. 2nd by J. Alleman.

Motion carried with 12 aye, 0 nay, 0 abstaining.

IHRB 10-09 Investigation into Shrinkage of High Performance Concrete Used for Iowa Bridge Decks and Overlays

Mark: This topic and original problem statement came from the Iowa DOT Office of Materials, and is basically a laboratory study looking at several different combinations of materials and the shrinkage of those materials in attempts to limit cracking, especially on some of our new structures with overlays.

C: About 15% of our new bridge deck overlays have some type of unexplainable cracking phenomena. The question is, could cracking be due to elasticity differences between the deck and underlying bridge deck? The Iowa DOT would like to know the answer to that question.

Motion to Approve RFP for Distribution As Written by J. Alleman. 2nd by R. Younie.

Motion carried with 12 aye, 0 nay, 0 abstaining.

IHRB 10-07 Evaluating Roadway Subsurface Drainage Practices

Mark: There have been issues with developing a project statement and RFP using the four bullet points presented; the first paragraph of this RFP is essentially what was submitted and voted on by the Board last year. I've received comments and discussion on each one of these bulleted items and this research has been or is being completed through other projects, and received input from Iowa DOT staff with concerns expressed regarding need for this. I'm wondering what results you were looking for through this research, if you weren't aware of the other projects covering this topic, or if there's something I've missed.

After discussing each of the four bulleted points in the RFP, Mark plans to initiate further inquiries into previous research to more clearly define needs and scope while cross-referencing those projects to determine if more research is required.

		21-Apr-10 Final Topic Priorities for 2011
IHRB-10-01	10.05	Improving Accuracy of the Deflection and Camber Predictions for Prestressed Concrete Bridge Girders
IHRB-10-02	3.02/6.03	Combination Snowfence & Right of Way Fence /Optimization of Snowfence Design for Iowa Conditions
IHRB-10-03	8.05	Risk Mitigation Strategies for Operations and Maintenance Activities
IHRB-10-04	5.11	Alkali Content of Fly Ash: Measuring and Testing Strategies for Evaluating Compliance
IHRB-10-05	1.01	Low Cost Rural Road Surface Alternatives
IHRB-10-06	10.01	Detection of Voids Below Approach Pavement
IHRB-10-07	4.02	Evaluating Roadway Subsurface Drainage Practices
IHRB-10-08	10.02	Evaluate the Need for Washing of Weathering Steel
IHRB-10-09	5.03	Investigation into Shrinkage of High Performance Concrete Used for Iowa Bridge Decks and Overlays

TRAVEL MEETING

The annual IHRB May Travel Meeting enhances understanding and networking between the Board, universities, transportation entities and personnel. Suggestions on where the May Travel Meeting should be held, with consideration of budget concerns, were requested. A project site or visit to a transportation facility of interest will be determined at the upcoming April 2011 IHRB meeting.

NEW TOPICS FOR 2012 RANKING

Mark: We're currently accepting topics for next year's ranking so please contact me with any ideas you'd like considered for funding by March 7, 2011. Topics will be listed together and emailed out before the April meeting for your consideration. The Iowa DOT Office of Bridges and Structures Focus Group, the Asphalt Materials Focus Group and our Concrete Pavement Focus Groups will be submitting ideas soon, and we'd like to see any ideas you may have either individually or from any groups you represent (county and/or city as well) by March 7th.

Also, the list of last year's topics that did not receive any votes was recently sent to you. If you'd like any of those reconsidered, please email me so they can be included in next year's list, otherwise they will be removed.

BRIDGES AND STRUCTURES FOCUS GROUP INVITATION

Everyone is invited to the Iowa DOT Office of Bridges and Structures Focus Group meeting to be held March 7, 2011, at Iowa State University/InTrans starting at 9 a.m.

ADJOURN

Motion to Adjourn by J. Alleman. 2nd by J. Joiner.
Motion carried with 12aye, 0 nay, 0 abstaining.

The next meeting of the Iowa Highway Research Board will be held Friday, April 29, 2011, in the East/West Materials Conference Room at the Iowa DOT. The meeting will begin promptly at 9 a.m.

Mark J. Dunn, IHRB Secretary