IOWA HIGHWAY RESEARCH BOARD (IHRB)

Minutes of February 23, 2007

Regular Board Members Present

A. Abu-Hawash
J. Adam
J. Berger
S. Gannon
J. Krist
R. Schletzbaum
J. Singelstad
D. Waid

Alternate Board Members Present

P. Hanley for R. Ettema
J. Cable for J. Alleman
D. Ahart for J. Rasmussen
J. Waddingham for T. Fonkert
B. Younie for S. Dockstader
C. Schloz
W. Zitterich

Board Members with No Representation

M. Nahra
J. Joiner

Secretary – M. Dunn

Visitors

Brian Keierleber	Buchanan County
Dean Bierwagen	Iowa Department of Transportation
Ken Dunker	Iowa Department of Transportation
Ed Engle	Iowa Department of Transportation
Mark Kerper	Iowa Department of Transportation
Sandra Larson	Iowa Department of Transportation
Mike Nod	Iowa Department of Transportation
Mary Starr	Iowa Department of Transportation
S. Hallmark	Iowa State University/CTRE
F. W. Klaiber	Iowa State University/CCEE
M. Suleiman	Iowa State University/CCEE
M. LaViolette	Iowa State University/Bridge Center

The meeting was held at the Iowa Department of Transportation's East/West Conference Room, Materials Building, Ames, Iowa. The meeting was called to order at 9:00 a.m. by Vice-Chairperson Jeff Krist. An initial total of 12 voting members/alternates were at the table. One Member joined the table later bringing the final voting total to 13.

Agenda review/modification

Item 7 on the Agenda – Innovative proposals will be presented rather than discussed and voted on (like last year) because only four innovative proposals were submitted.

Approval of the minutes

Minutes were approved and carried with a vote of 12 aye, 0 nay, 0 abstaining.

One Member joined the table bringing the total to 13.

UPDATE
TR-544, "Technology Transfer Toolbox: A Research Implementation How-To Guide," (Pooled Fund with Pennsylvania DOT) Edward Engle, IA DOT

Two years ago, IHRB voted to participate in this Pooled Fund study with seven other states. The project is sponsored by Pennsylvania DOT. The lead state is Washington.

The project has four main aspects:
1. Computer-based Toolbox
2. Implementation Time Module
3. Marketing & promotion Module
4. Executive briefing Module

IA DOT commitment was $20,000 each year for two years totaling $40,000. They were not able to get the number of states required to fully fund this project. Of the $600,000 required only $270,000 was committed. Because of lack of funding and communication regarding TR-544, Iowa has rescinded its participation; funds will be returned to IHRB. Two other states have also rescinded their commitments.

Q: How much money has already been spent on this project?
A: None. It was an obligation only.
Q: Was there any indication why there was resistance to this project?
A: No. It was difficult to gain information; personnel had been reassigned.

Motion to Withdraw Funding from TR-544
Motion from Jim Berger. 2nd by James Cable. 13 aye, 0 nay, 0 abstaining.

PROBLEM STATEMENT
Effects of Salt Pre-Wetting and Anti-Icing on the Performance of Cracked Bridge Decks, Fouad Fanous, ISU [This problem statement is a continuation of TR-405, "Impact on Deck Cracking and Durability – Phases I & II" completed in 2000.]

Objective
To determine if pre-wetting the dry mix with a liquid chemical such as sodium chloride or calcium chloride or using anti-icing would affect the service life of un-cracked and cracked bridge decks and to identify the threshold of steel degradation during the corrosion cycle. Duration anticipated: 5-8 years.

Tasks
1. Examine previously untested county and state bridges
2. Examine previously tested bridges for corrosion advancement findings
3. Examine different deicing methods and alternatives
4. Consult with an advisory committee

Q: You mentioned you have examined around 80 bridges during the first two phases; was there any indication that epoxy penetrating sealers had been applied on the bridges you tested?
A: On four of them, yes. One on the NW corner (the first one built in Iowa) and three in Tama County, which where sealed. The sample was collected after the sealing was applied, so the amount of corrosion taking place before the sealant was applied is unknown.
C: There may be some competing needs here; maintenance needs to remove storm ice as rapidly and safely as possibly. From the standpoint of building new bridges, we have lower permeability concrete being used for bridge decks. There are many variables that may make it difficult to bring this together. It's not clear what this study would bring to the knowledge base given these variables.

A: This study will prove that using the new techniques will provide resistance to corrosion. It is important to know if there are no concerns and if current ice removal efforts are effective.
C: In your selection of bridges, you might look at some where only brine is used.
A: Yes, we are going to do that.
Q: How practical is it to track two treatments on 80 bridges? Is this something that can be done?
A: We are getting to the point where we can collect that information; right now, we can't.
C: We seldom use sand or salt anymore without pre-wetting on state bridges; it varies with the storm and the bridge.
Q: Why the distinction between cracked and uncracked bridge decks?
A: Every bridge has cracks, but there is a big difference in the condition of through-cracks.
C: It is important to see how epoxy is performing even if only anecdotal evidence is presented.

Motion to Approve to Proposal Stage for Upcoming Review
Motion by Steve Gannon. 2nd by James Cable. 11 aye, 2 nay, 0 abstaining.

COMMENTS REGARDING THE STREET FUND
Mark Dunn- One of the first projects of the year (TR-561, "Pre-cast Bridge Elements") used a large percentage of the Street Fund (between 15-20% of the annual budget). Based on potentially funded projects today, I recommend the Board reduce the Street percentage contribution. The next two projects we'll discuss are good candidates for reduced Street Funding.

With IHRB 06-12, "Slow Moving Vehicles," the focus is more on rural high speed roadways and not as much of an issue on a city street. With IHRB 06-10, "Development of LRFD Design Procedures for Bridge Piles," cities may have some interest in this project, but 10% is a fairly large portion based on their funding. Typical funding is 40% State, 50% County and 10% Street unless modified.

C: Perhaps another entity could pick up 5% of the cities' 10% Street Funding.
C: Or perhaps (as with the Slow Moving Vehicles project), move the entire 10% to the County.

IHRB 2nd Solicitation 06-07 RFP Discussion
RFP 06-12, *Improving Safety for Slow Moving Vehicles on Iowa's High Speed Rural Roadways* (Neal Hawkins, ISU/CTRE) ($99,881)

C: The proposal appears to meet the goals of the RFP.

Move to Accept the Proposal and Split Funding - 40% State, 60% County
Motion by Dan Waid. 2nd by Roger Schletzbaum. 13 aye, 0 nay, 0 abstaining.

RFP 06-10, *Development of LRFD Design Procedures for Bridge Piles in Iowa* (Sri Sritharan, ISU/CTRE Bridge Engineering Center) ($250,000)

Move to Accept the Proposal and Split Funding - 45% State, 55% County
Motion by Jim Berger. 2nd by Ahmad Abu-Hawash. 9 aye, 4 nay, 0 abstaining.

PROPOSALS

Structural Design, Construction and Evaluation of a Prestressed Concrete Bridge Using Ultra High-Performance Concrete Pi Girders (Terry Wipf, ISU/CTRE) ($80,000)

Background

In 2005, Buchanan County submitted an Innovative Bridge Research and Construction (IBRC) proposal, in cooperation with the Iowa Department of Transportation and the Iowa State University Bridge Engineering Center, to the Federal Highway Administration (FHWA) for the construction and evaluation of an Ultra-High Performance Concrete (UHPC) bridge. The proposal utilized a recently developed optimized cross section (Pi shape) by the company who developed the advanced material (LaFarge). During review of the proposal this Pi shape cross section was being tested and evaluated by the FHWA at the Turner Fairbank Highway Research Center facilities. In 2006, IBRC funding of $400,000, at a slightly reduced amount, was awarded to Buchanan County. Soon after the project began FHWA test data indicated the Pi shape was not appropriate for certain serviceability conditions.

This required that the Pi shape be modified for this IBRC project, which required changes in the research scope, including the addition of analytical and laboratory experimental tasks. This effort is an important step in the evaluation of emerging bridge engineering technologies. Along these lines it is noteworthy that Wapello County received a similar IBRC project to construct the nation's first bridge with UHPC. Knowledge from the project represented a first step which has been continued at the Turner Fairbank Laboratory and will be furthered by the work proposed.

Objectives

- Advance the state-of-the-art in concrete bridge construction technology
- Develop and build on experience in Iowa in the design and construction of bridges utilizing advanced materials
- Evaluate the long-term performance of the nation's first Pi Shape UHPC bridge

Motion to Approve

Motion by Ahmad Abu-Hawash. 2nd by Steve Gannon. 13 aye, 0 nay, 0 abstaining.

SELECTION OF PROPOSALS FROM THE INNOVATIVE 2007-2008 RFP

Procedure for Selection - Four projects were presented. Voting took place with each Member (University Representatives abstaining) receiving two votes each. After the first round, the top two selections were voted on again for ranking in approval of funds totaling $150,000.

APPROVED

Received 8 Votes First Round - 6 Votes Second Round:

1. ***Embedded Micro-Electromechanical (MEMS) Sensors and Systems for Monitoring Highway Structures and for Infrastructure Management***, Halil Ceylan, ISU/CTRE ($99,571)

Background

The term micro-electromechanical systems (MEMS) refers to a collection of microsensors and actuators that sense their environment and have the ability to react to changes in that environment with the use of microcircuit control. Typically no bigger than a grain of sand, these MEMS devices are complex machines that enable chips to become "intelligent." These devices act as the most direct links between digital electronics and the physical world, allowing the integration of electronics and

mechanical systems on a single chipset. MEMS merge the functions of sensing and actuating with computation and communication to locally control physical parameters at the micro scale.

Objectives
The primary objective of this research will be to study the feasibility of using Micro-ElectroMechanical Systems (MEMS) sensors to gather real-time condition data from highway pavements and bridges and determine:

- The effect of asphaltic medium on MEMS
- How many MEMS devices are to be installed per 1 km of pavement
- Where the designer will install or embed the microdevices (MEMS) in the pavement
- MEMS performance throughout this period
- How environmental conditions affect the performance of MEMS in pavement condition monitoring
- How the effects of chemical medium such as corrosion in reinforced concrete structures affect the performance of MEMS
- If it will be a cost-effective method of collecting continuous data

Q: Will this project provide real-time data that drivers can use?
A: This technology can provide a broad range of real-time data that can be used, for example, to detect a vehicle traveling the wrong way on a roadway. The MEMS will be triggered by the reverse order of movement and send information to a computer which, in turn, can direct notification to alert drivers.
Q: Can MEMS provide stress/strain analysis for bridges at approach sections?
A: Yes. Sensors could be placed for research applications or monitoring and provide evaluations.
Q: How do they communicate?
A: Singularly, small ones or large ones with batteries are used as a wireless communicator; to a computer, web page, database, etc.
Q: What about heavily re-enforced bridge approach sections; can MEMS detect needs?
A: Yes. They can monitor embankment compaction and moisture content better than the ways currently used. MEMS can detect the compaction of the soil in different directions, vehicle direction and movement as well as many other attributes.

Received 8 Votes First Round - 5 Votes Second Round:
2. ***Ethanol Plant By-Product Uses for Pavement Geo-Materials Stabilization***, Halil Ceylan, ISU/CTRE ($189,014)

Background
Lignin (derived from the paper industry) is currently used as soil stabilizing agents separated from trees by a chemical pulping process. Some traditional uses for lignin and modified lignin are: concrete admixtures, binders, dust control, fiberglass insulation, emulsifiers, vanillin production, etc.

Objective
To demonstrate if lignin derived from biorefineries is an effective aggregate/soil stabilizing agent. Lignins are currently available and are anticipated to become readily available in the future in abundance; benefits of using lignin as a dust suppressant on unpaved roadways will be explored.

Q: Is the lignin in powder form?
A: It depends on the type of bio-refining used; there are different stages, methods and plants used for lignin production. This new method produces 60-70% lignin efficiently.
Q: How is lignin used now?

A: As cattle feed and in Iowa, feed for pigs and chickens. Iowa has lignin in abundance. Because of advancing technology, Iowa has new production plants being built that will produce the product as requested by the customer.
Q: What about the longevity of lignin? Is it a soil stabilizer?
A: There are different types – some are not soluble in water; some are. Applications of lignin at the foundations will stabilize them.
Q: Is there variability in product?
A: The main core is the same; this is something that can be studied and documented for variation.
Q: Will it break down over time?
A: This is not a concern.

Funding Determinations - Mark Dunn suggested that the second ranked project, *Ethanol Plant By-Product Uses for Pavement Geo-Materials Stabilization,* be re-submitted with a revised budget reflecting funds remaining after full funding approval was given to the first selection, *Embedded Micro-Electromechanical (MEMS) Sensors and Systems for Monitoring Highway Structures and for Infrastructure Management*.

Motion that *Ethanol Plant By-Product Uses for Pavement Geo-Materials Stabilization* be Re-submitted to IHRB with a Revised Budget with $50,000 available for funding
Motion by Bob Younie. 2nd by Roger Schletzbaum. 13 aye, 0 nay, 0 abstaining.

NOT APPROVED – TOPICS TO BE RECONSIDERED NEXT FISCAL YEAR
Received 3 Votes First Round
3. *Automated Monitoring of Bank Erosion Using a Photo-Electronic Erosion System*, Thanos Papanicolaou, The University of Iowa ($46,227)

Background
It is apparent that streambank stability problems for bridge waterways would be assisted greatly by the availability of an instrument that allows unattended bank erosion measurements on a continuous basis. Such an instrument would serve as a practical and useful aid for existing monitoring procedures used by the Iowa DOT and by County and Civil Engineers, as well as consulting engineers engaged in the design and monitoring of bridge waterways.

Objectives
- Utilize/enhance the capabilities of a new instrument, the Photo-Electronic Erosion Pin System (PEEP), for automated monitoring of bank erosion
- Demonstrate the PEEP potential to establish the timing of individual bank erosion events and perform a pilot study along Indian Creek under I-80, near Colfax, Iowa
- Establish the new methodological procedure for PEEP calibration, installation, frequency of acquisition, data logging, data transferring, and performing QA/QC
- Create a web site that will be used to store the guidelines for operating PEEP and the monitoring results of the pilot study using relevant cyber-infrastructure techniques

Q: Does the device work at any level above the water? How high or low on the bank are these placed?
A: The monitoring system can work at any level on the bank; it can be submerged and continue functioning. Turbidity can be high but that is not a problem. We have tested the device at four times the level expected without issue. They are well insulated.
Q: Are we validating bank flow?

A: Not with this instrument, but we will be with another instrument.
C: There is a better erosion problem at the North Raccoon River.
A: The more locations that are monitored, the better.

Received 3 Votes First Round
4. ***Analysis of Available Field Data on Scour Around Bridge Abutments and Comparison of Recently Acquired Laboratory Data Through NCHRP 24-20*** (Estimation of Scour at Abutments), Tatsuaki Nakato, The University of Iowa/IIHR ($57,789)

Objectives
The primary objective of the proposed study is to conduct a literature survey on field abutment scour data and analyze them for comparison with IIHR laboratory data acquired under the NCHRP 24-20. Additionally, detailed local field data around bridge abutments in floodplains in Iowa will be collected during flood periods in the proposed study. The data assembled and analyzed will deepen understanding of physical processes involved in abutment scour and provide a better estimation of abutment scour.

BRAINSTORMING
Mark Dunn asked that all research topics to be presented for ranking during upcoming FY 2007-2008 be emailed to him and that a paragraph stating need and objectives be included in a concise format.

TRAVEL MEETING DISCUSSION
Mark Dunn asked Members to begin consideration of destinations for the upcoming annual Travel Meeting scheduled for June 1, 2007. A final decision for the trip will be determined at April's meeting. He suggested visiting Boone City, Iowa, the location of the Precast Bridge Components project. Another suggestion was to tour a local ethanol plant.

NEW BUSINESS
None

ADJOURN
Motion to Adjourn
Motion by James Cable, 2nd by Bob Younie.
Motion carried with 13 aye, 0 nay, 0 abstaining.

The April 2007 meeting of the Iowa Highway Research Board will be held **FRIDAY, April 27, 2007 at 9:00 a.m. in the East/West Materials Conference Room at the IA DOT.**

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Mark J. Dunn, IHRB Secretary