**IOWA HIGHWAY RESEARCH BOARD (IHRB)**

*Minutes of April 24, 2009*

**Regular Board Members Present**

A. Abu-Hawash
J. Adam
J. Alleman
J. Berger
V. Dumdei
S. Gannon
J. Joiner
J. Krist
B. Moore
M. Nahra

**Alternate Board Members Present**

K. Mayberry for D. Ahart
D. Schnoebelen for K. Hornbuckle
J. Moellering for J. Waddingham
R. Kieffer for W. Weiss

**Members With No Representation**

S. Rinehart

**Alternates Present as Guests**

R. Younie

**Secretary - M. Dunn**

**Visitors**

| | |
|---|---|
| Robert Dawson | Iowa Department of Transportation |
| Edward Engle | Iowa Department of Transportation |
| John Hinrichson | Iowa Department of Transportation |
| Sandra Larson | Iowa Department of Transportation |
| Kevin Merryman | Iowa Department of Transportation |
| Kimball Olson | Iowa Department of Transportation |
| Scott Schram | Iowa Department of Transportation |
| Mary Starr | Iowa Department of Transportation |
| Will Zitterich | Iowa Department of Transportation |
| Jeramy Ashlock | Iowa State University-InTrans |
| Shashi Nambisan | Iowa State University-InTrans |
| Paul Wiegand | Iowa State University-InTrans |
| David White | Iowa State University-InTrans |
| Chris Williams | Iowa State University-InTrans |

The meeting was held at the Iowa Department of Transportation's Ames Complex, Materials East/West Conference Room on Friday, May 24, 2009. The meeting was called to order at 9 a.m. by Chairperson Jim Berger with an initial number of 12 voting members/alternates at the table.

**Agenda**

The Agenda was modified and Dr. Sutter's presentation for Final Report TR-480 was moved to the end of the meeting; after approval, the meeting was adjourned and an in-depth discussion of the project took place.

**Approval of the Minutes**

Motion by J. Alleman to approve minutes from the March 27, 2009 meeting. 2nd by Brian Moore.
Motion carried with 12 aye, 0 nay, 0 abstaining.

*** Two Members Joined the Table***

**Final Report TR-587, "Crack Development in Ternary Mix Concrete Utilizing Various Saw Depths,"** Kejin Wang, Iowa State University/InTrans ($40,000)

BACKGROUND
With conventional sawing, joint cracking is generally observed within several days. However, some early entry sawing joints (transverse) in Iowa had delayed cracking up to weeks or months after sawing. An urgent concern is whether early entry sawing could lead to late-age random cracking.

In this study 10 joints were made with the early entry sawing method to a depth of 1.5 inches, and two strain gages were installed in each joint. Another ten joints were made using the conventional sawing method with five sawed to a depth of 1/3 of the pavement thickness (3.3 in.), and the rest sawed to a depth of 1/4 of the pavement thickness (2.5 in.). One strain gage was installed in each of the joints made with the conventional sawing method. In total, 30 strain gages were installed in 20 joints.

CONCLUSIONS
1. All 30 joints cracked within 25 days after paving. No random cracking was observed in the test section two months after construction.
2. Most joints made with the early entry sawing method cracked later than the joints made with the conventional sawing method.
3. The strain gages used were capable of monitoring the deformations at the joints.
4. After the joints cracked, the pavement expanded or shrank according to the daily ambient temperature.
5. The tested section was closed to traffic during the project, however, it was reported that test sections were prematurely loaded by the contractor's equipment. It was uncertain how this affected the joint cracking.

Q: Was Iowa DOT spacing used on joints?
A: Yes.

Q: Was there any traffic on it?
A: There was no traffic other than some construction traffic; we try to not have any traffic on it.

Q: Is it correct that some sections had no cracks for nine months?
A: Yes. That was the motivation for this project; one joint did crack but this could be special and is not typical. This research shows average cracking.

**Motion to Approve** by J. Joiner. 2nd by V. Dumdei.
Motion carried with 14 aye, 0 nay, 0 abstaining.

**Final Report Presentation TR-590, "PHASE II – Examination of Curing Criteria for Cold In-Place Recycling,"** Hosin "David" Lee, The University of Iowa ($100,000)

BACKGROUND
Previous research (TR-553) performed laboratory experiments to measure the impacts of curing on the indirect tensile strength of both CIR-foam and CIR-emulsion mixtures. However, a fundamental question was raised during PHASE I regarding a relationship between field moisture content measured using a nuclear gauge and the laboratory moisture content in gyratory compacted specimens. The main objectives of this (PHASE II) research were to: 1. Measure the moisture levels throughout a CIR layer and, 2. Develop a moisture loss index to determine the optimum curing time of CIR layer before HMA overlay.

CONCLUSIONS
1. The moisture condition of a CIR layer can be monitored accurately using a capacitance moisture sensor.
2. The moisture loss index for a CIR layer is a viable tool in determining the optimum timing for an overlay without measuring the moisture content using a nuclear gauge.
3. The modulus of a CIR layer back-calculated from deflection measured by FWD seemed to be in a good agreement with the stiffness measured by geo-gauge.
4. The stiffness of a CIR layer increased as curing time increased. The layer stiffness seemed to be affected by the pavement temperature more than the moisture content.
5. The geo-gauge should be considered for measuring the stiffness of a CIR layer that can be used to determine the optimum timing of an overlay.

Q: How did you measure percentage of moisture?
A: It's a weight ratio. We can saturate a specimen in the laboratory. The moisture content was measured by embedding capacitance moisture sensors at a midpoint and a bottom of the CIR layer and compared against the moisture content measured by a nuclear gauge. A set of moisture loss indices was developed based on the initial moisture content and temperature of CIR-foam and CIR-emulsion layers.

Q: What is the voyd ratio in CIR asphalt?
A: About 2%.

Q: Did you continue to detect moisture in the buried sensors after they were covered over?
A: We could measure moisture percentages accurately for up to one year and download data; however, we haven't done that on this project. This would be something we could do in a future study.

Q: If you're looking at the strength of the under-layer to find out when it's best to do an overlay and find out that moisture doesn't have a lot of effect on strength, another concern would be if you're trapping water in there by doing an early overlay.
A: The water would go nowhere, and that is a concern; however, we can monitor moisture content after the overlay. That is something we haven't done yet; examine how water saturations would fluctuate when it rains.

C: In the field I've found that it's difficult to get that 1.5% moisture content; we generally overlay higher than that. I think you're on to something looking at the stiffness of the Cold In-Place pavement and that moisture isn't something that's terribly critical. My oldest Cold In-Place project is now seven years old and I haven't seen any indication that there's any failure underneath.

Q: You mentioned future research but I didn't see that information here. We really like the Cold In-Place Recycling application.
A: We plan to return to present that presentation after the beginning of the next fiscal year.

**Motion to Approve** by M. Nahra. $2^{nd}$ V. Dumdei.
Motion carried with 14 aye, 0 nay, 0 abstaining.

**PROGRESS OF FUNDED INNOVATIVE PROJECTS**
Information on the progress of funded innovative projects was distributed to the Board.

**TOPIC PRIORITIZATIN VOTING**
Several Board Members and others spoke in support of the following projects:

Bruce Brakke (Iowa DOT) – 10.03 & 10.15
Merle Olson (Iowa DOT) – 10.07
Scott Schram (Iowa DOT) – 5.05, 5.07, 5.08 & 7.07
Brian Moore (Wapello County) – 1.06
Ahmad Abu-Hawash (Iowa DOT) – 4.01

Each regular Board member or their alternate (in their place) received 20 votes to place on various topics of interest, with up to a maximum of 4 votes applied to any one topic. After each voter placed all of their votes, totals were tallied and projects ranked. (If neither the member nor their alternate were present, they were able to submit votes to Mark prior to the meeting. One early submission was made by proxy and added to the ranking.)

**VOTING RESULTS**

| Rank | Proj. # | 28-Apr-09 | Votes |
|---|---|---|---|
| 1 | 10.10 | Proposal for Study of the Effects of Implements of Husbandry on Iowa Bridges | 27 |
| 2 | 10.07 | Evaluation of Separation Railing Systems in Iowa | 18 |
| 2 | 10.15 | Maintenance and Design of Steel Abutment Piles in Iowa Bridges | 18 |
| 4 | 10.02 | Timber Abutment Piling and Back Wall Rehab and Repair | 15 |
| 5 | 1.06 | Use of Ultra-High Performance (UHPC) Concrete in Geotechnical and Substructure Applications Phase II: Connection Details and Field Implementation of UHPC Piles | 14 |
| 5 | 7.03 | Development of Quality Standards for Inclusion of High Recycled Asphalt Pavement Content in HMA | 14 |
| 5 | 8.06 | Development of Geometric Design Guides for Roundabouts | 14 |
| 5 | 5.08 & 7.07 | HMA Longitudinal Joint Construction | 14 |
| 9 | 6.05 | Investigation and Evaluation of Iowa Department of Transportation Bridge Deck Epoxy Injection Process | 12 |
| 10 | 11.01 | Temporary Traffic Control Plans for Local Agency Improvements | 11 |
| 11 | 3.03 | Evaluation and Rating of the Effectiveness of Temporary Erosion and Sediment-Control Measures in Iowa Conditions | 10 |
| 11 | 5.05 | Evaluation of Alternative Materials to Prevent HMA Stripping (Moisture Damage) | 10 |
| 13 | 5.10 | Use of Recycled Concrete Aggregates in New Pavements | 9 |
| 13 | 6.01 | Pavement Surface Rehabilitation Techniques for Poor Subgrade Conditions in Iowa | 9 |
| 13 | 10.01 | Detection of Voids Below Approach Pavement | 9 |
| 13 | 10.03 | Evaluate the Need for Washing of Weathering Steel | 9 |
| 13 | 11.05 | Shielding Median Bridge Piers with High Tension Cable Guardrail: Iowa's Experience | 9 |
| 18 | 7.05 | Opening Strength for Concrete Overlays | 8 |
| 19 | 4.04 | Evaluating Roadway Subsurface Drainage Practices | 7 |
| 20 | 8.02 | Investigating the Impact of Tax Increment Financing on Iowa's Secondary Road System | 6 |
| 20 | 11.02 | Perform an In-depth Study of Low Volume Rural Road Crashes | 6 |
| 22 | 1.04 | Low Cost Rural Road Surface Alternatives | 5 |
| 22 | 4.06 | Riverbed Scour and Deposition Monitoring Plan for Floods using a Multibeam Hydrographic Survey System | 5 |
| 22 | 5.09 | Evaluation of Epoxy Patching Materials for Concrete Pavement | 5 |
| 22 | 8.01 | Effective Training and Management of Multi-skilled Local Government Workforces | 5 |
| 26 | 4.02 | Low Impact Design Practices BMPs Pollutant Reduction | 4 |
| 26 | 8.03 | Determination of Effectiveness & Potential Enhancements of the Statewide Urban Design & Specifications Program | 4 |

| Rank | Proj. # | 28-Apr-09 | Votes |
|---|---|---|---|
| 26 | 10.12 | Adapting Accelerated Bridge Construction (ABC) Best Practices for small Scale Projects with Local Jurisdictions | 4 |
| 26 | 11.04 | The Effect of Roadside Vegetation on Frequency of Deer Collisions | 4 |
| 30 | 5.11 | Increasing the Stability of Unbound Shoulder Materials | 3 |
| 30 | 10.04 | Totally Precast Bridge Piers for Accelerated Construction | 3 |
| 32 | 5.01 | Research on Developing Regional Material Constants for Use in Prestressed Beam Design | 2 |
| 32 | 5.07 | Development of Performance Testing Criteria for HMA Design and QC/QA Testing | 2 |
| 32 | 2.03 & 2.04 | Risk Control for Highway Bridges | 2 |
| 35 | 3.04 | Optimization of Snowfence Design for Iowa Conditions | 1 |
| 35 | 5.02 | Evaluation of HMA Sampling Procedures | 1 |
| 35 | 5.03 | Preventing Random Cracking Through Proper Design and Concrete Mixes | 1 |
| 35 | 5.04 | Investigation into Shrinkage of High Performance Concrete Used for Iowa Bridge Decks and Overlays | 1 |
| 39 | 1.02 | Use of Geofabrics for Gravel Road Stabilization | |
| 39 | 2.02 | Improved Measurement and Analysis for LWD Tests | |
| 39 | 2.03 & 2.04 | Network Analysis for Mitigating Transportation Networks at Risk from Flooding | |
| 39 | 3.01 | Developing a Protocol for Burning Roadsides | |
| 39 | 3.02 | The Effect of Tall Vegetation on Blowing and Drifting Snow | |
| 39 | 4.03 | Development of a Revised Floodplain Map for the State of Iowa by Identifying the Highways and Bridges Under High Risk of Flooding Due to the Drastic Climate Changes | |
| 39 | 4.05 | Incorporating Bridge Rail Hydraulics for Floodplain Mapping | |
| 39 | 5.06 | Determining Cost Effective Methods for Obtaining & Maintaining Acceptable Skid Resistance for HMA Pavements | |
| 39 | 6.02 | Combination Snowfence-Right of Way Fence | |
| 39 | 6.03 | Update Weatherview to Include Temperature Sensors on County Roads | |
| 39 | 6.04 | Winter Maintenance Techniques for Pavement Surfaces with High Macro-Texture | |
| 39 | 7.02 | Advancing Slipform Paver Machine Control Application | |
| 39 | 7.04 | Value of Joint Sealing to Protect Concrete Pavements from Use of Anti-icing Brine | |
| 39 | 7.06 | PCC Joint Seal Maintenance | |
| 39 | 7.08 | Value of Joint Sealing to Protect Concrete Pavements from Use of Anti-icing Brine | |
| 39 | 8.04 | Determination of Level of Access for Driveways on Urban Arterials | |
| 39 | 9.01 | Poplar/Willow Tree Buffers in Ditches Cropped for Multiple Benefits: Safety, Pollutant Capture & Harvested Biofuels | |
| 39 | 10.05 | Replacing Existing Deteriorated Bridge Deck Overlays | |
| 39 | 10.06 | Validation of Structural Health Monitoring Damage Detection Algorithm | |
| 39 | 10.08 | Developing of a Rating Software for Concrete Box Culverts | |
| 39 | 10.11 | Methods for Removing Deteriorated Bridge Decks on Reinforced or Prestressed Concrete Beam Bridges | |
| 39 | 10.14 | Accelerated Bridge Construction (ABC) for Substructures | |
| 39 | 10.16 | Protection of P/S Concrete Beam Ends from Chloride Penetration | |
| 39 | 11.03 | Addressing Rural Motorcycle Safety | |
| 39 | 11.06 | Winter Crash Analysis and Safety Audit | |

**NEW BUSINESS**

None

**Final Report TR-480, "The Deleterious Chemical Effects of Concentrated Deicing Solutions on Portland Cement Concrete,"** (Transportation Pooled Fund Study TPF-5[042]: The Deleterious Chemical Effects of Concentrated Deicing Solutions on Portland Cement Concrete), Dr. Lawrence Sutter, Director, Michigan Tech Transportation Institute ($80,000)

BACKGROUND
This research investigated the effects of concentrated brines of magnesium chloride, calcium chloride, sodium chloride, and calcium magnesium acetate on Portland Cement Concrete. Although known to be effective at deicing and anti-icing, the deleterious effects these chemicals may have on concrete have not been well documented.

Two phases of laboratory studies were completed for this project as well as examination of field specimens from various sites across the country.

CONCLUSIONS
As a result of this research, it was determined that there is significant evidence that magnesium chloride and calcium chloride chemically interact with hardened portland cement paste in concrete resulting in expansive cracking, increased permeability, and a significant loss in compressive strength. Although the same effects were not seen with sodium chloride brines, it was shown that sodium chloride brines have the highest rate of ingress into hardened concrete. This latter fact is significant with respect to corrosion of embedded steel.

The mechanism for attack of hardened cement paste varies with deicer chemicals but in general, a chemical reaction between chlorides and cement hydration products results in the dissolution of the hardened cement paste and formation of oxychloride phases, which are expansive. The chemical attack of the hardened cement paste is significantly reduced if supplementary cementitious materials are included in the concrete mixture.

C: Iowa is going to participate in the collaborative "Joint Rot" study headed by S. Dakota.

Q: Are any deicers being applied to the UHPC bridges in Buchanan County?
A: Those bridges are on gravel roads and no deicers are being applied; however, the bridge being built next year will be on a paved road so there will be opportunity to see how that affects bridge decks.

DISCUSSION: An in-depth discussion was held after IHRB approval and adjournment of the meeting.

**Motion to Approve** by J. Alleman.. 2nd M. Nahra .
Motion carried with 14 aye, 0 nay, 0 abstaining.

**ADJOURN**
**Motion to Adjourn**
Motion by B. Moore. 2nd by J. Alleman.
Motion carried with 14 aye, 0 nay, 0 abstaining.

The April 2009 meeting of the Iowa Highway Research Board will be held **FRIDAY, April 24, 2009 at 9:00 a.m. in the East/West Materials Conference Room at the Iowa DOT.**

**Mark J. Dunn, IHRB Secretary**