IOWA HIGHWAY RESEARCH BOARD (IHRB)
Minutes of September 25, 2015

Regular Board Members Present

A. Abu-Hawash
K. Jones
T. Nicholson
S. Okerlund
R. Knoche
D. Schnoebelen
D. Miller
P. Mouw
K. Mayberry
L. Roehl
R. Fangmann
T. Wipf

Alternate Board Members Present

C. Poole

Members with No Representation

W. Weiss
R. Stutt

Secretary – V. Goetz

Visitors

Wayne Sunday	Iowa Department of Transportation
Donna Buchwald	Iowa Department of Transportation
Francis Todey	Iowa Department of Transportation
Charlie Purcell	Iowa Department of Transportation
Scott Schram	Iowa Department of Transportation
Mike Nop	Iowa Department of Transportation
Brian Worrel	Iowa Department of Transportation
Brent Phares	Iowa State University
Sri Sritharan	Iowa State University
Chris Williams	Iowa State University
Dale Herrington	CP Tech Center
David Eash	USGS
Jon Nania	USGS
Clint VanSchepen	USGS

The meeting was held at the Iowa Department of Transportation Ames Complex, Materials East/West Conference Room, on Friday, September 25, 2015. The meeting was called to order at 9:00 a.m. by Chairperson Terry Wipf with an initial number of 12 voting members/alternates at the table.

1. **Agenda review/modification**
   Item E on the agenda "Development of Non-Petroleum-Based Binders for Use in Flexible Pavements-Phase II" will not be presented today because the TAC has requested to visit this project one last time before they actually present and finalize it.

2. Motion to approve Minutes from the June 26, 2015 meeting

Motion to Approve by R. Knoche; 2nd D. Schnoebelen
Motion carried with 12 Aye, 0 Nay, 0 Abstaining.

3. Final Report: TR-625, "*Improving the Accuracy of camber Predictions for Precast Pre-tensioned Concrete Beams",* Sri Srithraram, ISU.

OBJECTIVES

The goals of this research were to improve both the short-term and long-term camber predictions and to minimize the error between the expected and actual camber of PPCBs, especially at the time of erection. The project goals were achieved through systematically investigating the short-term and long-term material behavior, examining the camber measurement techniques, and quantifying the camber from the time of construction of PPCBs to the completion of bridges using these PPCBs. The following objectives were used to achieve the project goals:

1. Complete a thorough literature review with an emphasis on recently completed work on this research topic
2. Review the existing camber data recorded in the past by precasters at transfer and by contractors and the Iowa DOT at the time of erection
3. Quantify concrete properties such as compressive strength, modulus of elasticity, creep, and shrinkage for representative concrete mixes from three precasting plants
4. Obtain accurate camber measurements from a variety of Iowa DOT PPCBs at the time of transfer, during storage at the precast plants, at the time of erection, and before/after the casting of the deck
5. Investigate the potential sources of scatter in the measured data for both the instantaneous camber and the long-term camber and quantify the effects of different variables such as concrete material properties, camber measurement techniques, bed deflection, creep and shrinkage, support location (i.e., overhang length), and thermal effects
6. Propose a new measurement approach to accurately capture the instantaneous camber and recommend any modifications to the PPCB fabrication process to decrease variations in the camber of identical PPCBs
7. Improve the estimation of the instantaneous camber
8. In conjunction with the measured field data, develop analytical models using finite element analysis (FEA) and simplified analysis to compute a new set of long-term camber multipliers to predict the at-erection camber more accurately

DISCUSSION

Q. Are the other States surprised by what you have found with the friction topic?
A. We measured one hundred and ten different beams and each beam we quantify what the friction is. Then based on the beam length we can predict what the value is going to be.

Implementation

We can divide implementation into two groups, one related to design vs construction. The construction side we already have IM for prestress concrete beams revised to reflect the recommendation. We put a 360 degree laser at a mid-point and then we have these three locations that have a smooth surface and we go down and target both ends so we have a direct

comparison. In terms of Design we are working on modifying the procedure which is not in the design manual yet.

Motion to Not-Approve by D. Miller; 2nd A. Abu-Hawash
Motion carried with 12 Aye, 0 Nay, 0 Abstaining.

4. **FINAL REPORT: TR-660,** *"Investigation of Negative Moment Reinforcing in Bridge Decks",* Brent Phares, Iowa State University

BACKGROUND

For design, multi-span pre-tensioned pre-stressed concrete beam (PPCB) bridges are usually assumed to experience two different stages of behavior. During the first stage, the PPCB girders are placed on supports and are assumed to behave as a simply-supported span to resist the self-weight of the structure. After the concrete deck is placed and fully cured, the bridge moves to the second stage, during which it behaves like a fully continuous structure over the intermediate support to resist live loads and superimposed dead loads that occur after the deck has cured. During the second stage, the structure will experience negative moments over the intermediate supports, and, as a result, reinforcement must be provided to satisfy the strength and serviceability requirements. According to the Iowa Department of Transportation (DOT) Office of Bridges and Structures (OBS) bridge design manual, continuous longitudinal reinforcement (b1 reinforcement) is provided over the top and bottom of the entire deck. In addition to the b1 reinforcement, negative moment reinforcement (b2 reinforcement) is provided for strength over the intermediate supports and to control the cracks due to negative moments

OBJECTIVES

Because the Iowa DOT OBS has observed satisfactory historical performance of its PPCB bridges, there is a desire to provide research evidence as to the appropriateness of current OBS policy. If necessary, the current OBS policy should be modified. The objectives of this work were as follows:

- Investigate the OBS policy regarding the required amount of b2 reinforcement
- Investigate the OBS policy regarding the termination length of b2 reinforcement
- Investigate the impact of the b2 reinforcement termination pattern
- Investigate the effect of secondary moments on the performance of PPCB bridges

DISCUSSION

Q. Is there any reason why we are experiencing cracks in that region?
A. The cracks that we have seen are relatively minor and are right at the termination point of the bars so I believe that having those bars in there is creating a stress concentration at the end of the bar.
Q. Is there any discussion with AASHTO about your findings?
A. We have not discussed this with AASHTO. We are putting together a couple journal papers to be distributed.

Implementation

What we are doing is fine but will continue looking at the performance.

Motion to Approve by L. Roehl; 2nd T. Nicholson

Motion carried with 12 Aye, 0 Nay, 0 Abstaining.

5. **FINAL REPORT: TR-661**, "*Evaluation of the Need for Longitudinal Median Joints in Bridge Decks on Dual Structures*", Brent Phares, Iowa State University

BACKGROUND

For wide bridges, the Iowa Department of Transportation (DOT) requires the use of longitudinal joints, in part, to minimize deck cracking. Cracking can be induced by transverse contractions due to temperature change, shrinkage, and/or live loads. Longitudinal deck joints are thought to provide a relief point and reduce the amount of shrinkage that must be accommodated. However, longitudinal joints have been known to allow chloride-contaminated water to penetrate the bridge deck; minimizing longitudinal joints may significantly lessen this problem. Moreover, there is little agreement among state DOTs regarding the maximum width for a continuous deck, which can range from 60 to 120 ft.

OBJECTIVES

The primary objective of this project was to determine the effect of bridge width on bridge deck cracking. Other factors, such as bridge skew, girder spacing and type, abutment type, pier type, and number of bridge spans, were also studied.

Motion to Approve by K. Jones; 2nd D. Schnoebelen
Motion carried with 12 Aye, 0 Nay, 0 Abstaining.

Implementation

We will be looking at extending bridge decks to 120 feet so there is implementation coming out of this project.

6. **FINAL REPORT: TR-641**, *"Reflective Crack Mitigation Guide for Flexible Pavements*", Chris Williams, Iowa State University

BACKGROUND

Reflective cracking of asphalt mixtures is a common distress that results in a loss of pavement ride quality and service life. Several strategies exist to mitigate reflective cracking depending on the pavement structure, including the use of crack relief layers in the form of membranes and specialty asphalt mixtures (e.g., Strata), crack and seat, rubblization, cold in-place recycling (CIR) of existing asphalt overlays, and full-depth reclamation (FDR). Depending on the pavement structure, pavement condition, and traffic level, varying strategies exist that improve the performance of the pavement economically.

OBJECTIVES

•Use Iowa's Pavement Management Information System (PMIS) to select reflective cracking mitigation strategies at the network level
•Perform project-level pavement site investigations to evaluate existing treated composite pavements

DISCUSSION
Q. Was that the DOT's PCI? Could you show what factors went into that report?
A. Yes it was the DOT's and I don't know what went into the PCI.
Q. The problem statement said you would be creating a guide, do you have a guide?
A. We have a computer program that goes through the process for what would be the best selection for a reflective crack Mitigation.
Q. Does it have the cold in place option?
A. It does not have the cold in place because we didn't have enough failures at this stage.
Q. Has this given us any new information?
A. There is plenty of different strategies that can be employed to mitigate reflective cracking. I think modifed rubblization is the better approach.

Member K. Jones motioned to approve conditional on removing the table from the report that included treatment cost amounts.

Motion to Approve by K. Jones; 2nd R. Knoche
Motion carried with 12 Aye, 0 Nay, 0 Abstaining.

7. **FINAL REPORT: TR-678**, "*Comparisons of Estimates of Annual Exceedance-Probability Discharges for Small Drainage Basins in Iowa, Based on Data Through Water Year 2013*", David Eash, USGS

BACKGROUND
An examination was conducted to understand why the 1987 single-variable RREs seem to provide better accuracy and less bias than either of the 2013 multi- or single-variable RREs. The re-assignment of hydrologic regions for streamgages and the use of a mixed landform calculation for the 1987 single-variable RREs seem to have had no substantial effect regarding the relative accuracy and bias compared to the 2013 multi- or single-variable RREs for drainage basins with areas less than 20 mi^2
A comparison of 1-percent annual exceedance-probability regression lines for hydrologic regions 1–4 from the 1987 single-variable RREs and for flood regions 1–3 from the 2013 single-variable RREs indicates that the 1987 single-variable regional-regression lines generally have steeper slopes and lower discharges when compared to 2013 single-variable regional-regression lines for corresponding areas of Iowa. The combination of the definition of hydrologic regions, the lower discharges, and the steeper slopes of regression lines associated with the 1987 single-variable RREs seem to provide better accuracy and less bias when compared to the 2013 multi or single-variable RREs; better accuracy and less bias was determined particularly for drainage areas less than 2 mi^2, and also for some drainage areas between 2 and 20 mi^2. The 2013 multi- and single-variable RREs are considered to provide better accuracy and less bias for larger drainage areas.

OBJECTIVES
Results of this study indicate that additional research is needed to address the curvilinear relation between drainage area and AEPDs for areas of Iowa. The development of two sets of RREs for large and small drainage areas, and the development of a method to resolve the problem of transitioning estimates of AEPDs between the two sets of RREs, may need to be reconsidered in future research for flood-estimation studies in Iowa.

DISCUSSION
Q. Were you surprised by the results?
A. We thought we were doing a better job testing the smaller drainage areas but it wasn't until this study where we tested everything side by side and focused on looking at testing smaller drainage areas we found out the 2013 equations are not doing as well as we thought they were.
Q. How do you see this being utilized long term?
A. I believe they are incorporating this study in the culvert program for small drainage areas that will help users know what flood estimation can be used for what areas of the State and what size of drainage area for these small drainage areas.

Motion to Approve by R. Fangmann; 2nd P. Mouw
Motion carried with 12 Aye, 0 Nay, 0 Abstaining.

8. **Continuation Proposal: HR-140,** "Collection and Analysis of Streamflow Data", Jon Nania, USGS

BACKGROUND
The USGS makes every effort to be on site at Crest Stage Gages (CSGs) to obtain measurements of streamflow. These measurements are used to define the relation between stage and discharge at each location. Because of the flashy nature of small watersheds it is difficult to know when the streams are flowing so direct measurements of streamflow can be made. In an effort to reduce unproductive trips to the field and to know when these smaller basins are flowing, the USGS has been adding real-time sensors and platforms for hourly data transmission to the USGS webpages. The CSG network was refined in 2014 to make funds available to add real-time sensors at two locations annually. The USGS has upgraded a total of 24 CSGs to real-time sensors (3 in 2015) and is planning to upgrade another two in the coming Fiscal Year. This will result in better data collection and eventually a cost savings as the initial costs will be higher but absorbed within the regular funding program, hence the small number of gages to be upgraded each year. The long term cost savings will result from better data, better stage-discharge relations, fewer trips to the field, and less field time checking sites for anticipated streamflow. As a result of these real-time sensors, the most streamflow measurements made in a single year for the CSG network were made in 2015. An added benefit for these real-time sensors is that the National Weather Service has been using the data to verify their flood forecast models during floods.

OBJECTIVES
The objectives of this proposed research are to:
(1) Operate, maintain, and publish streamflow data for 21 continuous-record streamgages located throughout the State
(2) Operate, maintain, and publish high-flow data for 80 partial-record (crest-stage) streamgages located throughout the State.
(3) Collect and publish water-surface profiles, and storm and flood description information, for significant flood events of interest to the IDOT.

DISCUSSION
Q. Is this request partially funding the gages and partially funding the on call work that we may or may not utilize?

A. Yes
Q. In the past years have we under or over spent?
A. It has never been that we have ever under spent. There has always been a flood that we have profiled and the following reports that are written up for those floods.
Q. What do other States do with their DOT's?
A. Other States have similar programs with the CSG networks and the stream gages that are pretty common. As for as the flood profile program I have seen similar studies in other States. We probably have the most detailed.

Motion to Approve by R. Knoche; 2nd L. Roehl
Motion carried with 12 Aye, 0 Nay, 0 Abstaining.

9. **Implementation Proposal:** "Real-time Flood Forecasting and Monitoring Systems for Highway Overtopping in Iowa", Jon Nania, USGS

BACKGROUND

The Iowa DOT has utilized the BridgeWatch program since 2006 to provide alerts when rainfall events or stream gages indicate the potential for significant flooding at scour critical bridges. The Iowa DOT would like to use this real-time warning program to provide alerts when a highway is about to overtop due to flooding. To this end we proposed a project to interface the information of sonic-sensors developed by the Iowa Flood Center and the prediction of their hydrologic model with BridgeWatch and perform a study to determine the impact of merging these technologies in improving response to situation of road flooding, and flash flooding.
In order to better predict the potential for flood waters to overtop a highway, the University of Iowa's hydrologic model CUENCAS will be used to provide flood forecasting at various sites where the highway infrastructure is most vulnerable to flooding. The Iowa Flood Center has created a hydrologic model for the entire state which can incorporate real-time rainfall events and forecast resultant peak flows along any basin in the state of Iowa. The hydrologic model can provide a predicted flood discharge that can be integrated with a stage/discharge relationship in the BridgeWatch program so that real-time warnings can be provided to maintenance staff before a highway overtops thereby enhancing public safety.

OBJECTIVES

There are many types of forecasts, each of which calls for slightly different methods of verification. The table below lists one way of distinguishing forecasts, along with verification methods that are appropriate for that type of forecast. David Stephenson has proposed a classification scheme for forecasts. It is often possible to convert from one type of forecast to another simply by rearranging, categorizing, or thresholding the data. Allan Murphy, a pioneer in the field of forecast verification, wrote an essay on what makes a forecast "good" (Murphy, 1993). He distinguished three types of "goodness":
Consistency - the degree to which the forecast corresponds to the forecaster's best judgement about the situation, based upon his/her knowledge base
Quality - the degree to which the forecast corresponds to what actually happened
Value - the degree to which the forecast helps a decision maker to realize some incremental economic and/or other benefit

DISCUSSION

Q. Is this a sonic sensor that you are using? Are the sensor's off the shelf and you are just mounting them?
A. The sensor itself is off the shelf but the whole construction is manufactured at the Iowa Flood Centers along with the electronics that are also built in house.
Q. Have you worked with any of the railroads with this project?
A. No, we have not worked with the railroad.
Q. The Iowa Flood Center would be maintaining and monitoring the sensors through the fall of 2018 and what will happen after 2018?
A. They will stay the same and the Iowa Flood Center will keep maintaining them.
Q. Would you consider the direction with involving USGS?
A. There is definitely an overlap; we have this idea of filling in the gaps that are missing.
Q. You mentioned that USGS is the gold standard. If we are funding the USGS as a gold standard where does that leave this project?
A. The gold standard is one that comes at a cost so the rating curves do not get developed over night.

Motion to Approve by D. Schnoebelen; 2nd K. Jones
Motion carried with 12 Aye, 0 Nay, 0 Abstaining.

***** 1 member left the table. Total voting members = 11.**

10. RFP Proposals

a. IHRB-14-08, "Concrete Overlay Performance on Iowa's Roadways", Peter Taylor, Iowa State University

Motion to Approve by K. Jones; 2nd R. Knoche
Motion carried with 11 Aye, 0 Nay, 0 Abstaining.

11. New Business

a. Iowa LTAP Funding: Due to loss of one source of LTAP funding, the October proposal for LTAP funding will be higher than previous years.

Adjourn

The next meeting of the Iowa Highway Research Board will be held Friday, October 30, 2015, in the East/West Materials Conference Room at the Iowa DOT. The meeting will begin promptly at 9 a.m.

Vanessa Goetz, IHRB Secretary