IOWA HIGHWAY RESEARCH BOARD (IHRB)

Minutes of September 27, 2019

Regular Board Members Present

W. Weiss
P. Geilenfeldt III
L. Bjerke
B. Wilkinson
J. Thorius
T. Kinney
W. Dotzler
C. Poole
T. Nicholson
R. Koester
R. Knoche
A. Bradley

Alternate Board Members Present

M. Rydl
T. Wipf

Members with No Representation

D. Claman

Executive Secretary – V. Goetz

Visitors

Tammy Bailey	Iowa Department of Transportation
Brian Worrel	Iowa Department of Transportation
Khyle Clute	Iowa Department of Transportation
Francis Todey	Iowa Department of Transportation
Halil Ceylan	Iowa State University/InTrans
Yang Zhang	Iowa State University/InTrans
Sunghwan Kim	Iowa State University/InTrans
Ashley Buss	Iowa State University/InTrans
Chris Williams	Iowa State University/InTrans
Justin Dahlberg	Iowa State University/InTrans
Alice Alipour	Iowa State University/InTrans
Terry Wipf	Iowa State University/InTrans
Shauna Hallmark	Iowa State University/InTrans
Sri Sritharan	Iowa State University
Siddique Muhammad	Iowa State University
Gordon Smith	National Concrete Pavement Technology Center
Jon Nania	U S Geological Survey
Amy Russell	U S Geological Survey
Padraic O'Shea	U S Geological Survey
John Rasmussen	Pottawattamie County

The meeting was held at the Iowa Department of Transportation Ames Complex, East/West Materials Conference Room on September 27, 2019. The meeting was called to order at 9:00 a.m. by Chair Allen Bradley with an initial number of 14 voting members/alternates at the table.

1. **Agenda review/modification**

2. **Minutes Approval from the July 26th meeting**
   Motion to Approve by R. Knoche; 2nd L. Bjerke
   Motion carried with 14 Aye, 0 Nay, 0 Abstaining

3. **Minutes Approval from online Special meeting 1 for TR-730**
   Motion to Approve by M. Rydell; 2nd R. Koester
   Motion carried with 14 Aye, 0 Nay, 0 Abstaining

4. **Minutes Approval from online special meeting 2 for TR-730**
   Motion to Approve by W. Dotzler; 2nd L. Bjerke
   Motion carried with 14 Aye, 0 Nay, 0 Abstaining

5. **Final Report: TR-684, *"Laboratory and Field Evaluation of an Alternative UHPC Mix and an Associated UHPC Bridge"*,** Brent Phares, Iowa State University, $85,792. (15 min)

BACKGROUND

UHPC is a relatively new class of concrete that has material and durability properties superior to normal concrete. These unique properties make it appropriate for use in accelerated bridge construction (ABC) for highway bridges.
The unique properties of UHPC offer several advantages, which can be summarized as follows:

Because of the increase in compressive and tensile strengths, smaller sections can be used to design flexural beams that support large loads. Using smaller sections leads to reduced dead weight of the structure. In addition, the depth of the girders and shear reinforcement can be reduced.

Due to the compactness of the material, it is impermeable to water and aggressive chemicals, making it a highly durable material. High durability can lead to longer service life of the structure and lower maintenance cost over the structure's lifecycle.
Field applications of UHPC for highway bridges in the US started in 2006. After understanding the effective properties of UHPC, the Iowa Department of Transportation (DOT) used it in the

rehabilitation and construction of several bridges in Iowa: the Wapello County UHPC bridge, the Jakway Park Bridge in Buchanan County, a waffle deck panel system bridge in Wapello County, and the Mars Hill Bridge south of Ottumwa.

OBJECTIVES

The objective of this project was to evaluate an alternative ultra-high-performance concrete (UHPC) mix that used locally sourced cement, sand, and ready-mix trucks and a bridge constructed using the mix for its cross-section pi-girders in Buchanan County, Iowa.

DISCUSSION

Q. You mentioned the use of rebar was lower, do you have a percentage?
A. Reduction of steel was 80%

Motion to Approve by W. Weiss; 2nd T. Nicholson
Motion carried with 14 Aye, 0 Nay, 0 Abstaining

6. **Final Report: "TR-711, *"Investigation of Exterior Girder Rotation and the Effect of Skew during Deck Placement"*,** Brent Phares, Iowa State University, $89,999, (15 min)

BACKGROUND

The practice of using common girder sizes for all girder lines limits the bridge designer's ability to economically design the fascia girder to withstand bridge deck construction loads. In general, large eccentric deck placement loads come from two sources: large overhangs and deck finishing equipment typically positioned at the edge of the overhang. Combined, the resulting torsional loads have resulted in issues in both steel and concrete superstructures.

It has been observed that current construction practices associated with placing bridge decks sometimes result in excessive out-of-plane and torsional loads on the exterior girders. Structurally, this can result in decks that are too thin or girders with excessive (and unintended) internal stresses. Functionally, this can result in bridges that are difficult to maintain or have rideability issues. In some cases, the most extreme situations have occurred during bridge widening projects.

OBJECTIVES

The objectives of this work were to investigate exterior girder rotation and the effect of skew during bridge deck placement.

DISCUSSION

Q. Is it the exterior beam deflection that's causing the fitting or is it the slap jacks on the outsides lack of stiffness causing it or the exterior beam?

A. It is not limited to the exterior.

Motion to Approve by R. Knoche; 2nd R. Koester
Motion carried with 14 Aye, 0 Nay, 0 Abstaining

7. **FINAL REPORT: TR-615, *"Connection Details and Field Implementation of UHPC Piles-Phase II",*** Sri Sritharan, Iowa State University, $210,000, (15 min)

BACKGROUND

Through laboratory and field studies, the first phase of this project showed that UHPC can be efficiently used in precast and prestressed piling to improve foundation durability, reduce bridge maintenance costs, and extend the service life of a bridge.

UHPC is a cement matrix often used with steel fibers, and it has several advantages over other materials often included in bridge foundations. These advantages include strength, ductility, durability, and aesthetic design flexibility, which are achieved by eliminating the characteristic weaknesses of normal concrete.

OBJECTIVE

The primary objective of this research was to improve the design of ultra-high-performance concrete (UHPC) piles through the development of suitable connection and splice details, and the verification of their performance under laboratory and field conditions.

Motion to Approve by W. Dotzler; 2nd B. Wilkinson
Motion carried with 14 Aye, 0 Nay, 0 Abstaining

8. **Proposal IHRB-187**
   a. **IHRB-0187,** "Development of Approaches to Quantify Superloads and Their Impacts on Iowa Road Infrastructure System", Chris Williams, Iowa State University, $390,000
   b. **IHRB-0187,** "Development of Approaches to Quantify Superloads and Their Impacts on Iowa Road Infrastructure System", Halil Ceylan, Iowa State University, $389,926
   c. **IHRB-0187,** "Development of Approaches to Quantify Superloads and Their Impacts on Iowa Road Infrastructure System", Dr. Beiwen Li, Iowa State University, $68,511

   d. Approved: IHRB-0187, "Development of Approaches to Quantify Superloads and Their Impacts on Iowa Road Infrastructure System", Halil Ceylan, Iowa State University, $389,926

      Motion to Approve by W. Weiss; 2nd W. Dotzler

Motion carried with 13 Aye, 0 Nay, 1 Abstaining

9. **Proposal: HR-140: *"Collection and Analysis of Streamflow Data",*** Jon Nania, USGS Central Midwest Water Science Center, $445,185 (FY20 $261.525, FY21 $261,525), (15 min)

BACKGROUND

Research project HR-140 was established July 1, 1968, by consolidating three separate research projects then under contract between the U.S Geological Survey (USGS) and the Iowa State Highway Commission. In cooperation with the USGS Central Midwest Water Science Center, HR-140 funds three separate programs: (1) continuous-record streamgages in Iowa, (2) partial-record crest-stage gages in Iowa, and (3) flood profiles of Iowa streams. The oldest of these three programs began operation in 1950; the other two began in 1957 and 1959.
The first research by the USGS for the Iowa State Highway Commission was a compilation and analysis of existing records of the streamflow of Iowa streams. This research produced Iowa Highway Research Bulletin I, *Iowa Floods--Magnitude and Frequency* (Schwob, 1953). Coincident with the preparation of this bulletin, the USGS established a number of streamgages on smaller streams in Iowa which generally drain areas of less than 100 square miles. Prior to this time, there existed only an extremely small amount of information on the magnitude of streamflow in these smaller streams. Currently, the streamflow gaging portion of project HR-140 fully or partially funds the operation and maintenance of 101 streamgages on rivers and streams in Iowa. This network of stations includes fully funding 80 crest-stage gages (CSG) and partially funding 21 continuous-record streamgages. Site visits to each streamgage occurs on a six-week interval for routine measurements of streamflow and gage inspection. During flood events, additional measurements of streamflow are made to better define the stage-discharge rating curve.

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 annual peak-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. When did the DOTs relationship with USGS start with this?
A. 1968
Q. Is this the data that is collected that goes into streamstats?
A. It's a little different. (I couldn't understand him.)

Q. Did this project fund installing more gauges?
A. No, it's to maintain the network of gauges.

Motion to Approve by W. Weiss; 2nd T. Nicholson
Motion carried with 14 Aye, 0 Nay, 0 Abstaining

10. Matching Fund Proposal, *"Use of Organosilanes to Mitigate the Impact of Freeze-Thaw Damage to the Granular Roadways in Iowa"*, Bora Cetin, Michigan State University, $349,672, (15 min)

BACKGROUND

When the air temperature at the surface is lower than the temperature of the soil, heat is extracted from the soil, causing its temperature to drop. If the surface temperature is below 0°C, a freezing plane advances into the soil. Ice crystals begin to form along the freezing plane and water migration starts from the lower unfrozen soil toward the freezing front due to suction pressures that result from the freezing action. This water migration produces higher moisture contents at the top portion of the soil than it was before freezing. Ice crystals continue to grow and join the freezing front if the freezing is slow and fed mostly by capillary water, forming ice lenses. The formation of ice lenses produces a vertical pressure that heaves the surface. The conversion of water in the soil pores to ice produces an increase in volume of about 9%, however ice lensing can create much larger volumetric increases, as shown in Fig. 3. The increase in the volume of the soil due to the formation and growth of ice lenses is known as frost heave.

The frost heave varies over a wide range, but vertical movements of 4 inches to 8 inches are not unusual and movements as large as 24 inches have been reported. For soils where the only supply of water is that held within the pores of the freezing soil, the frost heave is limited to the change in volume of the in-situ pore water upon freezing. This would also result in discrete ice lenses while external water sources produce larger ice lenses and increase the severity of frost action. This behavior has long been recognized, with Taber documenting continuous vertical displacement via successive ice lens formation and growth. Studies performed with soils with different gradations showed that frost heave increased linearly with increasing fine contents and kaolinite fractions. Heaving pressures also vary within wide limits and depend on the type of soil and its moisture content, with findings in this general area chronicled by Darrow et al
.
As mentioned above, ice segregation and frost heaving are dependent on a favorable balance between the removal of heat and the influx of soil water, usually by capillary flow. If the capillary flow is prevented via the use of OS, the formation of ice lenses will be prevented, which will ultimately reduce the migration of water towards topsoil. Thus, the frost heave potential of soils will be reduced.

OBJECTIVES

The overarching ***research objective of this proposal*** is to evaluate the use of organo-silane (OS) to mitigate frost heave-thaw settlement and freeze-thaw weakening of frost susceptible soils and clayey soils under granular roadways in Iowa.

Motion to Approve by T. Kinney; 2nd J. Thorius
Motion carried with 13 Aye, 0 Nay, 1 Abstaining

11. New Topic Ranking

The following new topics were selected by the IHRB to move forward towards Project Development and Requests for Proposals will be issued per funding availability.

Submission #	Proposed Title
346	Load Rating for Standard Bridges for LRFR
341	Thin Bonded Concrete Overlays on Concrete to Improve Rehabilitation of Iowa Roadways
326	Improving Maintenance and Rehabilitation Practices on Iowa Gravel Roads
286	Development of Iowa Granular Road Structural Design Tool
275	Design of Bridges for Minimum Maintenance: Phase I
328	Utilization of Plastic Waste Recycling Materials for Iowa Road Infrastructure Applications

12. Revisit Topics on Hold

Submission #	Topic Action	Proposed Title
210	Hold	Best Practices for Joint Sawing
160	Hold	Fiber Reinforcement for HMA pavements

13. New Business

14. Action Items

- TR-684 – discuss ideas on making Korean UHPC enter the marketplace in US

15. Regular Meeting Adjourn

The next meeting of the Iowa Highway Research Board will be held Tuesday, December 10, 2019 at 1:00 pm at the Boardroom 3, Veteran's Memorial Community Choice Credit Union Convention Center, 833 5th Ave, Des Moines, Ia

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Vanessa Goetz, IHRB Executive Secretary