IOWA HIGHWAY RESEARCH BOARD (IHRB)

Minutes of February 25, 2022

Regular Members Present

J. Hauber
D. Skogerboe
J. DeVries
R. Koester
R. Knoche
A. Bradley
D. Sanders
W. Weiss
T. Roll
J. Fantz
A. McGuire
A. Bardgett

Alternate Members Present

B. Wilkinson
T. Wolken
A. Clemons

Members with No Representation

C. Burke

Executive Secretary

V. Goetz

The meeting was opened on February 25, 2022 at 9:00 a.m. by Chair Andrew McGuire with an initial number of 13 voting members/alternates.

AGENDA

1. **Agenda review/modification**
Moving Halil to present first.

Motion to Approve by T. Roll 2nd by D. Sanders
Motion carried with 13, 0, 0

2. **Minutes Approval from the December 14, 2021 meeting**
Correct misspelling
Low Volume Roads Conference to be held in Cedar Rapids

Motion to Approve by W. Weiss 2nd by R. Koester
Motion carried with 13, 0, 0

3. **IHRB 2022 Membership Update**
James Hauber new DOT member, alternate Ashley Buss.
Dustin Skogerboe new DOT member, alternate Zach Gunsolley.
Ron Knoche city member and John Joiner city alternate were re-appointed to another term.

Jacob Thorius is a new permanent alternate for Wade Weiss.
William Rabenberg moved to County member, alternate Bret Wilkinson.
Trent Wolken is new County alternate for Mitchel Rydl.
Derek Snead is new alternate for Anthony Bardgett.

Annual Report for the Iowa Highway Research Board FY21 has been published. It is posted on the Iowa Research website https://iowadot.gov/research/Programs-and-Partnerships/Iowa-Highway-Research-Board#509792161-annual-report

Member Joined

4. **TR-810** Innovative Idea Proposal #3561: "Use of Iowa Eggshell Waste as Bio-Cement Materials in Pavement and Gravel Road Geo-Material Stabilization", Halil Ceylan, Iowa State University, $60,000

Abstract
The primary objective of this study is to explore and demonstrate the concept of using Iowa eggshells as bio-based, cementing materials to strengthen and stabilize frost-susceptible soils and improve the low quality of local aggregates presently used in Iowa pavement and gravel road applications. Specific objectives for achieving this primary objective include: (1) identifying and characterizing Iowa eggshells; (2) performing laboratory assessments with respect to constructability and performance of geo-material stabilization techniques using Iowa eggshell-based, bio-cement materials; and (3) demonstrating success/improvement of eggshell-based, geo-material stabilization techniques for use in Iowa pavements and gravel roads while also developing implementation recommendations for their real-world application.

Motion to Approve by A. Clemons 2nd by W. Weiss
Motion carried with 14, 0, 0

5. **TR-805** Proposal #3071: "Design of Self-Cleaning Solutions for Mitigating Sedimentation at Twin-and Single-Box Culverts", Marian Muste, University of Iowa, $349,956.

Abstract
Sedimentation at multi-box culverts is an ongoing maintenance issue for the crossroads located in low-gradient, erosion-prone watersheds such as those located in Iowa landscapes. Sediment deposits diminish the culvert capacity to convey peak flows leading to damages to the culvert structures and potentially create backwater upstream from culvert locations. The proposed research investigates self-cleaning solutions for the single- and twin-box culverts building on the successful experiences garnered through extended research carried out on sedimentation at culverts in Iowa. The previous research has only targeted three-box culverts as they were considered of most immediate concern to the Iowa Department of Transportation (DOT) at the initiation of this research in 2006. The series of previous projects developed self-cleaning designs combining inn1feren1ce1s 1fro1m field observations, hydraulic modeling, and numerical simulations. After closing 1th1e research phases, construction and in situ monitoring over several years followed. The research on three-box culverts has recently expanded to include culvert configurations and stream environments at other state DOTs in the nation through a Transportation Pooled Fund.
The need for a distinct research for development of self-cleaning designs for single- and twin-box culverts stems from the fact that their hydraulics is different from culverts with odd number of boxes as the latter culvert configuration includes a central box which is used for enhancing the conveyance of the sediment. In the absence of the central box, the self-cleaning solutions for the single- and double-box culverts have to seek for altern1ative flow-deflecting geometries that take up the sediment conveyance role. We are confident that by adopting the same design principles, research strategy, and practical considerations as those utilized for the previous research on three-box culverts, we can develop new self-cleaning designs that will keep the single- and double-box culverts free of sediment without outside intervention.

Motion to Approve by T. Roll 2nd by A. Bradley
Motion carried with 13, 0, 1

6. **TR-806** Proposal #3402: "Ultra High-Performance Concrete Repair of Steel Bridge Girder Ends", Behrouz Shafei, Iowa State University, $300,000.

Several state and county engineers are facing the daunting task of maintaining an inventory of corroding steel structures. Capitalizing on the superior strength and durability properties of ultrahigh performance concrete (UHPC), an innovative solution will be developed, tested, and demonstrated through this research project. This will lead to substantial advances in the repair and retrofit of steel bridges subjected to corrosive environments. The use of UHPC is believed to introduce a broad spectrum of benefits in both the short and long term. Specifically, UHPC offers a workable repair that can be applied in the field with minimum equipment requirements. This significantly expedites the repair process, resulting in minimized road closures and traffic disruptions. When repaired using UHPC, steel girders will not only regain their lost structural capacity but will also be protected against corrosive environments by a strong yet passive layer. This is an important feature, which will greatly extend the expected service life of steel bridge girders without having to repeat maintenance actions every few years. To achieve the ultimate goal of this research project, a holistic set of research tasks and activities have been planned, including conceptual designs, numerical simulations, laboratory investigations, and a field demonstration. With the development of supporting technology transfer materials, the outcome of this project is expected to pave the way to utilizing the advantages of this repair solution for future use and implementation in various state- and county-owned steel bridges.

Motion to Approve by A. Clemons 2nd by R. Koester
Motion carried with 14, 0, 0

7. **TR-807** Innovative Idea Proposal #3544: "Beneficial Use of Iowa Waste Ashes in concrete through Carbon Sequestration", Kejin Wang, Iowa State University, $60,000.

Abstract
By 2019, Iowa was the 16th in the nation in coal power generation, with 72 operating coal-fired power units totaling 6,492 megawatts (MW). Presently, each of the power plant still produces significant amount of waste ashes, most of which have been deposited in landfills because they do not meet specifications for construction and other applications. The landfills pose serious risks for the surrounding environment, e. g., leaching of chemicals into ground and surface waters. Recently, research has shown that many of these power plant waste ashes are rich in silicate and/or calcium, and they could react with carbon dioxide (CO2) in atmosphere to produce calcium carbonate (CaCO3), thus altering the properties of these ashes. Based on this concept, the proposed study is to inject captured CO2 into selected Iowa power plant waste ashes (coal and RDF ashes, fly ash and bottom ashes) to treat or cure the waste ashes, change their properties (e.g., surface chemistry, morphology, and pore structure), and enable them to be beneficially used in concrete. The main tasks of the study will include (1) to optimize carbon curing procedure (Pressure, moisture, and time) for the selected waste ashes, (2) to determine the effects of carbon curing on properties (the surface chemistry, morphology, pore structure, etc.) of the ashes, (3) to learn about the effects of carbon cured ashes on the properties (set time, flowability, hydration, strength etc.) of cement composites (e. g., paste and mortar), and (4) to investigate how much CO2 can be consumed by or sequestrated in the waste ashes, and (5) to assess the potential benefit-to-cost ratio of the carbon curing treatment for the waste ashes. It is expected that this study can generate profound environmental, economic, and social impacts as overabundant waste ashes in Iowa are extensively and beneficially used.
Discussion
Q. If the research is far enough along to include in Grant applications, for a deck or portion of a bridge?
A. The goal is to put this research in the field. Field implementation with be the next phase.

Motion to Approve by D. Sanders 2nd by R. Knoche
Motion carried with 14, 0, 0

8. **TR-808** Innovative Idea Proposal #3545: "A Sustainable Air-entraining and Internal Curing Agent", Ravi Kiran Yellavajjala, North Dakota State University, $60,000.

Abstract
We hypothesize that a biodegradable corn-starch hydrogel when dispersed in concrete in tiny droplets can serve as an internal curing agent in the initial stages (within 14 days) and will deteriorate in the long run leaving behind a network of finely distributed air voids. The technical objectives are 1) to synthesize biodegradable corn-starch hydrogel crystals; 2) to evaluate the biobased hydrogel as an internal curing agent, and 3) to quantify the air content and freeze-thaw performance of the hydrogel concrete.

Motion to Approve by W. Weiss 2nd by A. Clemons
Motion carried with 14, 0, 0

9. **TR-809** Innovative Idea Proposal #3553: "Introducing Smart Materials in Granular Roadway and Pavement Foundation Systems for Mitigating Freeze-Thaw Damage", Bora Cetin, Michigan State University, $60,000.

Abstract
The objective of the proposed research is to investigate the extent to which phase change materials (PCMs) mitigate the impacts of freeze-thaw cycles on heaving and strength loss among frost susceptible subgrade soils. This new mitigation method has the potential to dramatically extend the service life of civil infrastructure systems while demonstrating the use of smart materials as a novel method for soil improvement. Seasonal frost heaving and freeze-thaw weakening have a significant effect on granular and local roadways. A lack of insight as to and viable solutions for these problems exacerbates maintenance costs. The principal hypothesis of the proposed work is that PCMs will help keep the soil temperature above freezing (> 0 °C) for longer which will minimize the existing and capillary water in soils to freeze and form ice lenses thereby preventing frost heave and strength loss in subgrade soils. This hypothesis will be tested via a series of state-of-the-art laboratory-scale tests under various settings, and numerical modelling. The proposed research contains three phases: (1) characterization; (2) optimization; and (3) performance. The characterization phase will determine the index and physicochemical properties of soils, PCMs, and soil-PCM mixtures while the optimization phase will determine the best inclusion method for PCMs in soils. Experiments in the performance phase will evaluate how PCM inclusion impacts the frost heave and the strength loss after freezing and thawing.

Motion to Approve by R. Koester 2nd by A. Bardgett
Motion carried with 14, 0, 0

10. 13th International Conference on Low Volume Roads, July 23 – 26, 2023 Cedar Rapids, IA – Conference Support: Nancy Whitting, Transportation Research Board, $60,000

The Iowa Highway Research Board requested that TRB explore the viability of a lower conference registration rate as part of IHRB's sponsorship of the conference. IHRB will commit an additional $60,000 in support of the 13th International Low Volume Roads Conference to allow a lower registration rate with the goal to encourage low volume road practitioners in mostly local public agencies and tribal government staff to attend the conference

Motion to Approve by W. Weiss 2nd by R. Knoche
Motion carried with 13, 0, 1

11. Summer 2021 Cycle IHRB Ranking:

a. #3543 - Use of Waste Glass Powder as an alternative pozzolanic material in concrete **#2**
b. #3480 – Roller Compacted Concrete Shoulders **#1**
c. #3473 – Coordinated Promotion of Local Transportation Agency Careers **#3**

12. New Business

https://ideas.iowadot.gov/ is our Research project portal for managing submittal of ideas and project requests. The site is visible to anyone. Iowa DOT employees can use their current log in credentials to access the site. Anyone external to the DOT can view the site as an external guest. However, in order to comment, like, vote, or interact with the site, external DOT guests must create a free account.

A brief overview of how ideas are reviewed can be found here: https://ideas.iowadot.gov/how-it-works/84/widget_id_18?qmzn=iKFrYf

Here's a filtered view of IHRB projects. Please note, older projects are being migrated into the site when final reports are completed.

For information or a tour of our site, please send an email to contact.research@iowadot.us

13. Adjourn

Motion to Approve by R. Koester 2nd by R. Knoche
Motion carried with 14, 0, 0

The next regular meeting of the Iowa Highway Research Board is scheduled for March 25, 2022.
VG