IOWA HIGHWAY RESEARCH BOARD (IHRB)
Minutes of September 29, 2006

Regular Board Members Present

R. Ettema
T. Fonkert
J. Ites
J. Joiner
J. Krist
M. Nahra
J. Rasmussen
R. Schletzbaum
C. Schloz
D. Waid

Alternate Board Members Present

J. Cable for J. Alleman
M. Kerper for L. Jesse
J. Berger for J. Adam
D. Maifield for Ahmad Abu-Hawash
Jon Singelstad

Board Members with No Representation

S. Dockstader

Secretary - M. Dunn

Visitors

Dave Claman	Iowa Department of Transportation
Randy Faber	Iowa Department of Transportation
Sandra Larson	Iowa Department of Transportation
Judy McDonald	Iowa Department of Transportation
Mary Starr	Iowa Department of Transportation
Lowell Greimann	Iowa State University/CTRE
Shauna Hallmark	Iowa State University/CTRE
Larry Stevens	Iowa State University/CTRE
Mohamed Elhakeem	The University of Iowa

The meeting was held at Iowa State University's Scheman Center, Room 250-252, Ames, Iowa. The meeting was called to order at 9:00 a.m. by chairperson Jon Ites with an initial total of 13 voting members/alternates at the table.

Agenda review/modification

None

Approval of the minutes

- Motion by Roger Schletzbaum to approve the minutes from the July 28, 2006 meeting. 2nd by Clark Schloz. Carried 13 yea, 0 nay, 0 abstaining.

FINAL REPORTS

Final Report TR-510, "Laboratory Study of Structural Behavior of Alternative Dowel Bars," Max Porter, ISU/CTRE ($57,992)

Purpose – To determine testing procedures for a modified version of the current AASHTO T253 test procedure. The Iosipescu was very effective at creating a pure shear condition at the joint of the test specimen. The problems associated with the Iosipescu test were constructability issues. It was difficult and time-consuming to build the load apparatus to create this pure shear.

Objectives - To study the determination of the Modulus of Dowel Support, *k0,* while examining the following variables:

- Joint width
- Dowel bar shape
- Dowel bar material
- Relative joint deflection
- Bearing stresses between dowel bars and surrounding concrete
- To determine the adequacy of alternative dowel bars
- To determine improvements to the current AASHTO T253 dowel shear procedure

Conclusions - Behavioral

- As flexural rigidity increases, *k0* increases and bearing stresses increase
- As dowel width increases, *k0* decreases and bearing stresses decrease
- Larger deflections correspond to lower *k0* values and lower bearing stresses
- Different joint widths do not provide definitive changes to *k0* Procedural
- The cantilever test did not yield results preferable to those obtained from the modified AASHTO procedure
- Clamping mechanism was not adequate to resist increased applied moments to test block

Recommendations – Future Research

- Effects of wider joints, such as those used for contraction, e.g. 1-inch or more
- Effects of repeated loading (fatigue testing) on the oblonging of dowel holes
- Long-term evaluation of FRP in pavement structures
- Effects of repeated loading
- Effects of environment

Modifications of AASHTO Procedures

- Change uniform longitudinal load to two linear, transverse loads at 3" inside joints
- Specify dual end clamps to further restrict effects of end block rotation

New Test Procedures - Modify test specimen in order to combat 2 unwanted variables:

- Excess end block rotation
- Excess middle block twisting about the dowel

Larger specimens

- Will allow for greater clamping forces on end blocks
- Will allow for an additional pair of dowel bars per specimen

Suggested New Test Procedures

- Cross-section simulates incremental portion of a highway slab

- Vertical post tensioning ducts allow for greater clamping forces without unwanted normal forces applied to dowel
- Minimal horizontal post tensioning is similar flexural reinforcement in a reinforced concrete beam
- Prevents damage to specimen when moving
- Provides additional resistance to end block rotation

(During the presentation 2 Board Members joined the table.)

Motion to Approve
Motion by Jim Berger, 2nd by Clark Schloz.
Motion carried with 15 aye, 0 nay, 0 abstaining.

Final Report TR-478, "Evaluation of Composite Pavement Unbonded Overlays: Phase III," Jim Cable, ISU/CTRE ($49,520)

Problems - Iowa is known for its large amounts of Portland Cement Concrete (PCC) pavements. The design life of the initial pavement systems was established as 20 years. This meant that by the 1970s many of the systems had reached or were exceeding their design life. The decision was made to widen and resurface these pavements with asphalt cement concrete (ACC). This philosophy was used to extend the life for 10–15 years, or until funding could be found to replace the pavements.

Purpose - Rather than continue to overlay these composite pavements with asphalt, this study incorporates previous research on concrete alternatives that provide longer life at a lower life-cycle cost and investigates thin, unbonded concrete overlays which are a relatively new option for the paving industry and study durability and stability of these new processes.

Objectives – To measure the stability and durability of unbonded, thin PCC overlays over time considering the following factors:

- Bonding between the PCC and ACC layers
- Joint spacing
- PCC thickness
- Use of concrete fibers in the concrete
- Surface preparation
- Joint/crack preparation in the existing pavement

The objectives of this research were accomplished by conducting both laboratory and field tests, collecting data, and analyzing the data appropriately. The Final Report documents practices and results as well as information concerning the achievements of the research.

Conclusions –
- Overlay depths of 3.5" or greater can be built without the use of fiber inclusion.
- Adding fibers to overlay depths of 4"or less will provide insurance against loss of materials in the event of an individual slab loss-of-support and multiple cracking.
- Structural fibers can provide an opportunity for larger slab sizes without loss of load transfer or increased cracking rates in overlays of 4.5" or less.
- Minimal scarification of the base asphaltic concrete surface is shown to be the most efficient way to control overlay quantities, assure proper cross slope, and minimize overlay thickness design while placing additional concrete in the rutted areas of existing surface.

- Three isolated areas in an outer wheel path sustained fractured slabs and loss of up to 1–4 panels over the course of the research. The panels were replaced with hand methods and concrete repair materials supplied by the Maintenance Staff of the Iowa DOT. Joints were reestablished, and the patches are performing well at this time. No common variables were demonstrated in the three separate areas, and it can be noted that the fibers in the concrete did control loss of section when the concrete cracked.
- This project has shown that maintenance personnel with normal materials and equipment can maintain the concrete surface when isolated panels fail under this design system.
- The wider joint openings at the beginning of the project have collected more particle debris, but they exhibited no distress at the end of the research period.
- Test segments where sawing dust was not removed performed equally to those where joints were cut and blown clean.
- The results of this project and 2 others in Iowa indicate that a design process now exists to provide engineers with a portland cement concrete answer to pavement rehabilitation needs. All that remains is implementation and use.

Motion to Approve
Motion by Mark Nahra, 2nd by Todd Fonkert.
Motion carried with 15 aye, 0 nay, 0 abstaining.

Final Report TR-513, "Decision Support Model for Assessing Archaeological Survey Needs for Bridge Replacement Projects in Iowa," Joe Artz, The U of I ($50,000)

Background – To comply with Section 106 of the National Historic Preservation Act, the Federal Highway Administration (FHWA) and Iowa Department of Transportation (Iowa DOT) are required to determine the effects of federally-assisted transportation undertakings, including bridge replacements, on archaeological sites.

In the past 30 years, hundreds of archaeological surveys have been conducted for local and primary system bridge replacement projects. These surveys often require costly and time-consuming subsurface excavation to search for sites that may be deeply buried in thick deposits of alluvial (stream-deposited) sediments. This project assists with pre-determination of need for further assessment by using critical variables from years of investigation involving pre-historic sites in relation to bridge replacement projects and deep sub-surface testing.

Purpose – In this report, the University of Iowa Office of the State Archaeologist (OSA) explore the feasibility of using GIS data to evaluate archaeological survey needs for Iowa DOT bridge replacements. The resultant Bridges Decision Support Model integrates information on archaeological sites, surveys, bridges, and their geological contexts. The model will help streamline the Section 106 process by facilitating communication and information transfer; by providing consistent, well-informed, and uniformly-applied decision criteria; and by improving the cost-effectiveness of cultural resource compliance using critical variables and related data sources.

Objectives - The Bridges Decision Support Model objectives are:

1. Evaluate data from previous archaeological surveys with regard to their ability to detect archaeological sites buried in alluvium
2. Identify critical variables that influence the presence, preservation, and relative age of sites buried in alluvium

3. Develop a Decision Support Model that applies the critical variables to evaluate the archaeological potential of proposed bridge replacement projects
4. Develop a web-based resource to link users to data sources and guide them in its application

Conclusions – There is a need to continue web site development for this project providing ease of use and availability. Continuing discussion with Iowa DOT and local systems about doing tests, we find we need to use the Bridges Support Model with application of the 5-year plan for bridge replacement which will give us the opportunity to gather more bore log data from specific sites near bridges and practice using various assorted historic map resources for interpretation; finally, this will allow us to pre-screen a large number of bridges.

Motion to Approve
Motion by Rob Ettema, 2nd by John Rasmussen.
Motion carried with 15 aye, 0 nay, 0 abstaining.

PROPOSALS

Proposal – *Investigation of Utility Cut Repair Techniques to Reduce Settlement in Repair Areas* – Phase II, Muhannad Suleiman, Iowa State University ($165,316)

Background **–** Poor performance of pavements over utility trenches on local and state road systems often causes unnecessary maintenance problems, due to improper backfill material and/or its properties and construction procedures. The expense and inconvenience of repairing pavements as a result of poorly performing utility cut restoration can be improved with an understanding of proper material selection and construction practices.

Based on the results of Phase I, the research team recommends monitoring the constructed utility cuts for two more years, constructing new trenches using the three methods suggested by the research team during Phase I, and instrumenting utility trenches to further understand the mechanisms of trench backfill settlement and load distribution.

Objectives - to improve utility cut construction practices by continued monitoring of restored cuts, and improving the understanding of trench settlement and load transfer through the instrumentation of utility trenches, with the goal of increasing the pavement patch life and reducing the maintenance of the repaired areas. The results of this research will improve on the state-of-the-practice techniques recommended for SUDAS during Phase I. Activities under the proposed research plan include:

Products –
- A Final Report
- A Technology Transfer will be created and presentations made at appropriate local/regional conferences
- An executive presentation will be presented to the IHRB and will be made available to be used at local/regional meetings
- Pictures and videos taken during the course of the project will also be provided to the IHRB
- Presentations at national and/or international conferences
- Published results in journals

This research will be conducted through a statewide collaborative effort, including researchers from Iowa State University, the Center for Transportation Research and Education (CTRE), the Statewide

Urban Design and Specification (SUDAS) Committees (six District committees and the Geotechnical Committee), and Iowa DOT Material and Construction Department.

Motion to Approve
Motion by John Joiner, 2nd by Jeff Krist.
Motion carried with 15 aye, 0 nay, 0 abstaining.

Proposal – *Development of Stage-Discharge Relations for Ungaged Bridge Waterways*, Thanos Papanicolaou, The University of Iowa ($112,000)

(This revised presentation was given per the request of IHRB at its July 28, 2006 meeting; in addition, Hungry Canyon Alliance is supporting this project with funds totaling $70,000.)

Background - Discharge is one of the most important variables that control fluvial, geomorphologic, and ecological processes in streams. Aggradation and degradation, channel scour during floods, local scour around structures, formation of river bends, fining, coarsening and armoring of stream-beds and fish habitat degradation are examples depicting the streams response to changes in flow discharges.

Measurements of stream discharges can also provide information about flood, wet and dry seasons of a certain stream. Statistical analysis of flow discharge records statewide can help in decision-making and effective design of hydraulic structures and enhance our ability to model and predict changes in river morphology and their engineering impacts on bridge waterways crossings.

It is apparent that an important aspect in the design of stable bridge waterways crossings is accurate data of the discharge variation. Lack of funds for continuous monitoring of small and medium size streams necessitates the development of alternative techniques for measuring flow discharge. Stage-discharge relations constitute an alternative technique for estimating accurately flow for ungaged sites.

Objective – This 3-year project will establish stage-discharge relationships for 10 ungaged streams in the HCA region (western Iowa) by setting a semi-automatic sensor network. The 10 streams are selected from small, medium and large sized drainage areas and will be representative of the streams found in the area. Secondly, comparisons of this study's findings regarding discharge will be compared with other studies made by The University of Iowa and other research institutions with comparative and/or similar objectives.

Suggestions from the IHRB regarding the proposal have been incorporated into the objectives of this project, including focusing on western Iowa streams and utilizing and cross-referencing data from similar IHRB studies such as TR-515, TR-521, TR-533 and TR-519.

Products –
1. Stage-discharge relations for ungaged streams in western Iowa providing comparisons with other ongoing studies.

2. A tool for predicting river response based on discharge knowledge. Explain scour and erosion processes that may occur at bridge waterways. Indicate how past, present, and possible future changes in river or stream dynamics may affect bridge-waterway stability as function of discharge.

3. Description and documentation of knickpoint propagation in the HCA region; aid in identifying and prioritizing the sites that are "at-risk", thereby avoiding potential safety and asset risks due to knickpoint propagation and channel vertical shift.

4. A detailed technical report (in IIHR format) describing the performance of bridge crossings under different flow conditions. The report would be thoroughly illustrated to show the field conditions as well as to portray the results and data trends.

5. Presentations

Iowa DOT and County Involvement - The project would be conducted with the participation of HCA and IHRB members. It is anticipated that John Thomas (HCA), David Claman (IDOT), Edward Engle (IDOT) and John Rasmussen (Pottawattamie Co. Engineer) will serve on the advisory panel.

Motion to Approve
Motion by Mark Nahra, 2nd by John Joiner.
Motion carried with 14 aye, 0 nay, 1 abstaining.

Status Report HR-140 D, "Collection and Analysis of Streamflow Data," Dave Eash and Greg Nalley, USGS ($218,414)

(The U.S Geological Survey (USGS) Federal-State Cooperative Program funds 45% of HR-140.)

Background - Research project HR-140 was established July 1, 1968, by consolidating 3 separate research projects then under contract between USGS and the Iowa State Highway Commission. For the USGS-Iowa Water Science Center, HR-140 funds 3 separate programs:
1. Continuous-record streamflow-gaging stations in Iowa
2. Partial-record (crest-stage) gaging stations in Iowa
3. Flood profiles of Iowa streams - The oldest of these three programs began operation in 1950; the other two began in 1957 and 1959.

Currently, the streamflow gaging portion of project HR-140 fully or partially funds the operation and maintenance of approximately 114 gaging stations on rivers and streams in Iowa. This network of stations includes fully funding 89 crest stage gages and partially funding 25 continuous-record gages.

Problem –The efficient and safe design of bridges and culverts depends considerably on accurate hydrologic information. The Office of Bridges and Structures obtains the necessary hydrologic information from several sources; however, much of this information is obtained from the USGS.

HR-140 is subject to annual renewal and is supported with funds from both the USGS and the IA DOT. Project HR-140 is subject to annual review and renewal. USGS personnel are equipped for and are experienced specialists in collecting, compiling, and publishing streamflow information.

In 2007, changes in the standard CSG will be made with the use of pressure transducers because the current CSG do not supply enough information. Information will be logged on 15 minute increments for better characteristics of flow. Changes in the watershed will be documented, not just peak flow; in addition, there will be fewer problems due to ice.

Greg Nalley, USGS, presented Flood Profiles of the Turkey and Maquoketa Rivers and online resources were referenced.

Proposal for Continuation of HR-140 "Collection and Analysis of Streamflow Data," David Eash, USGS ($222,379)

Data Dissemination
- Annual Data Report is now on CD
- Annual Data Report is available online at: http://ia.water.usgs.gov
- Real Time data available via internet (includes annual peak flow for all stations)
- Numerous reports have been written and information distributed to federal, state, county and city personnel as well as made available for public use through libraries

Website pages and their numerous aspects and easy-to-use links were presented, including links for historical (some back to 1874) and current data, statistics, national information, as well as real-time information by gauge or area by tab (table) selection or graph.

Flood Profiles are shown on the homepage with regions shown in red that have been profiled in past profile reports. Thus far, 31 profile reports have been published with a list presented on the web page.

Objectives of the Flood Profile Project are to document water surface elevation profiles and discharge of flow to the Department of Transportation. Since 1990, 16 reports have been published and are online as well as future floodwater reports. Some years there are multiple reports.

Distribution of reports includes printing about 150 reports which are dispersed to various public institutions including counties and Iowa DOT personnel.

An overview of the budget was given.

Motion to Approve
Motion by Mark Nahra, 2nd by Clark Schloz.
Motion carried with 15 aye, 0 nay, 0 abstaining.

NEW BUSINESS
None

ADJOURN
Motion to Adjourn
Motion by Roger Schletzbaum, 2nd by Clark Schloz.
Motion carried with 15 aye, 0 nay, 0 abstaining.

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Mark J. Dunn, IHRB Secretary