

IOWA HIGHWAY RESEARCH BOARD

Minutes of September 29, 2000

Regular Board Members Present

J. Adam	M. Gardner
J. George	L. Greimann
R. Krauel	T. Myers
J. Odgaard	D. Osipowicz
L. Smithson	T. Stoner
W. Weiss	J. Witt

Alternate Board Members Present

T. Welch for D. Little	S. Andrle
L. Brehm	R. Younie

With No Representation

None

Visitors

Ed Engle Iowa Department of Transportation
Bob Steffes Iowa Department of Transportation
Ian MacGillivray Iowa Department of Transportation
Dave Claman Iowa Department of Transportation
Mohammad Mujeeb Iowa Department of Transportation
LeRoy Bergmann Iowa Department of Transportation
Saleem Baig Iowa Department of Transportation
W. Sunday Iowa Department of Transportation
Reg Soulettye Iowa State University - CTRE
Dale Harrington Iowa State University - CTRE
Terry Wipf Iowa State University - CTRE
Dean Majzoub Iowa State University - CTRE
F. Wayne Klaiber Iowa State University
Fouad Fanous Iowa State University
Robert Lohnes Iowa State University
Jim Cable Iowa State University
Curtis Monk Federal Highway Administration

The meeting was held at the large Materials Conference Room at the Iowa Department of Transportation, Ames, Iowa. The meeting was called to order at 9:00 A.M. by T. Myers.

Board Replacement

T. Myers announced that John Adam would be replacing Champ Narotam who passed away in June.

Approval of the Minutes

T. Stoner made a motion to accept the minutes and R. Krauel seconded the motion. It was approved by the Board with 13 yes, 0 no and 0 abstaining.

Final Report

F. Wayne Klaiber presented a final report on TR-410, "Investigation of Two Bridge Alternatives for Low Volume Roads - Phase II," Volume 2 of 2. Volume 1 of 2 will be presented at the October meeting. Volume 2 presents the results of Concept 2 - Modification of the Beam-in-Slab Bridge, while the continued work on Concept 1 - Steel Beam Precast Units is presented in Volume 1.

In previous research (HR-382) an alternate shear connector (ASC) was developed and subjected to static loading. In this investigation, the ASC was subjected to cyclic loading in both push-out specimens and composite beam tests. Based on these tests, the fatigue strength of the ASC was determined to be significantly greater than that required in typical low volume road single span bridges.

The ASC was also used in the full-scale composite beam specimens tested to determine their service load behavior, ultimate strength and fatigue strength. Two of the specimens had inverted T-beams and one was constructed with an I-beam. Two full-scale two-beam specimens - representing possible bridge systems - were constructed and tested to determine their strength and behavior. These specimens also used the ASC. One of the specimens was very similar to the Canadian steel free deck system, the other - a concrete arch system - was essentially the BISB with concrete removed from the tension side and composite action added.

In all of these tests, the ASC was effective in creating full composite action during the service load tests. None of the specimens experienced a bond failure when loaded to failure. Both the steel-free deck system and concrete arch system - with the ASC for composite action - were determined to meet AASHTO strength and serviceability requirements and thus are viable low volume road bridge systems.

Each of the systems previously described are relatively easy to construct. Use of the ASC rather than welded studs significantly simplifies the work, equipment, and materials required to develop composite action between the steel beams and the concrete deck.

T. Myers - What about the bond between the I-beams and the concrete due to freeze/thaw. Do you have a seal there?

F. Klaiber - In the original system in Benton County, the first one I showed you? No, there is no seal. When your loaded, your forcing the concrete from top to bottom flange. We got minimal slippage in the laboratory in Phase I.

Volume 1 is a lot more fun. That one has a video showing you how to construct the bridge. There is a slide series also. That will come in October on Concept 1.

The funding was 100% Secondary.

D. Osipowicz made a motion to accept the final report. J. George seconded the motion and it carried with 13 yes, 0 no and 0 abstaining.

Final Report

Fouad Fanous of Iowa State University presented a final report for TR-405, "Impact of Deck Cracking on Durability." Concrete bridge decks subjected to corrosive environment because of the application of deicing chemical could deteriorate at a rapid rate. In an effort to minimize corrosion of the reinforcement and the corresponding delaminations and spalls, the Iowa Department of Transportation started using epoxy-coated rebars (ECR) in the top mat of reinforcing around 1976 and in both mats about 10 years later. The overall objective of this research was to determine the impact of deck cracking on durability and estimate the remaining functional service life of a bridge deck. This was accomplished by conducting a literature review, visually inspecting several bridge decks, collecting and sampling test cores from cracked and uncracked areas of bridge decks, determining the extent to which epoxy-coated rebars deteriorate at the site of cracks, and evaluating the impact of cracking on service life.

Overall, 81 bridges constructed with ECR were sampled. Fick's Second Law was applied in this study to estimate the time required to reach the corrosive threshold of chloride concentration at the rebar level, i.e., the time length of the corrosion initiation stage.

No signs of corrosion were observed on the rebars collected from uncracked locations. Rebars that had surface corrosion undercutting the epoxy coating were those collected from cores that were taken from cracked locations. In general, no delaminations or spalls were found on the decks where these bars were cored. The surface chloride concentration at 0.5 inches below the deck surface and the diffusion constant were found to be 14.0 lb/yd³ and 0.05 in²/yr, respectively. For a corrosion threshold range from 3.6 to 7.2 lb/yd³, the predicted service life for Iowa Bridge decks considering corrosion of ECR was over 50 years. This illustrates that ECR can significantly extend the service life when compared with bridges constructed with black rebars.

T. Stoner - You had indicated that there was an advantage to having sealers placed on the bridges.

F. Fanous - It was a little better.

T. Stoner - It seemed to be in the conclusions that sealers were more effective in the longer span bridges with more flexibility. Do you have any comment?

F. Fanous - The only thing I know, sealer was applied in 1984, but what happened before 1984 I don't know. I don't want to say that it is really extending the life or adding anything unless I go back. As I mentioned, I wish I had 2 or 3 bridges constructed at the same time, under the same circumstances and I could compare the performance of them.

The difference wasn't very much in the rebar rating; there is a table in the report summarizing them.

Funding was 65% Primary, 25% Secondary and 10% Street.

L. Smithson made a motion to accept the final report. M. Gardner seconded the motion and it carried with 13 yes, 0 no and 0 abstaining.

Construction Report

J. Cable of Iowa State University presented a construction report for TR-432, "Ultrathin Portland Cement Concrete Overlay Extended Evaluation." In recent years, ultra-thin whitetopping (UTW) has evolved as a viable rehabilitation technique for deteriorated asphalt cement concrete (ACC) pavement. Numerous UTW projects have been constructed and tested, enabling researchers to identify key elements contributing to their successful performance. These elements include foundation support, interface bonding condition, portland cement concrete (PCC) overlay thickness, synthetic fiber reinforcement usage, joint spacing, and joint sealing. The interface bonding condition is the most important of these elements. It enables the pavement to act as a composite structure, thus reducing tensile stresses and allowing an ultra-thin PCC overlay to perform as intended.

The Iowa Department of Transportation (Iowa DOT) UTW project (HR-559) initiated UTW in Iowa. The project is located on IA 21 between IA 212 and US 6 in Iowa County, near

Belle Plaine, Iowa.

The objective of this research was to investigate the interface bonding condition between an ultra-thin PCC overlay and an ACC base over time, considering the previously mentioned variables. This research lasted for five years, at which time it was extended an additional five years. The new phase of the project was initiated by removing cracked panels existing in the 2-inch thick PCC sections and replacing them with three inches of PCC. The project extension (TR-432) will provide an increased understanding of slab bonding conditions over a longer period, as well as knowledge regarding the behavior of the newly rehabilitated areas.

In order to accomplish the goals of the project extension, Falling Weight Deflectometer (FWD) testing will continue to be conducted. Laboratory testing, field strain gage implementation, and coring will no longer be conducted.

This report documents the planning and construction of the rehabilitation of HR-559 and the beginning of TR-432 during August of 1999.

T, Myers - Did the loads change on the surface or was it a low level load road?

J. Cable - It is a 1500, ADT road, about 30% trucks, a lot of those are agricultural trucks. The final report will give you a little bit better handle on the loads. We had a weigh-in-motion device set on that slab. We had some communication problems for a couple years, finally about 6 months ago we were able to get a good handle on what has happened there over five years.

There is about 375,000 ESALS that have gone over that road, what you would call a good heavy duty county road.

T. Myers - Since 1994, we see a lot of 650 bushel grain wagons carrying 30,000 lbs. on single axles. Have you seen any of that?

J. Cable - Not in that particular location. On the 2 inch concrete, if you don't exercise a lot of planning in setting your string line grades and assuring that at any of the minimal points you have 2 inches or more, you will experience a problem in the outer wheel path.

To me, ultrathin is another rehabilitation technique. I'm not going to say it is a 20 year fix, but

10-15 years I do think you can get out of it. There is a project over in the Quad Cities area that the county engineer has on the Rock Island side and he is very pleased with. It goes to the garbage dump in the high school. It has 4 big bulk pump producers on it. You and I would look at it and say there is an awful lot of cracking in it, but he is happy with it because every time he put an asphalt overlay on it, all he was doing was going back about 3 years later and milling it off and putting it back. He put down 3 inches of concrete, last I knew it was still in there. It has been there about 10-12 years now. It is another tool that may help you.

D. Osipowicz - Do you see any outward migration on the outer part of the slab when you cut it at the quarter point?

J. Cable - No. I haven't seen any outward migration anywhere. Maintenance, and I would have probably done the same thing because you don't have a ready mix plant to run to on Sunday. They went out and put cold mix in two sites. I can show you 32 - 2 ft. square slabs in either direction that tried to slide into the hole. They do migrate longitudinally and they will migrate about an inch totally. The joints didn't open up, I don't know where we took the slack out of them. You want to patch with the material you take out, don't put a different material in. Other than that, there has been no migration out.

No motion was needed.

Progress Report

A progress report for TR-442, "Systematic Identification of High Crash Locations" was in the packet for the Board's review. The research project is developing tools and processes by which Iowa engineers can identify potentially hazardous roadway locations and designs. Furthermore, by identifying design features or characteristics that may lead

to higher crash risk, engineers can proactively avoid such hazards in future roadway designs or eliminate them in existing roadways. Through a series of case studies, the project is identifying the relationship between crash rates and specific roadway design features, geometry, and other characteristics (e.g., high levels of truck traffic). The process is being developed based on a system of integrated, geographically referenced databases, whereby the safety performance of Iowa's highways, highway segments, specific design features, and individual locations can be monitored.

T. Welch - From the Iowa DOT's perspective, we are really pleased with the progress and what we have been able to accomplish.

No motion needed.

Old Business

I. MacGillivray - HR-140 has been funded with SPR funding. There is still a little debate about where we are going to take the matched funds needed for the federal funds which would be \$30,000 out of \$158,000, but I don't think it will be coming out of research funds. I think we will be able to maintain it in that program from now on.

Other Business

T. Myers - Last month we were called by I. MacGillivray on a phone pole to move faster on a project.

I. MacGillivray - Last month Mark and I talked to a number of board members and asked you to approve a project that was presented without advance warning and to do so between board meetings because of the time lag. The project was for the development and presentation of a workshop and demonstration program on foamed asphalt technology. The board did, through a letter ballot, approve participation in that project and will pool that funding along with FHWA, Story County and contractors who contributed time and equipment.

As we continue to look at business practices and we start looking at the results of going through our new approach towards an agenda, I think this is another type of issue that your going to want to see where it fits in your business model in the long run.

No comments from the Board members.

T. Myers - Randy Krauel has an update on the review of the proposal from Dr. Lee

R. Krauel - The Non-NHS Task Force of the Pavement Management Committee has been presented the proposal. Response from the task force has been limited, primarily from the Iowa DOT. Of the comments received, some of the shortfalls of the proposed method are that it does not provide the crack type or severity. It may be useful to the Iowa DOT as a substitute for manual comparison to other methods of collecting pavement distress data to help verify those models. No feedback was received from the cities and counties.

Comments will be solicited from the county and city task force members and a formal response of collected comments will be sent to Dr. Lee so that he may respond to them in his proposal to the board.

New Business

No new business

Date of Next Meeting

DATE OF THE NEXT MEETING WILL BE OCTOBER 27, 2000 AT 9 A.M. IN THE LARGE MATERIALS CONFERENCE ROOM AT THE IOWA DOT.

Mark Dunn, Secretary