

IOWA HIGHWAY RESEARCH BOARD

Minutes of December 9, 1999

Regular Board Members Present

M. Gardner J. George L. Greimann D. Little G. Mauer T. Myers C.
Narotam
J. Odgaard D. Osipowicz T. Stoner J. Witt

Alternate Board Members Present

M. Walton for L. Smithson C. Marker J. Weber T. Welch B. Younie

Regular Members With No Representation

R. Krauel

Visitors

Bob Steffes	Iowa Department of Transportation
Dave Heer	Iowa Department of Transportation
Mohammad Mujeeb	Iowa Department of Transportation
Saleem Baig	Iowa Department of Transportation
Steve Gent	Iowa Department of Transportation
Bob Stanley	Iowa Department of Transportation
John Sommers	Iowa Department of Transportation
Chris Brakke	Iowa Department of Transportation
Hosin (David) Lee	University of Iowa
Nat Fox	GEOPIER Foundation Company
John Pitt	Iowa State University
David White	Iowa State University
R. L. Handy	Iowa State University
Tom Maze	Iowa State University - CTRE
Steve Andrie	Iowa State University - CTRE
Keith Knapp	Iowa State University - CTRE
Gary Thomas	Iowa State University - CTRE
Ali Kamyab	Iowa State University - CTRE
Aemal Khattak	Iowa State University - CTRE
Omar Smadi	Iowa State University - CTRE
Gordon Smith	Iowa Concrete Paving Association
Dean Majzoub	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 1:00 P.M. by T. Stoner.

Approval of the Minutes

G. Mauer made a motion to accept the minutes and T. Myers seconded the motion. It was approved by the Board with 11 yes, 0 no and 0 abstaining.

Research Proposal

J. Pitt and D. White of Iowa State University presented a research proposal on "Highway Applications for Rammed Aggregate Piers in Iowa Soils." Iowa is blessed with some of the best soils for agriculture and worst soils for engineering of any state in the U.S. The primary objective of this research is to evaluate a new method for soil reinforcement called Geopiers with Iowa soils, with particular emphasis on two problem areas: a) reinforcement of soft soils prior to construction of highway embankments in order to minimize settlement, and b) reinforcement of embankment or cut toe slopes in order to prevent slope failures.

In relation to the potential for reducing settlement in either natural soil or embankment fill, Geopiers are unique in that the installation method increases lateral soil stress up to the passive limit, such that consolidation under a vertical load is restricted and may be prevented altogether. The main advantages will be to avoid long construction delays from preloading and waiting for consolidation to reach equilibrium before final grading and paving, and to reduce the potential for settlement after paving is completed. Note that the high lateral stresses will be preserved by horizontal restraining friction from the base of the embankment.

In relation to the potential for increasing slope stability, the Geopiers themselves have a very high friction angle, on the order of 50 degrees. This is much higher than stone columns, and suggests a design based on partial replacement of weak potentially unstable soils. Secondly, lateral compaction by Geopiers has been shown to significantly increase both the strength and the modulus of soil between the Geopiers, a matter that needs further evaluation.

Results of the evaluation will be prepared in a summary report and made available to state, county and city agencies, which will provide a practical option to improve soft soils, reduce bridge approach settlement, and reinforce slopes and retaining structures. In addition, implementation of Geopiers as a maintenance option for rehabilitation of poor pavement sections, settling approach slabs, and slope failures will be recommended. Presentations will be made at local conferences.

This project is proposed for a period of 24 months at a total cost of \$148,938. Funding would be 50% Primary, 45% Secondary and 5% Street.

G. Mauer - Has the Iowa DOT used some of these Geopiers?

J. Pitt - There is a test section in Floyd County that was contributed by the Geopier companies that we are evaluating now.

G. Mauer made a motion to recommend the research proposal. C. Narotam seconded the motion and it carried with 12 yes, 0 no and 0 abstaining.

Research Proposal

K. Knapp of Iowa State University - CTRE presented a research proposal on "Systematic Identification of High Crash Locations." Transportation agencies are continually faced with decisions concerning the design and operations of highway systems. An important aspect of this decision-making process is the design impact on highway safety.

Most safety related improvements in Iowa are generally reactive. In other words, the safety countermeasures are applied to the roadway after high crash rates have been observed. According to the current Iowa safety practice, a candidate location is selected from a list of high accident locations, which are determined based on their crash history.

By quantifying the impact of highway geometry and design features on crash rates, this research would enable agencies to proactively identify and deal with "problem" areas. In other words, instead of waiting for crashes to occur in order to determine if a highway section warrants a countermeasure, they will be able to predict an expected crash rate of the section.

An important aspect of this research is that it exploits and builds on two existing Iowa data bases: the Iowa crash record system and the Iowa highway base record system. Iowa governments have spent considerable resources on these data bases, and this project will mine these data bases to provide additional safety returns.

The proposed research will include the following tasks.

Task I - Form an Advisory Committee

Task II - Select Study Topics

Task III - Develop an Integrated Data Base

Task IV - Identify "Problem" Types - Data Analysis

Task V - Identify Potential and Existing "Problem" Areas

Task VI - Document the Process

Task VII - Document the Findings

The proposed project has a cost of \$126,235 with the research period from January 2000 to January 2001. Funding will be 75% Primary, 22% Secondary and 3% Street. There will be an interim report provided in June 2000 and the final report in January 2001.

K. Knapp - You had asked at the last board meeting how this project fit in with Steve DeVries project. We have communicated with Steve. He has told us what he is doing and we have told him what we are doing. His conclusion was that there really wasn't any overlap, any repeat. Steve said what will be coming out of this project will be good input to what he is doing, will make his output better because he will be able to use our output as his input. I agree with what he told us.

C. Narotam - I don't see any where in the proposal where it states the proposed implementation, how are we going to use this research.

K. Knapp - What will be produced out of this research will be relationships between contributing factors in accidents.

T. Welch - Implementation is how we program our safety dollars and how we program some of our five year funding programs.

T. Stoner - How is this information going to do me any good as a county engineer?

K. Knapp - What we are doing is producing potential accident locations, causes behind them, that type of things. The original data base that this is based on will be continually updated.

C. Narotam - Are you seeking to get a model using the systematic approach and model the systematic approach to contributing factors to high crash locations?

K. Knapp - In general, no. We are doing it from three case studies. In order to figure out contributing factors, you have to do a statistical model.

M. Walton - I'm still not clear. We have the CTAMS, which to me I thought was an integrated data base effort also, yet it looks like we are putting the safety data over into another system with integrated data bases?

K. Knapp - Again, I'm getting into Reg Soulerettye's purview, that is one of the reasons I didn't know about CTAMS. I have never worked with them.

O. Smadi - Probably what is going to happen is that CTAMS the way it was developed as we start integrating, for example maintenance and pavement and oh let's put inventory, and then we ended up with CTAMS. Once they finish their work, that data will be available in CTAMS. Whatever tools they develop is probably going to be developed in CTAMS too. It is a continuation of the effort of integrating all the data bases at the Iowa DOT. The advantage of this is because CTAMS has all the inventory records, which include city and county roads and ALAS has also accidents on city and county roads, that adds another perspective to consider just from the Iowa DOT perspective, now it is a statewide perspective. I see that as where most of the advantages are going to come from.

M. Walton - So it would have the migration capabilities to potentially go into CTAMS.

O. Smadi - Yes, definitely.

D. Little made a motion to recommend the research proposal. J. George seconded the motion and it carried with 12 yes, 0 no and 0 abstaining.

Research Proposal

Hosin "David" Lee of the University of Iowa presented a problem statement entitled, "Development of Automated Crack Measurement System for Iowa Cities and Counties."

The Principal Investigator (PI) has been developing a digital image processing system that can provide the city and county engineers with an objective, cost-effective and easy-to-use system for measuring cracking condition of the pavements. It can automatically measure cracks from the images taken from the smooth pavement surfaces; however, it was not able to accurately measure cracks from the images taken from the rough pavement surfaces such as a chip-sealed pavement surface.

The objective of the proposed research is to improve the current image processing algorithm developed by the PI to automatically process digital images collected from all types of pavement surfaces, which include asphalt, concrete, and chip-sealed pavements.

The implementation outlook for this proposed project is very realistic as indicated by the implementation results of the research by the PI over the past 10 years. The proposed research addresses the ongoing search for less expensive modular and robust crack imaging system, which can be used for all types of pavements. The proposed system improves the accuracy and consistency over the current labor-intensive manual system at significantly lower costs. Further, the proposed system, based on pavement texture, is a significant advancement over the current crack imaging algorithm. This research will produce both a full automated crack data collection system and a robust crack imaging algorithm and software to measure the extent of cracks objectively. No system available on the market today can match the cost and performance of the proposed system. With the proposed funding of \$100,000 from the Iowa Highway Research Board, the system will be implemented in Iowa cities and counties by the end of 2001.

Suggested funding is 55% Primary, 38% Secondary and 7% Street.

J. George - How are you coordinating with the pavement management program that CTRE is working with? My understanding is that there is quite a bit of photography on that. You mentioned a different way to mount the camera. A lot of it is obtained by the cameras in the front bumper. Have you coordinated with CTRE on some of that?

D. Lee - I thought CTRE brought in some commercial data collection like ROADWARE. I understand the cost is very expensive to buy. O. Smadi says they are just purchasing the service. I bet the cost will be close to \$50 per mile. That is a very conservative estimate. It could be more. Do you have dollar figures?

O. Smadi - It is lower than that.

D. Lee - We are not really competing with this highway system. This whole package (ROADWARE) if you would buy would be close to ½ million dollars, the whole van everything included or could be quarter million dollars, something like.

O. Smadi - \$250,000 to \$500,000 for it.

D. Lee - What I am talking is it would be a lot of money. What I showed to you is a system that would cost \$1,000. You just buy a camera and some supports and you go out and start taking pictures. We are not trying to duplicate what CTRE is doing. What CTRE is doing is perfectly okay for the purpose of a federal aid system, but there are 90% or more maybe non-federal aid system in the state of Iowa, which needs some kind of objective data to be fed into a needs study. I read a report that needs study is only collected from certain sections of roads. It didn't cover secondary roads or other paved roads. It is just a limited sampling. If you have your own system you can go out and collect your own data. The knowledge gained from this system would stay in the state and not necessarily be counting on vendors if they changed their software system.

O. Smadi - The federal aid system we are dealing with is about 26,000 miles of paved highways. That is the majority of the paved highways in the state. There are a lot of gravel roads which probably your system can do much about too. You aren't going to be collecting data on the gravel roads are you?

D. Lee - Not at this point.

O. Smadi - Our system is covering at least 75% of the paved roads in the state. There would be a lot of duplication of your efforts.

D. Lee - We are trying to develop a software package so if you collect the data say from ROADWARE or IMS or you collect the data yourself from a digital camera, you could still use the software that we are developing. ROADWARE uses a software called WISECRACK. Who knows what is in WISECRACK? How do they calculate WISECRACK? We can check output, but sometimes we try to push this crack, whether it is types of crack, severity crack. A lot of states over the years weren't too happy about the output because it is not very consistent. It is a very difficult problem. What we are approaching here, is lets take care of the crack index first. Then we are going to move on to type selection. There is not a whole lot of work done on the software development side. That is what I worked on. The focus area is the local cities and counties. We can compete with any software package, WISECRACK or whatever. We can see which one produces the more accurate crack index. It all depends on the crack types, surface conditions like gravel roads, nobody will be able to do that, but if you know what is going on you can take care of that and develop a system that will meet your needs. My goal is to eventually be able to develop software which can be distributed to any city and county for their own use. If they want to use their own digital camera, that is fine. It is very economical now to do it since the price of digital cameras has reduced in price.

T. Stoner - Assuming the problem statement is approved, I would suggest a coordination effort with CTRE to make sure that we understand in the proposal the differences between what you are doing and what they are doing. You are throwing numbers that sound awful attractive to us. I would like to see that what you are doing is not already being done commercially, not going to duplicate.

C. Narotam made a motion to recommend the problem statement. T. Myers seconded the motion and it carried with 12 yes, 0 no and 0 abstaining.

Election of Officers

M. Walton nominated Champ Narotam as 2000 Vice Chairman. D. Little seconded the motion and made a motion that nominations cease. The Board approved the nomination with 11 yes and 1 abstaining.

T. Stoner nominated T. Myers as 2000 Chairman. D. Osipowicz seconded the motion and made a motion that nominations cease. The Board approved the nomination with 11 yes and 1 abstaining.

Thank You

M. Dunn thanked G. Mauer for his service on the Board. Wade Weiss from Greene County will replace Gary.

New Business

M. Dunn - We had a project HR-379, "Recycled Asphalt Shingles for Slurry Leveling & Crack Filling." The principal investigator was Charles Fisher from the city of Spencer. He passed away and there was not a lot of file left on the project. What I understood it was not all that successful, so we will be terminating that project. There was \$77,000 appropriated to it and just under \$9,000 was spent. The rest will be turned back into the accounts.

Tom Maze introduced Steve Andrlle as his successor as Director at CTRE. He is a University of Iowa graduate. He worked at TRB for seven years. Before that he was in the private sector working as a consultant. He is originally from the Cedar Rapids, Iowa area.

Wade Weiss and Jim George will be attending TRB this year under project HR-375, "Transportation Research Board Education for County Engineers."

Date of Next Meeting

**DATE OF THE NEXT MEETING WILL BE JANUARY 28, 2000 AT 10:00 A.M.,
IN THE LARGE MATERIALS CONFERENCE ROOM AT THE IOWA DOT.**

Mark Dunn, Secretary