

**IOWA HIGHWAY RESEARCH BOARD (IHRB)**

*Minutes of IHRB meeting held December 6, 2007*

**Regular Board Members Present**

|            |               |
|------------|---------------|
| J. Adam    | M. Nahra      |
| J. Berger  | J. Rasmussen  |
| T. Fonkert | J. Singelstad |
| J. Joiner  | D. Waid       |

**Alternate Board Members Present**

D. Lee for Keri Hornbuckle  
F. Fanous for J. Alleman  
M. Kerper for Ahmad Abu-Hawash  
R. Younie for S. Dockstader

**Secretary**

E. Engle for M. Dunn

**Visitors**

|               |                                   |
|---------------|-----------------------------------|
| Chris Brakke  | Iowa Department of Transportation |
| Sandra Larson | Iowa Department of Transportation |
| Mary Starr    | Iowa Department of Transportation |
| Alice Welch   | Iowa Department of Transportation |
| Larry Stevens | Iowa State University – CTRE      |
| Paul Wiegand  | Iowa State University – CTRE      |

**Agenda review/modification**

The chairperson was unable to attend the meeting, therefore, a motion was made that Board Member Robert Younie act as chairperson for this meeting, by J. Joiner, 2<sup>nd</sup> by J. Rasmussen.

Carried 11 yea, 0 nay, 0 abstaining.

**Approval of the minutes**

Motion to approve the minutes from the October 26, 2007 meeting by M. Nahra, 2<sup>nd</sup> by J. Rasmussen.

Carried 11 yea, 0 nay, 0 abstaining.

**\*One Board Member joined the table.\***

Certificates of Appreciation were given to the following Board Members for completion of service on the Board: Todd Fonkert (present), Scott Dockstader (to be delivered), and Roger Schletzbaum (given previously at the county engineer's conference).

Board Member Changes and New Board Members: J. Jay Waddingham will become the Member representing District 2 with J.D. King acting as his Alternate; Brian Moore (Member) and Steve Akes (his Alternate) will represent District 5.

# **FINAL REPORT TR-493, “Performance Evaluation of Steel Bridges – Phase II,” Terry Wipf, Iowa State University/CTRE (\$196,421)**

## **BACKGROUND**

Volume I summarizes a structural health monitoring (SHM) system developed for the Iowa DOT to remotely and continuously monitor fatigue critical bridges (FCB) to aid in the detection of crack formation. The FCB SHM system enables bridge owners to remotely monitor FCB for gradual or sudden damage formation. The SHM system utilizes fiber bragg grating (FBG) fiber optic sensors (FOS) to measure strains at critical locations. At specified intervals, the SHM system autonomously generates evaluation reports that summarize the current behavior of the bridge, which are distributed to the bridge owner.

Volume II summarizes the development and demonstration of an autonomous, continuous SHM system that can be used to monitor typical girder bridges. The developed SHM system can be grouped into two main categories: an office component and a field component. The office component is a structural analysis software program that can be used to generate thresholds which are used for identifying isolated events. The field component includes hardware and field monitoring software which performs data processing and evaluation. The hardware system consists of sensors, data acquisition equipment, and a communication system backbone. The field monitoring software has been developed such that, once started, it will operate autonomously with minimal user interaction.

The SHM system features two key uses: the system can be integrated into an active bridge management system that tracks usage and structural changes and the system helps owners to identify damage and deterioration.

## **OBJECTIVES**

The SHM system developed in this study has been developed for the Iowa DOT bridge engineers to remotely and continuously monitor a FCB in order to aid detection of crack formation by identifying gradual changes in bridge structural behavior. The specifications for the system were identified as follows:

- Monitoring must be continuous and capable of identifying changes in bridge structural behavior (elastic or inelastic) from a preexisting state, which may be indicative of crack development and/or propagation.
- Data collection, reduction, evaluation, and storage must be autonomous.
- Summaries of reduced data and evaluations must be presented in a clear, understandable format; the presentation of the data must be in a report that is autonomously generated and electronically delivered.
- DOT work forces with proper training must be capable of installing the system.

Previous experience with long-term SHM at the ISU BEC resulted in the accumulation of massive amounts of data, but it was determined that only a small percentage of data were useful for assessing the condition of the structure. As a result, in addition to the previously defined objectives, this study also included significant efforts to 1) develop data reduction procedures that identify and extract the information in data files that is useful for evaluating the condition of the bridge, and 2) develop evaluation methods that effectively utilize the extracted data to correctly report the structural condition of the bridge.

## **IMPLEMENTATION**

Briefly, research shows that the:

- SHM system allows bridge owners to monitor bridge behavior for signs of damage;
- System ability to identify and evaluate repeatable bridge behavior has been shown; and
- Evaluation reports summarize continuous monitoring results into a familiar, graphical format for bridge owner/manager interpretation.

C: As stated in the Board packet email notification, the draft report is technically correct requiring editorial changes only. Approval is for the final report with editorial changes made and a technical transfer brief.

Motion to Approve by M. Nahra, 2<sup>nd</sup> by J. Adam.

Carried 12 yea, 0 nay, 0 abstaining.

## **Final Report TR-523, “Appropriate Traffic Calming Techniques for Small Iowa Communities,” Shauna Hallmark, Iowa State University (\$94,782)**

### **BACKGROUND**

Many rural communities have developed around highways or major county roads; as a result, the main street through small rural communities is often part of a high-speed rural highway. Highways and county roads are characterized by high speeds outside the city limits, transitioning into a reduced speed section through the rural community. Traffic calming in small rural communities along major roadways is common in Europe, but the U.S. does not have experience with applying traffic-calming measures outside of major urban areas.

### **OBJECTIVES**

The purpose of the project was to evaluate traffic-calming treatments on the major road through small Iowa communities using either single-measure low-cost or gateway treatments. Seven different low-cost traffic treatments were implemented and evaluated in five rural Iowa communities. The research evaluated the use of two gateway treatments in Union and Roland; five single-measure treatments (speed table, on pavement “SLOW” markings, a driver speed feedback sign, tubular markers, and on-pavement entrance treatments) were evaluated in Gilbert, Slater, and Dexter.

### **CONCLUSIONS**

Dexter – (Red pavement markings used with white text that displayed the speed limit. In addition to red markings with 35 mph, an eight-inch edge-line was painted along the sets of treatments.) The treatments were effective in reducing speeds at all three of the locations where they were tested. Nine months after installation, the effectiveness of the treatments seemed to decrease, most likely due to the fact that markings had faded over time. The treatments were repainted and effectiveness increased at the twelve-month data collection period.

Gilbert – (A Seminole profile speed table was installed and evaluated.) The speed table was successful in decreasing speeds both immediately upstream and downstream of the speed table. The table slowed speeds in both directions. The effectiveness of the speed table remained relatively constant over time.

Roland – (Converging chevrons, on-pavement speed markings, and lane narrowing.) On-pavement speed limit markings reading 25 mph were placed at regularly spaced intervals throughout both the eastern and western sections of the gateway treatment area. In addition, lanes were narrowed by painting wider shoulders. The gateway entrance treatments were reasonably effective. Speeds decreased at all of the data collection locations and decreases remained constant over the year-long data collection period.

Slater – (Variable message feedback sign, island with longitudinal channelizers and on-pavement ‘SLOW’.) Results indicate that the longitudinal channelizers used to form a center island for the southern section of R-38 significantly reduced speeds; the driver speed feedback sign was also found effective in reducing speeds. Use of the on-pavement “SLOW” markings did not appear effective.

Union – (Peripheral transverse pavement markings, lane narrowing through median and shoulder widening, and driver feedback signs.) The transverse markings appeared moderately effective in decreasing speeds directly downstream of the markings for all three locations, although none of the differences were large. Lane narrowing did not appear effective. When speed feedback signs were installed, significant speed decreases resulted.

Q: When red 35 MPH was painted on the roadway, was skid resistance measured?

A: No. We spoke with Pat Rouse and he was convinced that the amount of beads we put down was OK; in retrospect, we would definitely do the skid resistance.

Motion to Approve by J. Adam, 2<sup>nd</sup> by J. Joiner.

Carried 12 yea, 0 nay, 0 abstaining.

## **Proposal National Agriculture Image Program Participation, Karen Carroll, Iowa DOT (\$100,000)**

Note: This proposal was initiated from within the IA DOT. Discussions have been taking place on the need to obtain quality imagery on an annual basis and making that data available free of charge statewide. A stipulation requires funding sources to be identified by December 28, 2007. Negotiations are underway for funding totaling \$118,000 from other (possibly legislative) sources, in addition to funding from Iowa DNR (\$40,000) and Iowa's Department of Homeland Security (\$20,000). The total need for Iowa's share of this project is \$278,000.

### **BACKGROUND**

A single statewide program can be managed and implemented for far less money than state and local governments spend when they issue independent contracts; since 2004, 34 of the counties in Iowa have acquired digital aerial imagery. Twenty-four of these counties have paid an average of \$72,500 apiece for this imagery. If all counties in the state were acquired at this rate it would cost the Iowa taxpayers \$7,179,000.

In 2007, major budget cuts prevented FSA from acquiring imagery in most states, but Iowa was flown at 2m resolution again. From now on, FSA has established a goal of having 1m imagery no older than five years. The National Agriculture Imagery Program (NAIP) is not currently planned for 2008 in Iowa. According to the Farm Service Agency's (FSA) status map showing 1m acquisition cycle, Iowa won't be flown again until 2011. Acquisition on a shorter cycle can occur if partners provide cost share funds. FSA offers to partner with states that want more frequent coverage.

### **OBJECTIVES**

The objectives of this proposal are numerous. Briefly, the researchers will participate in funding the requisition of high resolution quality aerial imagery on an annual basis making it publically available, free of charge. This will reduce duplication of acquisition of aerial imagery by providing a product that will meet the needs of state, county and local officials in the majority of cases. It is imperative to find ways to combine limited resources to meet the needs of those who utilize this imagery on a frequent basis and to eliminate the need for costly field inspections to determine existence or changes in features.

### **BENEFITS**

Iowa needs to develop an annual funding strategy to partner with FSA every year for NAIP. This will ensure an uninterrupted, reliable source of imagery for the state. Imagery for the Nation (IFTN) at some point may become available. IFTN would provide 100% federally funded yearly 1m leaf-on ortho imagery nationwide and alleviate the need for state support for NAIP-type imagery. Those who will benefit: USDA, DNR, IA DOT, Local Governments, the public.

### **IMPLEMENTATION PLAN**

- Acquire annually
- 1m resolution
- Secure funding to ensure that an uninterrupted reliable source of imagery for all
- Eliminate funding if/when Imagery for the Nation (IFTN) exists

### **PRODUCTS**

- Interim Compressed County Mosaics (CCM) within 45 days of acquisition
- Digital Ortho rectified Quarter Quadrangles (DOQQs) within 8 months of acquisition
- Imagery will be provided free of charge to the public on the Iowa State University Geographic Map Server

Q: Was there any discussion on doing this as a 2' pixel rather than a 1m? Most of our GIS is what used to be called 1/400 flight, which is a 2' pixel. We got some free software from DNR in 2004, overlaid it within our GIS and it looks like GoogleEarth™. The cities were doing the 6" pixel. For it to be really effective for the counties and most of us who have GIS, a flight that comes in at that 1m (660) really won't give us what we need to replace our existing GIS information.

A: Not all counties have GIS information; we understand some of that 6" resolution isn't going to be there.

C: There's a huge difference in clarity using 2' resolution versus 1m.

A: We understand. This is an opportunity for counties to save money. If each county was going to fly this separately it would cost about \$72,000 anyway. We can acquire the imagery statewide for \$278,000, and have seamless application. For some of the things you use it for, this will not be good enough and will not work. However, for those who don't have the imagery and for a lot of counties, it is.

Q: Is it possible to look in subsequent years at getting the 2' pixel resolution? That's where the real savings will hit all 99 counties in Iowa.

A: Yes, there's no reason we can't approach the Department of Agriculture or look for other funding ourselves; there is a large part of this that is funded on a national level.

Q: Have surveys been sent out to counties to find out what they have available and what their needs would be?

A: We have done a little bit of work in that area, and formed agreements with 33 counties to share imagery; however that doesn't give us the annual data.

Motion to Approve one year's funding for \$100,000 at 70% state, 30% county with stipulation of improving pixel resolution for future data collection useful to all counties by M. Nahra, 2<sup>nd</sup> by J. Adam.

Carried 12 yea, 0 nay, 0 abstaining.

### ***Discussion of IHRB RFP 07-08, Using the Refined LiDAR Information That Meets FEMA Standards in All Counties***

Steve Kadolph, Iowa DOT Research & Technology Bureau, presented some background information regarding the proposed project.

Steve Kadolph: LiDAR stands for Light Detection and Ranging, also known as Airborne Laser Swath Mapping (ALSM). It involves an airplane flying over an area and painting that area with a laser beam; the laser beam sweeps back and forth. Unlike aerial imagery (which is a passive sensor), it relies on light reflected back up to the plane, the laser beam coming back up to the plane.

LiDAR is already being acquired statewide based on funding from the IA DOT, the IA DNR, the Iowa Department of Agricultural Land Stewardship and the Natural Resource Conservation Services. They've all stepped up and are providing \$4.5M to acquire LiDAR imagery for the entire state. A laser beam actually hits the ground every 1.4m, and is reflected back. This standard LiDAR format is not FEMA compliant.

How do we collect FEMA compliant data for all counties in Iowa? Right now we have FEMA compliant data for about 20% of Iowa. I'm on the Remote Sensing Coordinating Committee and the Iowa Geographic Information Council which started discussions regarding getting data for the entire state.

We're talking about 4 terabytes of information, so that's a huge amount of information. We try to fly in the fall and the spring, because the laser beam has to hit the ground and come back and that is helped by having the leaves off of the trees.

Q: Can you explain the FEMA compliant information needs?

A: The difference in the information we're collecting that is FEMA compliant and information that is not FEMA compliant is that there's more ground control and post-processing are required to meet FEMA guidelines; for disaster-type issues, it involves the release of emergency funding reimbursements.

Ed: We're already doing LiDAR for the entire state, and this RFP would be looking at re-doing the data-processing for the parts that have been flown, and setting up the areas that have not been flown with the

additional control points to allow the final analysis to be FEMA compliant; so it would be an add-on to what we're already doing and would make it FEMA compliant.

Q: Do we send out an RFP?

Ed: If the Board comes to consensus that this should go out, then it goes out.

Q: Is this a sole source?

A: It has to be sole source, because unless we do it with the people acquiring the LiDAR data, the cost will be a lot more.

Q: How often is the LiDAR data updated?

A: This is the first time. We're on the leading edge of getting this done. There are other states that have done this, but we're doing this under a contract with USGS and Sanborn, so my best guess is that in the foreseeable future we'll never re-fly the entire state for LiDAR data because the terrain will not change that much. We may need to re-fly some small areas where there's a lot of construction, where a lot of dirt is being moved; West Des Moines for example. But it is unlikely we will re-fly the state in the next 10-20 years.

Q: What's driving the timing for a decision we might make here?

A: If you look at the cost, the longer we delay the more the cost will be; they're actually out there putting 16 points on the ground before they fly, so to put another 4 points on the ground, they're already at that location. We're processing all the data on those 16 points, so all data [in blue on the map] would have to be re-processed. That's not to say we couldn't go back and post-process the data or do smaller areas, but it would cost more.

C: The state will be flown regardless of what we do here.

C: When was this set up originally?

A: Originally, I was on the Image Task Force (and helped get IA DOT participation) and felt in general we wanted to see some FEMA compliant data to see how much better it was but in general, didn't necessarily think we'd gain that much from having the data. Now for disasters the data's there, but that would have meant we would have been out there getting funding and didn't feel we could justify the additional cost; it was a short time frame because Sanborn was coming out with a really attractive package.

C: With LiDAR, you don't just get one return. You can get multiple returns with each laser beam; with trees, you can still get returns. In most places in Iowa, you will not have accurate data to meet FEMA standards.

Q: What value does this have to our Research Board? I'm not sure this is the right place to fund this project.

A: The LiDAR data will give you preliminary data, an estimate on the amount of dirt you have to move, wetlands...but not a road plan. You might still have to survey the land for that. You could figure out drainage areas and things like that.

Motion to withdraw the RFP 07-08 by M. Nahra, 2<sup>nd</sup> by Jim Berger.

Carried 12 yea, 0 nay, 0 abstaining.

## NEW BUSINESS

Discussion of IHRB 07-07 *Pavement Thickness Design for Local Roads in Iowa*

When we discussed this at the last meeting the Board came to the consensus that this is mostly a synthesis project and, based on that, decided that the funding should be \$50,000 over a year.

A proposer expressed concern that there are several parts in the RFP that involve analysis and specification design and that to do those would require more than \$50,000 and take longer than a year; the HMA focus group that originally suggested this project estimated \$250,000 and two years for this study.

Q: Was this generated by focus groups?

A: Yes, asphalt and paving groups.

C: The RFP has gone out. One project team has been working on the possibility of putting together a proposal; we've not received any other proposals. The question is: Do we leave the RFP (deadline is January 4th) out as is and see if we get any proposals back? Do we send out a change to that RFP that entertains a higher amount? or do we withdraw the RFP and resubmit it with new amounts?

C: The RFP objectives and problem statement are consistent with what we prioritized last spring; what's not consistent is the duration and funding for the project. The due date is January 4<sup>th</sup>; so there's still time to address this at today's meeting.

C: We'd still have to pull that back and change it.

C: The scope would remain the same with the duration and funding extended.

C: The proposers are also determining what they're going to get paid; that's our job and that's where I need to give this more thought.

C: If you're going to make a change, it doesn't matter what was in the prioritization because in the last meeting you as a Board decided it would be \$50,000 and one year.

C: I'm from the Office of Design; a pavement management engineer. I don't have a good background on research funding levels for university staff, but looking at the detail of the original problem statement it doesn't look like this project could be done for \$50,000. The first two items are the main focus of the entire project which address major issues involving substructures, volumes, subgrades and subbases; a substantial amount of work which gets you to number four, to possibly be incorporated into SUDAS. I wasn't involved with the original focus group but looking at SUDAS procedures there are issues to be addressed.

C: We're talking about six months more for five times the budget.

C: This is a guideline budget; we've had this come up before and then, we made a decision based on what we were getting out of the research.

No action was taken by the Board.

### **Adjourn**

Motion to adjourn by J. Rasmussen, 2<sup>nd</sup> by R. Younie.

Carried 12 yea, 0 nay, 0 abstaining.

The next scheduled meeting of the Iowa Highway Research Board will be held on **FRIDAY, JANUARY 25, 2008 FROM 9 A.M. TO 1:00 P.M. at the Iowa DOT Materials East/West Conference Room, Ames, Iowa.**

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Mark J. Dunn, IHRB Secretary