IOWA HIGHWAY RESEARCH BOARD (IHRB)

Minutes of December 10, 2019

Regular Board Members Present

D. Claman
W. Dotzler
R. Koester
R. Knoche
A. Bradley
D. Sanders
W. Weiss
P. Geilenfeldt III

Alternate Board Members Present

D. Sprengeler

Members with No Representation

C. Poole
S. Struble

Executive Secretary – V. Goetz

Visitors

Tammy Bailey Iowa Department of Transportation
Brad Skinner Appanoose County
John Rasmussen Pottawattamie County
Halil Ceylan Iowa State University
Jeramy Ashlock Iowa State University
Behrouz Shafei Iowa State University
Paul Wiegand Iowa State University
Beth Richards Iowa State University

The meeting was held at 1:00 pm December 10, 2019 in the Boardroom 3, Veteran’s Memorial Community Choice Credit Union Convention Center, 833 5th Ave, Des Moines, IA.

1. Agenda review/modification

2. Minutes Approval from the September 27 meeting
Motion to Approve by W. Dotzler; 2nd T. Kenney
Motion carried with 12 Aye, 0 Nay, 0 Abstaining

3. IHRB 2020 Membership update

Ahmad Abu-Hawash is taking the place of Michael Nop as Iowa DOT Alternate for Dave Claman.
Jeff De Vries is taking the place of Chris Poole as an IHRB Regular Member.
John Joiner is the new City Alternate for Rudy Koester.
Paul Henley is the new U of I Alternate for Allen Bradley.
Terry Wipf is the new ISU Alternate for David Sanders.
Joel Fantz is replacing Lee Bjerke as Regular County Member for Dist. 2 and Dusty Rolando is the new Alternate member.
Andrew McGuire is replacing Jacob Thorius as the new Regular County Member for Dist 5, and Brad Skinner will serve as the new Alternate.


BACKGROUND
The effect of additives on soil stabilization is determined by the measurement of strength improvement of the soil-additive mixture. The performance of soil stabilization is influenced by many factors, the most remarkable being the physical and chemical properties of the natural soil and the additive(s) used.
Over the last couple of decades, lignin products have been studied with respect to their soil stabilization properties and are believed to benefit soil mechanical properties. Many lignin products have been commercialized and marketed over a wide range of applications including concrete admixture, asphalt modifier, batteries, pavement-surface sealing, dispersants, animal nutrition, and agriculture.
In pavement construction, traditional lignin derived from the paper industry, termed lignosulfonate, has proven to have positive effects with respect to road dust control, service life, and antioxidation in the binder.

OBJECTIVES
• Evaluate the performance of BCPs in different soils with respect to engineering properties and strength properties.
• Evaluate the performance of BCPs in different soils with respect to freeze-thaw durability and moisture susceptibility
• Identify the mechanisms of BCP soil stabilization through microstructural analysis
• Identify the performance and mechanism of lignosulfonate soil stabilization

RECOMMENDATIONS
Lignin products added to natural soil can provide benefits in soil stabilization. They not only improve strength capacity for such soil but also increase freeze-thaw durability and resistance to moisture degradation. Generally, co-products with higher lignin content (BCP A and BCP C)
are more promising additives. Considering that lignin-based strength improvements are less effective than cement-based soil treatment, lignin products are primarily recommended for use in subgrade soil stabilization for unpaved, gravel paved, and low-volume roads, because their strength requirement is relatively less, and durability is of greater concern. While the addition of water to the oily liquid type BCPs can increase their flowability and make the BCP easily spreadable to produce a homogenous soil-additive mixture, the water in oily liquid co-products has a negative effect on soil binding. The recommendation for utilization of oily liquid products (BCPs and lignosulfonate) in field practice is, therefore, to adjust to optimum moisture content before using it as a soil stabilizer.

Future research is needed to evaluate the performance of BCP C on Soils 1, 3, and 4. BCP C was used only for the UCS and freeze-thaw durability testing of Soil 2, and its effects should be tested for the other three types of soil because it exhibited good performance on Soil 2. Standard Proctor compaction tests and DS tests of BCP A were not conducted in this study; hence, it is recommended to finish these tests if an appropriate quantity of material can be made available. Finally, more field demonstrations would be valuable for evaluating the benefits of lignin compared to traditional stabilizers. Field data should be collected and analyzed continuously to verify the effects of lignin products in soil stabilization practices.

Motion to Approve by W. Weiss; 2nd T. Kinney
Motion carried with 12 Aye, 0 Nay, 0 Abstaining

***Board Member Joined***


BACKGROUND
About 68,400 miles of granular roadways exist in the 114,000-mile road network in Iowa. Operation and maintenance of these granular roadways costs roughly $270 million annually.

The sustainability of granular roadways is very important to the rural economy, since these roads provide access to rural land and enable the transportation of agricultural products. Any interruption in access via these granular roadways can have a significant impact on agricultural productivity and the economy of Iowa.

Heavy traffic loads and freeze/thaw cycles during the winter and spring seasons can cause extensive damage to granular roads. Freeze/thaw damage leads to material loss, gradation change, loss of crown, surface erosion, rutting, and potholes. The rate of deterioration (or damage) is directly correlated to the quality of the granular aggregate materials used in the granular roads.

Performance and long-term sustainability of granular roadways are dependent to a considerable degree on the quality of the aggregate materials used, which varies considerably
from one source to another across Iowa. A wide range of granular material sources are available in Iowa, each producing different qualities, supply amounts, and prices.

**OBJECTIVES**

The goal of the project was to determine the cost-effectiveness of hauling high-quality course (clean) aggregates to improve the performance and reduce the maintenance frequency on granular roadways in regions having only low-quality aggregates. The specific objectives were as follows: Evaluate the quality of aggregate materials collected from various Iowa sources Monitor the change in material properties over time and its impact on granular roadway performance Determine the relationships between material properties and performance of granular roadway materials Conduct a comprehensive cost analysis for each test section

**Motion to Approve by** J. Thorius; 2nd L. Bjerke
Motion carried with 13 Aye, 0 Nay, 0 Abstaining

6. **FINAL REPORT: TR-718, “Evaluation of Alternative Abutment Piling for Low-Volume Road Bridges”,** Behrouz Shafei, Iowa State University, $50,000 (15 min)

**BACKGROUND**

Alternatives to driving H-piles are being utilized by a number of states and private industry. Helical/screw pilings are used, and the load bearings are listed as 5 to 50 tons per piling. Micropiles are also used with 90-ton bearing resistance typical per piling. Either of these two options can offer cost-effective and/or quick construction alternatives to driving H-piles. However, there is limited data available for tests on the strength of alternative piles or vibratory-driven piles. There is also a need to utilize safe, cost-effective pile driving systems to reconstruct or repair bridges, especially those for low-volume roads. Vibratory pile driving is a method to accomplish this goal.

**OBJECTIVE**

- Study the application and cost-effectiveness of alternative abutment pilings for low-volume road bridges
- Study the strength and bearing resistance of alternative piles as well as pilings driven with vibratory equipment

**RECOMMENDATIONS**

Based on the observations and results of this research, the following future research activities and developments are recommended:

- Building new test sections in different regions to examine a wider range of local quarry materials, traffic loads, and subgrade conditions
- Increasing the test section lengths from 500 ft to ¼ mile (at least) and conduct BCAs on longer granular roadway network that has been built with Class A-clean aggregate mixtures
Developing a new method of back-calculation to increase accuracy of modulus values from FWD data

- Performing BCA on construction and maintenance of low-volume roads with different materials, stabilization methods, or other conditions.

**Motion to Approve by** B. Wilkinson; 2nd T. Kinney
Motion carried with 13 Aye, 0 Nay, 0 Abstaining

***Member Stepped Out***


**BACKGROUND**
Local road agencies are responsible for construction and maintenance of county roads and bridges. To accomplish that mission, local agencies heavily use road equipment for construction and maintenance activities. In Iowa counties, about half of the total budget is spent on road maintenance, and equipment expenditures constitute 27% of the total expenditures.

Determining the optimal time for equipment replacement is challenging, since the cost of maintaining road equipment increases with equipment operation, while the economic value of the equipment decreases.

The LCCA approach, used in advanced equipment management programs, takes the two conflicting trends into account and estimates the optimum replacement time of equipment. Accurately estimating the optimal replacement time and predicting future costs of road equipment contribute to the effective use of equipment, while avoiding expensive maintenance activities.

**OBJECTIVES**
- Investigate state-of-the-art life-cycle cost analysis (LCCA) methods to identify methodologies that can be adapted
- Identify and analyze current equipment management processes and data collection practices in Iowa counties
- Develop guidelines for counties to use data-driven equipment record-keeping practices to aid in decision making
- Develop a spreadsheet-based decision aid tool for assessing the values of repairing, replacing, or retaining equipment and generating options available to the equipment manager to help counties minimize total life-cycle costs of their equipment fleet

**CONCLUSIONS**
This research project developed a data-driven spreadsheet-based tool to estimate replacement time and future cost of motor graders and trucks currently used in Iowa counties to enhance equipment management practice. This study conducted a comprehensive survey to understand the current practice of equipment management in Iowa counties and collected and analyzed
historical equipment management data to derive cost estimating models for use in the proposed tool. The research project reviewed advanced methods in LCCA and studied current application of LCCA by DOTs across the US that have similar duties as in Iowa counties. The tool adopts advanced LCCA techniques and captures current ownership and operating costs of a piece of equipment to estimate future costs and determine the economic life and the optimal replacement year. The research project also proposed an equipment record-keeping template to improve current practice. Using the outputs of this research can contribute to local agencies making justifiable decisions and bring about large savings in terms of their equipment budget.

Motion to Approve by R. Koester; 2\textsuperscript{nd} J. Thorius
Motion carried with 12 Aye, 0 Nay, 0 Abstaining

***Board Member Left***

8. FINAL REPORT: TR-729, “Development of Granular Roads Asset Management System”, Bora Cetin, Michigan State University, $250,000 (15 min)

BACKGROUND
Granular roads serve as an economically sustainable option when the traffic volume is insufficient to warrant paved roads. Approximately 67,000 of the 90,000 miles of Iowa’s secondary roadways consist of granular roads, but in 2018, only about 4 of the 291 miles of newly constructed secondary roads were granular roads. The sustainability of granular roadways is also very important to Iowa’s rural economy, since these roads provide access to local farms and enable the transportation of agricultural products. Ad hoc maintenance strategies are common in management policies for granular roads, given they are not very expensive to construct, and experience lower usage compared to their paved counterparts. However, proactive and effective maintenance policies are essential. Adequate maintenance of Iowa’s granular roads will increase overall roadway system safety, ride quality, and environmental sustainability.

OBJECTIVES
The goal of this project was to develop a Microsoft Excel-based GRAMS tool as a decision-support and communication-of-strategy tool for local agencies in Iowa. To accomplish this overarching goal, the research team successfully completed the following objectives.

1. Collect and synthesize the granular road performance and cost data.
2. Develop a material-quality indexing method to effectively predict the anticipated long-term performance of different materials properties used for granular roads.
3. Improve the previously developed method (or develop a formula) to estimate annual replacement needs in tons-per-mile (TPM) and the total tons needed for a particular local granular roadway system, based on a set of input parameters, such as a material quality index related to the rate of material loss, traffic volume and loading estimates, widths of roadways, weathering losses, crown and drainage, etc.
4. Develop a method to determine the amount of serviceable material present in a granular road’s crust at any given time (i.e., the rock-in-service [RIS] TPM tool).
5. Develop a probabilistic method based on the actual field data to quantify and estimate the risk that a granular road may fall below the minimum acceptable reliability when adverse subgrade conditions develop, with the amount of serviceable material in the crust measured in TPM as a main input parameter.

6. Develop a model to predict the system-wide risks and gravel needed in TPM in order to manage the risks.

7. Develop a comprehensive GRAMS by integrating methods and formulas developed from the previous objectives into a Microsoft spreadsheet and web-based platform. This GRAMS tool should be able to generate the most optimal maintenance strategy (maximum TPM, minimum TPM, and annual replacement rate) that can keep the risk of impaired road performance below a target maximum level over multiple years.

**CONCLUSION**

This project developed an Excel-based GRAMS tool that can help local agencies in Iowa consistently estimate annual gravel loss amounts and thus determine aggregate (rock) requirements for budgeting purposes. This tool is a network (county) level-based estimation tool that can estimate a range of gravel loss amounts and required rock quantities depending upon different target levels of service and performance. The tool is based upon survival analysis as a computational algorithm to estimate minimum annual aggregate (rock) requirements for various budget and risk scenarios. Thus, the tool offers a trade-off analysis of various aggregate (rock) materials and identifies the most effective and economical options. The gravel loss predictions estimated from the tool were compared to data obtained from a field test section in Decatur County, Iowa, which yielded similar results with smaller (<10%) percent errors. Since the user-input data to run the GRAMS tool are readily available to local agencies, the tool is highly practical. One of the features of the developed GRAMS tool is that it is significantly sensitive to the roadway drainage condition (i.e., ditch depth, roadway crown, and cross section) and therefore, caution is advised with this input parameter.

Motion to Approve by R. Knoche; 2nd J. Thorius
Motion carried with 12 Aye, 0 Nay, 0 Abstaining

9. **FINAL REPORT: TR-761, “Feasibility of an Iowa Urban Service Bureau”, Paul Wiegand, Iowa State University, $250,000 (15 min)**

**BACKGROUND**

In order to determine if there are any current organizations in other states similar to the proposed urban service bureau, an internet search was conducted. The following terms were searched:

- Statewide urban service bureau
- Statewide services
- [Insert each state] urban service bureau
- Public works service bureau

No organization similar to the proposed urban service bureau was noted during this search. In general, the typical listing included a state’s legislative service bureau, human service
organizations, metropolitan planning organization (MPO) designations of urban service areas, and urban youth services programs. Most state departments of transportation offer an urban element as a part of their programming. The Maine DOT has a community services division, which offers a local roads center, a local road assistance program, a municipal sand/salt facility program, and a listing of labor reimbursement and private equipment rates as a service to their cities. The state of Kansas has a municipal services section within its department of administration that offers some services, but they are primarily focused on budget and financing.

Many states also have league of cities organizations outside of the formal state government. They are established to provide services to the cities in their state. The Iowa League of Cities is such an organization. The organization’s primary activity is to provide advocacy for local governments regarding public policy at the state level. They also provide guidance and awareness to member cities through research, publications, and training. The League of Cities also assists cities in understanding and connecting with public works resources.

Based on this research, if a statewide urban service bureau was created in Iowa, it would be the first and only one in the country.

**OBJECTIVES**

The questionnaire yielded a 24 percent response rate (182 responses out of 744 contacts) to three of the questions; the fourth had a smaller response rate as it was inadvertently left off the initial email.

- When the “somewhat” and “highly” likely responses to each survey question are combined, it was apparent that a public works service bureau providing the services identified would be used and provide value across the state.
- The “somewhat” and “highly” likely responses to use the service bureau for various purposes showed support among cities of at least 76 percent.
- The questionnaire showed the most support (90 percent) for a system where cities could review a series of management tools, like organizational charts for cities of all sizes, sample ordinances, and job descriptions.
- The most economical alternative to organizing a service bureau involves adding web and computer applications staff to SUDAS

**CONCLUSION**

A majority of the research project Technical Advisory Committee endorsed the recommendation to develop an Iowa Public Works Service Bureau within the existing SUDAS program and to pursue funding of the IPWSB by expanding the current SUDAS funding sources.

An off-the-top allocation from the city portion of the Road Use Tax will be the recommended financing mechanism. A rate of 1/8 of 1 percent will generate approximately $385,750 annually, although not all of the funds would initially be needed. It will be necessary to work with the Iowa Legislature and the governor’s office to approve the off-the-top allocation.

The project team and a strong majority of the TAC recommend a Phase 2 from the Iowa Highway Research Board. The recommended scope of Phase 2 would involve establishing the Iowa Public Works Service Bureau within the SUDAS program and implementation of the organization identified in Alternative #4. Phase 2 would involve additional funding for two years, requesting $219,700 for the first year and $275,500 for the second year, with a total budget of $495,200.
Phase 2 would allow the research team to establish the service bureau website, market the program across the state to cities and various stakeholders, and begin the development of key service bureau applications. In addition, work would include pursuing the legislative change necessary to create the Iowa Public Works Service Bureau fund through an off-the-top allocation from the city portion of the Road Use Tax Fund.

Motion to Approve by T. Kinney; 2nd J. Thorius
Motion carried with 12 Aye, 0 Nay, 0 Abstaining

10. Continuation Project Voting – tabled until February IHRB Meeting

11. New Business

12. Regular Meeting Adjourn

The next meeting of the Iowa Highway Research Board will be held Friday, February 28, 2020 at 9:00a.m. In the East/West Materials Conference Room at the Iowa DOT.

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Vanessa Goetz, IHRB Executive Secretary