



Updates from the States: Iowa (March 2011)

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Concrete pavement research for the state of Iowa is accomplished through research programs run by the Iowa Department of Transportation (Iowa DOT) Research and Technology Bureau, and guided by the Iowa Highway Research Board (IHRB). Pavement research is conducted by in-house efforts at the DOT, and through various partnerships.

The DOT often partners the University of Iowa, Iowa State University and the University of Northern Iowa in order to accomplish research goals. The Institute for Transportation (InTrans) and the National Concrete Pavement Technology Center (CP Tech Center) at Iowa State University are very actively involved with Iowa DOT through the DOT-University partnerships on a number of concrete pavement research efforts. Iowa DOT is also actively involved in many Transportation Pooled Fund (TPF) projects associated with concrete pavements. These projects include State partnerships that bring together a group of people interested in accomplishing research on the same topic. TPF partnerships often include several other state DOTs, academic research centers such as the CP Tech Center, industry agencies, and the federal government.

To learn more about IHRB, Iowa State University, InTrans, the National CP Tech Center, the University of Iowa, and the TPF program, follow the links below.

- Iowa DOT Research and Technology Bureau: <http://www.iowadot.gov/operationsresearch/default.html>
- IHRB : http://www.iowadot.gov/operationsresearch/iowa_highway_research_board.asp
- InTrans: <http://www.intrans.iastate.edu>
- National CP Tech Center: <http://www.cptechcenter.org>
- The University of Iowa College of Engineering: <http://www.engineering.uiowa.edu/research/>

Figure 1 depicts the number of TPF, currently ongoing, and recently completed projects according to the CP Road Map Track for which the work is categorized under. Following Figure 1, titles for each of the projects are listed. Recently completed projects include those completed since 2007.

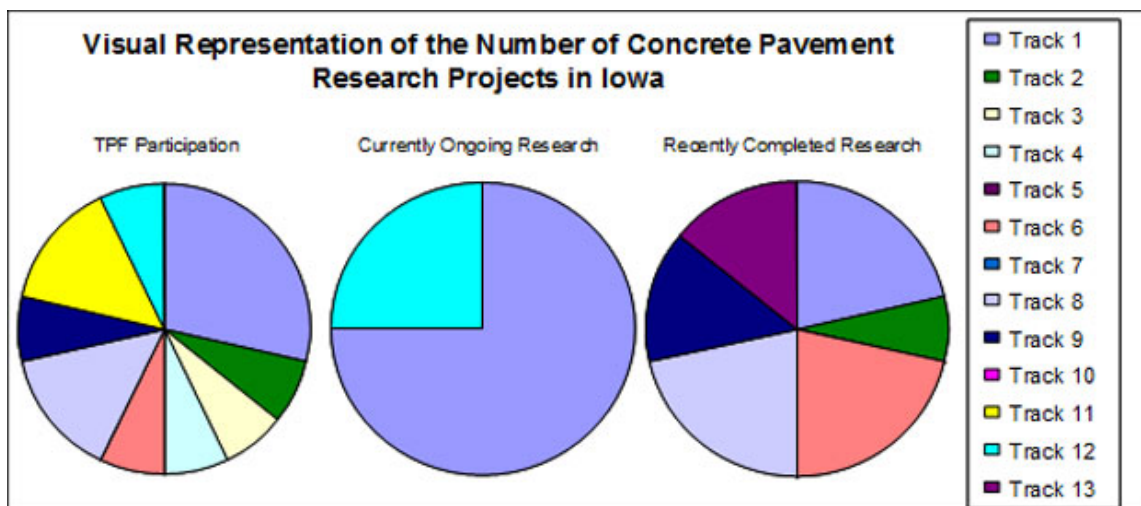


Figure 1. Concrete Pavement Research in Iowa Categorized by CP Road Map Tracks

Transportation Pooled Fund (TPF) Studies

Current concrete pavement research work underway in Iowa includes work done under various TPF projects. These projects, and how they align under the CP Road Map, include the following.

Track 1: Performance-Based Concrete Pavement Mix Design System

- TPF-5(066) Material and Construction Optimization for Prevention of Premature Pavement Distress in PCC Pavements
- TPF-5(117) Development of Performance Properties of Ternary Mixes
- TPF-5(179) Evaluation of Test Methods for Permeability (Transport) and Development of Performance Guidelines for Durability
- TPF-5(205) Implementation of Concrete Pavement Mixture Design and Analysis (MDA) Track of Concrete Pavement Road Map

Track 2: Performance-Based Design Guide for New and Rehabilitated Concrete Pavements

- TPF-5(183) Improving Foundation Layers

Track 3: High-Speed Nondestructive Testing and Intelligent Construction Systems

- TPF-5(136) High Speed Pavement Analyzer

Track 4: Optimized Surface Characteristics for Safe, Quiet, and Smooth Concrete Pavements

- TPF-5(139) PCC Surface Characteristics: Tire -Pavement Noise Program Part 3 - Innovative Solutions /Current Practices

Track 6: Innovative Concrete Pavement Joint Design, Materials, and Construction

- TPF-5(224) Investigation of Jointed Plain Concrete Pavement Deterioration at Joints and the Potential Contribution of Deicing Chemicals

Track 8: Long-Life Concrete Pavements

- TPF-5(100) Deicer Scaling Resistance of Concrete Pavements, Bridge Decks and Other Structures Containing Slag Cement

Track 9: Concrete Pavement Accelerated and Long-Term Data Collection

- TPF-5(042) Investigation of the Long-Term Effects of Magnesium Chloride and Other Concentrated Salt Solutions on Pavement and Structural Portland Cement Concrete

Track 11: Concrete Pavement Business Systems and Economics

- TPF-5(185) CP Road Map Operations Support
- TPF-5(159) Technology Transfer Concrete Consortium

Track 12: Advanced Concrete Pavement Materials

- TPF-5(098) Self-Consolidating Concrete - Applications for Slip Form Paving

Currently Ongoing Research

Currently ongoing research projects, and how they align under the CP Road Map, are listed here.

Track 1: Performance-Based Concrete Pavement Mix Design System

- Effect of Admixtures on Roller-Compacted Concrete Mixes
- Development of New Test Procedures for Measuring Fine and Coarse Aggregate

Track 12: Advanced Concrete Pavement Materials

- Pervious Concrete Mix Design for Wearing Course Applications, Phase I

Recently Completed Research

Recently completed projects (i.e., ones that have been completed since 2007) and how they align under the CP Road Map, are listed here.

Track 1: Performance-Based Concrete Pavement Mix Design System

- Improving Portland Cement Concrete Mix Consistency and Production Rate through Two-Stage Mixing
- Evaluation of PCC Long-Term Durability Using Intermediate Sized Gravels to Optimize Mix Gradations
- Improving Variability and Precision of AVA Test Results and Developing Rational Specification Limits
- Investigation into Freezing-Thawing Durability of Low Permeability Concrete with and without Air Entraining Agent

Track 2: Performance-Based Design Guide for New and Rehabilitated Concrete Pavements

- Pavement Thickness Design for Local Roads in Iowa

Track 6: Innovative Concrete Pavement Joint Design, Materials, and Construction

- Evaluation of Elliptical Steel Dowel Performance
- Evaluation of Dowel Bar Retrofits for Local Road Pavements, February 2008
- Crack Development in Ternary Mix Concrete utilizing Various Saw Depths

Track 8: Long-Life Concrete Pavements

- Improving Concrete Overlay Construction
- Investigation of PCC Pavement Sections from I-29 Pottawattamie County

Track 9: Concrete Pavement Accelerated and Long-Term Data Collection

- Air Content and Permeability of PCC Pavements: 1909 to 2006
- 100 Years of Concrete Pavements in Iowa

Highlights

The following provides a little more detail on four of the aforementioned recently completed research projects.

1. Evaluation of Dowel Bar Retrofits for Local Roads
2. Improving Concrete Overlay Construction
3. Evaluation of PCC Long-Term Durability Using Intermediate Sized Gravels to Optimize Mix Gradations
4. Pavement Thickness Design for Local Roads in Iowa

Evaluation of Dowel bar Retrofits for Local Roads

The report, *Evaluation of Dowel Bar Retrofits for Local Roads*, authored by James Cable, Max Porter, Daniel Frentress, Douglas Wood, Sybil Reinert, and Jason Walker, documents research efforts by Iowa State University and sponsored by IHRB. The purpose for this research was to construct field evaluation sites in Buena Vista County where dowel bar retrofit techniques could be evaluated for local road applications. A variety of dowel bar options (e.g., fiber-reinforced polymer (FRP) dowels, elliptical dowels, and standard dowels), placement of the dowels, costs, and performance were evaluated as part of this project. Recommendations cited in the report discuss the potential advantages for using FRP dowels and the expected pavement life as a result of the use of dowel bars and diamond grinding. This report, and the

research it documents, is an example of how innovative materials and design (i.e., placement of the dowels) can be used to improve load transfer at the joints. Therefore, it is an example of work categorized under the CP Road Map Track 6: Innovative Concrete Pavement Joint Design, Materials, and Construction. This work is also an example of how to preserve pavement life and can therefore be categorized under Track 8: Long-Life Concrete Pavements. For more information, access the report via the following link.

http://www.iowadot.gov/operationsresearch/reports/reports_pdf/hr_and_tr/reports/tr520%20Final.pdf

Improving Concrete Overlay Construction

Recent research by the Institute for Transportation at Iowa State University sponsored by IHRB and FHWA concluded with the report titled *Improving Concrete Overlay Construction*. This report follows the National CP Tech Center's publication of the *Guide to Concrete Overlays*. This report is an effort to bridge some of the gaps in information not covered by the *Guide* that may be of concern to designers and contractors with regard to concrete overlays. Authors Paul Wiegand, James Cable, Tom Cackler, and Dale Harrington, document the construction of overlays in four different Iowa counties. The purpose for this work was to evaluate the materials used and construction techniques applied in various field case studies. The goal for performing this work was to report on ways to minimize costs and user delays. The report includes discussions on global positioning systems (GPS) for controlled longitudinal joint formation and surface mapping, stringless paving operations, placement of nonwoven geotextile bond breakers, strength requirements for local traffic instead of normal highway traffic, traffic control for two-lane overlay construction, deflection data, overlay construction activities and timing, effects of the environment, joints formed by a knife joint former. This report, and the research it documents, is an example of work categorized under the CP Road Map Track 8: Long-Life Concrete Pavements. To read this report, follow the link below.

http://www.iowadot.gov/operationsresearch/reports/reports_pdf/hr_and_tr/reports/TR-600%20Final.pdf

Evaluation of PCC Long-Term Durability Using Intermediate Sized Gravels to Optimize Mix Gradations

A recent report, *Evaluation of PCC Long-Term Durability Using Intermediate Sized Gravels to Optimize Mix Gradations*, by Iowa DOT Portland Cement Concrete Engineer Todd Hanson documents research work performed in an effort to evaluate the use of Iowa DOT Class 2 and 3 gravel in concrete mixtures. While the use of the gravel would optimize gradations, their potential effects on long-term concrete pavement durability were the focus of this study. The report presents ASTM International C 666 and petrographic testing results of concrete specimens made from mixtures containing the questionable gravel. Recommendations based on this study suggest Class 2 and 3 gravels should be limited to 15 percent of the total coarse aggregate used in a mix and that additional specifications be developed. This study is an example of work categorized under the CP Road Map Track 8: Long-Life Concrete Pavements. For more details about this research, follow the links below.

Full report:

http://www.iowadot.gov/operationsresearch/reports/reports_pdf/mlr/reports/MLR-00-03%20Final.pdf

Performance Evaluation of Concrete Pavement Granular Subbase – Pavement Surface Condition Evaluation

The report, *Performance Evaluation of Concrete Pavement Granular Subbase – Pavement Surface Condition Evaluation* documents research work funded by IHRB and CTRE. Authors David J. White, Halil Ceylan, Charles Jahren, Thang Huu Phan, Sung Hwan Kim, and Kasthurirangan Gopalakrisnan, Muhannad Suleiman present results of an investigation of the use of recycled concrete aggregate (RCA) as base and subbase material. The work presented in this report includes laboratory testing methods and field evaluations. Laboratory testing was performed to compare material characteristics of RCA to the typical limestone aggregate used by Iowa DOT for similar applications. Field evaluations were conducted to investigate performance of pavements over RCA base and subbase layers. Among the conclusions, it is reported that

RCA specific gravity, gradation, abrasion resistance, California bearing ratio values, and permeability are different from that of limestone. Base and subbase layers, however, are performing adequately, and pavement performance is similar when compared to pavement over limestone. This research work is an example of recycling concrete pavement for re use in new construction; therefore, it is an example of work categorized under the CP Road Map Track 13: Concrete Pavement Sustainability. For more information, access the entire report at the following link.

http://www.iowadot.gov/operationsresearch/reports/reports_pdf/hr_and_tr/reports/TR-554%20Print.pdf

About the CP Road Map E-News

The **CP Road Map E-News** is the newsletter of the [Long-Term Plan for Concrete Pavement Research and Technology \(CP Road Map\)](#), a national research plan developed and jointly implemented by the concrete pavement stakeholder community. To find out more about the CP Road Map, or to get involved, contact Dale Harrington, dharrington@snyder-associates.com, 515-964-2020.

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The [National Concrete Pavement Technology Center](#) at [Iowa State University](#) provides operations support services to the CP Road Map program.
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