Updates from the States: Mississippi (February 2011)

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The Mississippi Department of Transportation (MDOT) sponsored a workshop in 2006, during which a list of research needs statements was identified. Among those statements were concrete pavement related topics including pavement preservation, concrete mix design and QC/QA based on performance specifications, and pavement noise mitigation.

In recent years, the MDOT Research Division has collaborated with various agencies in order to accomplish concrete pavement research work. Under cooperative agreements, MDOT has (and will continue to) worked with the Federal Highway Administration (FHWA), the University of Mississippi, the Mississippi Transportation Research Center (MTRC) at Mississippi State University, and private consultants. MDOT also participates in the Transportation Pooled Fund Program.

To learn more about each of these research facilities, follow the links below.

- MDOT
- University of Mississippi
- MTRC
- http://www.pooledfund.org/

The following lists the current TPF projects MDOT supports and the projects recently completed (i.e., projects completed since 2007) under MDOT cooperative agreements.

Transportation Pooled Fund (TPF) Studies

Current concrete pavement research work underway in Mississippi includes work done under various TPF projects. These projects, and how they align under the CP Road Map, are identified below.

Track 1: Performance-Based Concrete Pavement Mix Design System

- TPF-5(117) Development of Performance Properties of Ternary Mixes

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

- TPF-5(165) Development of Design Guide for Thin and Ultrathin Concrete Overlays of Existing Asphalt Pavements

Track 11: Concrete Pavement Business Systems and Economics

- TPF-5(185) CP Road Map Operations Support
- TPF-5(212) Southeast Transportation Consortium
- TPF-5(123) Pavement Preservation Technology Transfer Among Southeast States

Recently Completed Research

In addition, three concrete related research projects have been completed since 2007 under cooperative

agreements between MDOT, FHWA, the universities, and consultants. These projects, and how they align under the CP Road Map, are listed here.

Track 1: Performance-Based Concrete Pavement Mix Design System

- Effect of Moisture Content on the Coefficient of Thermal Expansion

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

- Development of Automated Faulting Measurements Module for ProVAL

Track 8: Long-Life Concrete Pavements

- Evaluation of the Effectiveness of Drainage Layers

Figure 1 is a chart that depicts the number of research projects for each of the CP Road Map Tracks that have been recently completed or are currently ongoing.

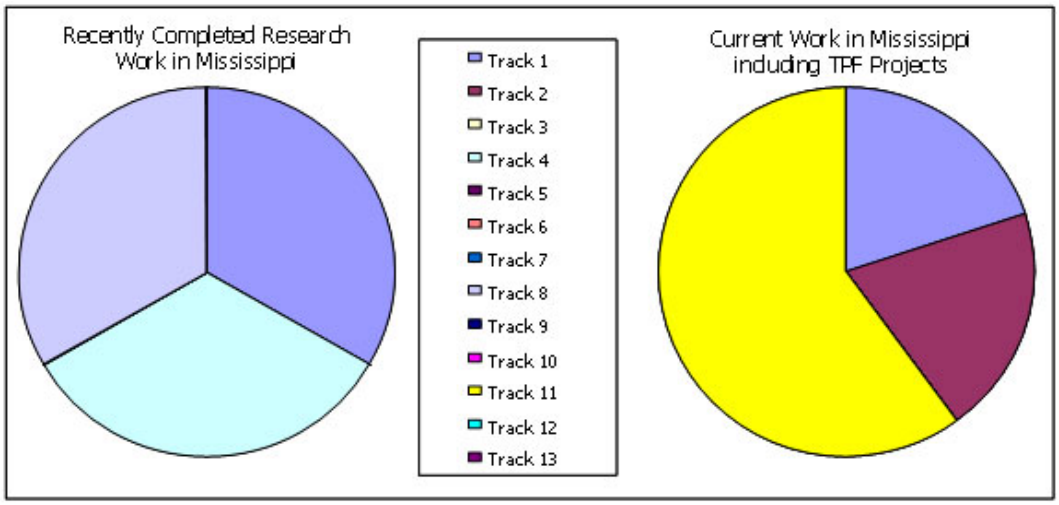

Figure 1. Concrete Pavement Research Recently Completed and Currently Underway categorized by CP Road Map Tracks

Highlights

The following provides a little more detail on the recently completed research projects and the TPF-5(165). Also highlighted below is one of the TPF projects Mississippi actively supports.

Effect of Moisture Content on the Coefficient of Thermal Expansion

In September 2007, University of Mississippi (UM) Associate Professor of Civil Engineering Ahmed Al-Ostaz completed a report titled *Effect of Moisture Content on the Coefficient of Thermal Expansion*. Dr. Al-Ostaz's research for this report was supported by a cooperative effort between the university, the Federal Highway Administration, and MDOT. The purpose was to evaluate how aggregate type, moisture content, and temperature affect concrete coefficient of thermal expansion (CTE). Twenty different mix designs were tested in accordance to three test methods the AASHTO TP 60-00, Danish T1-B, and Strain Gage methods. This report summarizes a literature review focused on investigating the three test methods, presents the testing plan, and provides conclusions that discuss the results obtained from each of the test methods. This work is an example of CP Road Map Track 1: Performance-Based Concrete Pavement Mix Design System. To read this report, follow the link below.

http://www.gomdot.com/Divisions/Highways/Resources/Research/pdf/Reports/InterimFinal/SS187.pdf

Evaluation of the Effectiveness of Drainage Layers

Jordan Whittington and Dr. Thomas White completed a report titled *Evaluation of the Effectiveness of Drainage Layers* in December 2007. The research for the report was supported by a cooperative agreement

between MTRC, FHWA, and MDOT. The purpose for this research was to evaluate existing pavement drainage systems and to provide recommendations for any revisions to current state standards, specifications, and/or guidelines. Research work documented in the report included a literature review and pavement evaluation. The literature review focused on pavement drainage design and construction concepts, current state practice, and maintenance procedures. Two pavement sections along US 82 were evaluated. One of the pavement sections was a newly constructed 9.5-inch hot-mix asphalt pavement over four inches of an asphalt drainage course; the other was a newly constructed 11-inch jointed plain concrete pavement (JPCP) over four inches of an asphalt drainage course. The goal of the evaluation was to measure the amount of rainwater that drained through each pavement type in order to determine how effective the base and subbase layers were at preventing water from becoming trapped. Conclusions presented in the report suggest that the 4-inch asphalt drainage layer has the potential to work well at allowing water to flow through and not become trapped. A routine maintenance schedule for edge drains was recommended as part of the conclusions. The need to construct pavements with good drainage layers that will ultimately improve pavement performance and longevity 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.gomdot.com/Divisions/Highways/Resources/Research/pdf/Reports/InterimFinal/SS189.pdf

Development of Automated Faulting Measurements Module for ProVAL

MDOT recently participated in research sponsored by FHWA and completed by Dr. George Chang of The Transtec Group, Inc. The purpose of the research was to develop an automated method for identifying joints and measure faulting based on profile data. The result of this research is an Automated Faulting Measurement (AFM) module for Profile Viewing and Analysis Software (ProVAL) (www.RoadProfile.com). Profile and fault data (the latter were measured with manual devices, e.g., Georgia Fault Meter) provided by MDOT and the Florida Department of Transportation (FDOT) was used to develop and validate the AFM. MDOT first developed an application called BatchCalcFault to locate the joints and the elevation differences between them. Transtec subsequently incorporated the MDOT algorithm as one of the analysis options in AFM. The AFM can either automatically reports the location of any joints that are faulted beyond a minimum threshold value or automatically generate the location of all joints and report the faulting measured at each joint. Faulting measurements are compatible with the methods recommended in the revised AASHTO R36-04, Standard Practice for Estimating Faulting of Concrete Pavements. It is anticipated that the AFM will avoid errors such as the grade issues associated with manual measuring techniques, as well as promote safety by keeping personnel off the highway. This work is an example of work categorized under CP Road Map Track 4: Optimized Surface Characteristics for Safe, Quiet, and Smooth Concrete Pavements. For more information, follow the link below to a presentation given at the Pavement Evaluation 2010 Conference .

http://www.cpe.vt.edu/pavementevaluation/presentations/Chang.pdf

TPF-5(165) Development of Design Guide for Thin and Ultrathin Concrete Overlays of Existing Asphalt Pavements

MDOT is currently involved in the TPF-5(165) project led by the Minnesota Department of Transportation. Missouri, New York, Pennsylvania, and Texas are also a part of TPF-5(165). The goal of this pooled fund effort is to develop national guidance on how to design thin and ultra-thin concrete overlays of existing hot-mix asphalt (HMA) pavements. In order to achieve the goal, several tasks were outlined: (1) analysis of the performance of existing thin and ultra thin overlays, (2) evaluation of the existing structural and performance models, (3) development of bond degradation models, (4) incorporate climate considerations with respect to accounting for seasonal changes in the HMA stiffness for each climatic region throughout the country and as well as establishing the effective equivalent linear gradients, (5) development of project sustainability and characterization of in-place structure, (6) investigation of the benefits of fiber-reinforced concrete (FRC) in overlay, (7) development of a mechanistic-empirical design procedure, (8) preparation of future rehabilitation guidelines, and (9) creation of implementation guidelines. Tasks 1, 2, and 4 have been completed. Some conclusions drawn from these above mentioned three tasks are the following:

Task 1

- A minimum requirement for HMA thickness is case-specific, but should not be less than 3 inches.
- Distress patterns relate to overlay thickness, HMA thickness, and HMA condition.
- The potential for reflective cracking increases when the stiffness ratio of PCC and HMA is less than one.
- A uniform bond minimizes the potential for corner cracks.
- Milling is the commonly accepted method for surface preparation.
- Joints should not fall in the wheel paths, and 5 x 6 ft panel sizes seem to be optimal.

Companion projects are not available to investigate the contribution of FRC; therefore an accelerated laboratory study shall be conducted to quantify the benefits of FRC.

Mississippi roadway sections that are a part of this TPF study include US-80 at SR-15 in Newton, the intersection of SR-35 and US-80, and the intersection of 22nd Avenue and North Frontage Road. A bonded concrete overlay five to six inches thick was constructed over each of these sections within the last eight years. Existing HMA was milled six inches prior to the construction of the overlay, and there are no dowel bars or tie bars. The performance of these sections will be monitored regularly during this project.

Once completed, this TPF project will result in another alternative to existing methods for designing concrete overlays of HMA pavements and is, therefore, an example of work under CP Road Map Track 2: Performance-Based Design Guide for New and Rehabilitated Concrete Pavements. For more information on this project, follow the link below.

http://www.pooledfund.org/projectdetails.asp?id=389&status=4

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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