# Updates from the States: Pennsylvania (October 2010)

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When it comes to highway research in Pennsylvania, there is a process that must be followed that is clearly defined by the Pennsylvania Department of Transportation (PennDOT), Bureau of Planning and Research (BPR). The process includes four key steps that are managed by BPR staff:

1. Program development
2. Project development
3. Project management
4. Implementation

For general PennDOT information and more information on this process, visit the PennDOT website or the PennDOT Bureau of Planning and Research website.

There are a variety of programs through which PennDOT research needs are met. PennDOT can initiate projects using Transportation Research, Education and Technology Transfer Invitation to Qualify (ITQ) contracts, which is a competitive bid-based program. The Transportation Pooled Fund (TPF) program enables PennDOT to participate in projects that include other states and affords PennDOT the opportunity to maximize their research funds.

PennDOT often collaborates with educational institutes including the Pennsylvania State University (Penn State), the University of Pittsburgh, Temple University, and the Mid-Atlantic Universities Transportation Center (MAUTC) Partnership to achieve research goals. MAUTC is a partnership led by Penn State that includes the University of Maryland, University of Virginia, Virginia Polytechnic Institute and State University, and West Virginia University. One of the original 10 centers in the University Transportation Centers Program established by the U.S. Department of Transportation, MAUTC receives annual funds from federal agencies that are matched with state, local, university, and private sources.

BPR staff actively manages each project initiated through the PennDOT Research Program and works to implement the results of completed research projects as they finish. With the help of an Implementation Evaluation Checklist, PennDOT tracks the implementation efforts of each completed project so that customized technology transfer activities can be developed for each project result.

The remainder of this page lists current PennDOT research projects, TPF involvement, and research completed within the last few years. How each of the research activities align with the CP Road Map is also identified.

## Current PennDOT Research

Current ongoing PennDOT research includes the following projects:

- Track 2: Performance-Based Design Guide for New and Rehabilitated Concrete Pavements
    - Establish Inputs for the New Rigid Component of the Mechanistic-Empirical Design Pavement Guide

- Track 6: Innovative Concrete Pavement Joint Design, Materials, and Construction
    - Premature Deterioration of Jointed Plain Concrete Pavements
- Track 7: Concrete Pavement Rehabilitation and Construction
    - Concrete Overlay Field Application

## Transportation Pooled Fund (TPF) Studies

PennDOT is involved in several TPF projects. A list of various concrete related TPF projects PennDOT is involved with and how the TPF projects are categorized according to the CP Road Map Track follows.

- Track 1: Performance-Based Concrete Pavement Mix Design System
    - 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
- Track 2: Performance Based Design Guide for New and Rehabilitated Concrete Pavements
    - TPF-5(159) Technology Transfer Concrete Consortium
- Track 4: Optimized Surface Characteristics for Safe, Quiet, and Smooth Concrete Pavements
    - TPF-5(063) Improving the Quality of Pavement Profiler Measurement
    - TPF-5(141) Pavement Surface Properties Consortium: A Research Program
- Track 7: High-Speed Concrete Pavement Rehabilitation and Construction
    - TPF-5(150) Extending the Season for Concrete Construction and Repair, Phase III
    - TPF-5(165) Development of Design Guide for Thin and Ultrathin Concrete Overlays of Existing Asphalt Pavements
- Track 8: Long-Life Concrete Pavements
    - TPF-5(183) Improving Foundation Layers

## Recently Completed PennDOT Research

- Track 1: Performance-Based Concrete Pavement Mix Design System
    - Evaluation Performance of Limestone Prone to Polishing (highlighted below)
    - Hardened Air in Concrete Roadway Pavements in Structures
    - Technology Evaluation on Characterization of the Air Void System in Concrete (highlighted below)
- Track 2: Performance Based Design Guide for New and Rehabilitated Concrete Pavements
    - Research of Current Practices in Pavement Performance Modeling
    - Concrete Pavement Cracking Rehabilitation (also falls under Track 7, and is highlighted below)
- Track 6: Innovative Concrete Pavement Joint Design, Materials, and Construction
    - Measured Response of an Instrumented Jointed Plain Concrete Pavement to Applied Vehicle Loads (highlighted below)
    - Smart Pavement: Response Characteristics of a Jointed Plain Concrete Pavement to Applied and Environmental Loads
- Track 7: High-Speed Concrete Pavement Rehabilitation and Construction
    - Prestressed Pavement Rehabilitation

For more information on other ongoing or completed projects, click here.

## Highlights

The following highlights only a few of the recently completed research projects by providing additional details and direct links for more information. The projects highlighted include:

1. *Evaluation Performance of Limestone Prone to Polishing* by Zoltan Rado
2. *Response Characteristics of a Jointed Plain Concrete Pavement to Applied and Environmental Loads* by Jennifer McCracken, Rania Asbahan, and Julie Vandenbossche
3. *Evaluation of Concrete Pavement Cracking Rehabilitation* by David Serra and Alberto Medina
4. *Technology Evaluation on Characterization of the Air Void System in Concrete* by Maria Lopez de Murphy, Cliff Lissenden, and Chao Xiao

**Evaluating Performance of Limestone Prone to Polishing**

The report *Evaluating Performance of Limestone Prone to Polishing* by Zoltan Rado dated December 31, 2009, documents research performed at the Thomas D. Larson Pennsylvania Transportation Institute, Pennsylvania State University and sponsored by PennDOT. The objective of this research was to investigate the use of Vanport limestone with regard to surface friction and to evaluate the effect of blending aggregates with this specific limestone on mixture performance. This research is the result of a need to identify the root cause for rapidly decreasing skid resistance along roadways constructed with Vanport limestone. Results of laboratory testing combined with field test data concluded an obvious trend between various blends and mixture properties and helped determine three superior mixture designs that include Vanport limestone. This research is an example of CP Road Map Track 1: Performance-Based Concrete Pavement Mix Design System.

For more information, click here.

**S.R. Smart Pavement**

In February 2008, the report titled *S.R. Smart Pavement: Response Characteristics of a Jointed Plain Concrete Pavement to Applied and Environmental Loads – Phase II Final Report* by the University of Pittsburgh's Jennifer McCracken, Rania Asbahan, and Julie Vandenbossche was submitted to PennDOT and Federal Highway Administration (FHWA). Driven by the need to design and construct more cost effective concrete pavements, this report is a result of research done for the Smart Pavement Project.

The Smart Pavement Project is a joint initiative including PennDOT, FHWA, Mascaro Construction, and the University of Pittsburgh. There are two primary objectives (i.e., phases) to the Smart Pavement Project as identified in this report. Of these two objectives, research documented herein helps fulfill the second goal: to establish Mechanistic-Empirical Pavement Design Guide (M-E PDG) for New and Rehabilitated Concrete Pavements inputs for a pavement constructed in Pennsylvania. The data from embedded sensors, surface profile measurements, truck loading, and falling weight deflectometer (FWD) measurements taken on a section of roadway along SR 22 in Murrysville, Pennsylvania were used to characterize a pavement's seasonal temperature and moisture conditions, describe response to loads, and validate finite element models developed to evaluate the accuracy of the M-E PDG calculations. Pavement thickness determined by M-E PDG methods were compared to typical PennDOT design methods.

Among the conclusions of this report, it is recommended that the finite element model developed herein be used to evaluate stresses and verify M-E PDG accuracy, and to continue collecting data for this section for another few years before performing a dowel bar retrofit of unrestrained slabs. This research work is an example of CP Road Map Track 2: Performance Based Design Guide for New and Rehabilitated Concrete Pavements.

For more information, click here.

**Evaluation of Concrete Pavement Cracking Rehabilitation**

The PennDOT Technical Report *Evaluation of Concrete Pavement Cracking Rehabilitation* by Dave Serra and J. Alberto Medina was published in August, 2009. The report documents field research evaluating the performance of alternative rehabilitation methods for cracked concrete pavements. Dowel bar retrofit (DBR), full-depth patching, steel mesh paving, hot-mix asphalt (HMA) overlays, and combinations thereof were used as rehabilitation methods along a deteriorated section of I-80 in Valley Township, Montour County. The purpose of this research effort was to identify the best alternative for rehabilitation of concrete

pavements in PennDOT District 3. The report concludes that DBR is a viable, faster alternative when cracking is of low severity, whereas full-depth patching is the preferred alternative when cracking is of high severity; steel mesh slows the progression of reflective cracking provided existed pavement is structurally sound; and HMA overlays improve long-term performance of DBR. This research work identifies and implements practical rehabilitation methods and identifies which method is a faster alternative. Therefore, this work is an example of CP Road Map Track 2 and Track 7.

For more information, click here.

**Technology Evaluation on Characterization of Air Void System in Concrete**

The PennDOT Technical Report *Technology Evaluation on Characterization of the Air Void System in Concrete* by Maria Lopez de Murphy, Cliff Lissenden, and Chao Xiao was completed on September 17, 2009. Sponsored by PennDOT, the research work was performed at the Thomas D. Larson Pennsylvania Transportation Institute, Pennsylvania State University. The goal of this research work was to identify devices capable of measuring air void systems in concrete and to investigate their ability to analyzing air void system parameters (e.g., size, spacing factor, surface characteristics) in both fresh and hardened concrete. The need for such research is to be able to improve quality control in order to maximize long-term durability. The report includes a comprehensive literature review, discussion of the formation of the air void system during cement hydration and how it relates to durability, testing procedures with results, and conclusions that identify ultrasound and thermography as technologies having the most potential for evaluating concrete air void systems. This work evaluates testing methods for the assessing materials, and therefore, is an example of CP Road Map Track 1: Performance-Based Concrete Pavement Mix Design System.

For more information, click here.

## 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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