**CP Road Map Interactions**

- **Interactions = Outreach**
  - To know what is going on where
  - To help provide strategic guidance if possible

- **Accomplished by -**
  - Contact with state research agencies:
    - DOT
    - Universities
    - Industry
  - Construction of database
CP Road Map E-News

• July-August 2011
  – Innovative Pavement Research Foundation investigates optimum use of fly ash in airfield concrete pavements
  – Minnesota researchers evaluate cold weather performance of pervious pavements
  – Pennsylvania DOT examines premature deterioration of jointed concrete pavement sections
  – New Jersey researcher utilizes nanotechnology to strengthen concrete
CP Road Map E-News

- September-October 2011
  - Pennsylvania evaluates statewide design inputs for the Mechanistic-Empirical Pavement Design Guide
  - Seal/No Seal Group publishes tech brief on backer rod absorption
  - Virginia DOT develops end-result specification for hydraulic cement
  - National CP Tech Center publishes tech summary on design of concrete overlays
CP Road Map E-News

- November-December 2011
  - Colorado DOT evaluates tie bar system for longitudinal joints
  - FHWA publishes tech brief on the impact of coefficient of thermal expansion on concrete pavement design
  - Washington State DOT investigates studded tire wear on concrete pavements
  - National CP Tech Center publishes technology deployment plan for the use of recycled concrete aggregate
CP Road Map E-News

• January-February 2012
  – Maryland DOT investigates use of concrete maturity method
  – National CP Tech Center publishes comprehensive study on pervious concrete
  – Wisconsin DOT explores lowering cementitious materials content of concrete pavements
  – Michigan researchers evaluate use of recycled concrete for new construction
March-April 2012

- MAP Brief: Sustainable Concrete Pavements: State-of-the-Practice
- Louisiana researchers investigate thermal properties of concrete pavement
- National CP Tech Center publishes feasibility study examining embedded sensors and systems in highway structures
- Minnesota researchers develop new design procedures for unbonded concrete overlays
- European Concrete Paving Association examines long-term sustainability of concrete pavements
# Track 1 - Materials and Mixes for Concrete Pavements

<table>
<thead>
<tr>
<th>Fiber in Continuously Reinforced Concrete Pavements</th>
<th>Quantifying Coefficient of Thermal Expansion Values of Typical Hydraulic Cement Concrete Paving Mixtures</th>
<th>High Plastic Concrete Temperature Specifications for Paving Mixtures</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Texas DOT</em></td>
<td><em>Michigan State University</em></td>
<td><em>Illinois Center for Transportation</em></td>
</tr>
<tr>
<td>This project investigated whether fiber-reinforced concrete may solve problems associated with siliceous river gravel, particularly spalling. Both synthetic and steel fibers were used in a comprehensive laboratory program and two full-scale field trials.</td>
<td>A laboratory investigation was conducted to determine the coefficient of thermal expansion (CTE) of a typical MDOT concrete paving mixture made with coarse aggregate from eight different sources.</td>
<td>This project developed improved specifications and procedures with respect to monitoring and maintaining plastic concrete temperatures to assure near and long-term concrete quality in the state of Illinois.</td>
</tr>
</tbody>
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<tr>
<th>Reduction of Minimum Required Weight of Cementitious Materials in WisDOT Concrete Mixes</th>
<th>Blended and Performance Cements</th>
<th>Development of Standardized Test Procedures for Evaluating Deicing</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Wisconsin DOT</em></td>
<td><em>FHWA Advanced Concrete Pavement Technology Program</em></td>
<td><em>Western Transportation Institute</em></td>
</tr>
<tr>
<td>This research explores the feasibility of lowering the cementitious materials content used in Wisconsin concrete pavement construction. The cementitious materials studied included portland cement, fly ash, and ground granulated blast furnace slag.</td>
<td>This research provides an overview of blended and performance cements for use in transportation infrastructure. An overall summary of the fresh and hardened properties of concrete made with blended and performance cements was investigated, along with a summary of current State practices.</td>
<td>This project aims to develop and/or identify a series of standard laboratory testing procedures and ranges that can be used to evaluate the performance of deicing chemicals, additives and mixtures used on roadways and other transportation facilities.</td>
</tr>
</tbody>
</table>
## Track 2 – Performance-Based Design Guide for New and Rehabilitated Concrete Pavements

<table>
<thead>
<tr>
<th>Topic</th>
<th>Description</th>
</tr>
</thead>
</table>
| Coefficient of Thermal Expansion in Concrete Pavement Design         | *FHWA Advanced Concrete Pavement Technology Program*  
This research describes the coefficient of thermal expansion (CTE) of concrete, its role in the behavior of concrete pavements, and recommendations for how to determine its value for concrete pavement design and analysis purposes. |
| Mechanistic-Empirical Design Concepts for Jointed Plain Concrete Pavements | *Illinois Center for Transportation*  
This research provided IDOT with an improved design process for JPCP based on new research findings over the past 15 years. Existing JPCP methods such as the Mechanistic Empirical Pavement Design Guide (MEPDG) were reviewed. |
| Evaluation of In-Situ Stiffness of Subgrade by Resilient and FWD Modulus | *Purdue University*  
In a recent project conducted by Purdue University for the Indiana DOT, the resilient modulus values of subgrade materials (as determined by laboratory testing methods) were compared to values calculated from falling weight deflectometer (FWD) testing. |
| Research of Current Practices in Pavement Performance Modeling        | *Pennsylvania DOT*  
This project investigated performance modeling activities and condition surveying used by other states and presents final recommendations for how PennDOT should proceed with modeling pavement performance |
| Best Design and Construction Practices for Concrete Pavement Transition Areas | *Texas Transportation Institute*  
This project conducted a survey of TxDOT and other state highway agency practices and identified the best practices toward incorporating them in guidelines for design and construction of transition areas. |
This research will enable WSDOT to make the best choice on the design and construction of concrete mixes for upcoming projects in the Puget Sound urban area. Implementation will be achieved through training and modified standard specifications or special provisions. |
**Track 3 – Intelligent Construction Systems and Quality Assurance for Concrete Pavements**

**Laboratory and Field Evaluation of Concrete Paving Curing Effectiveness**  
*Texas Transportation Institute*  
This research utilized several techniques to evaluate curing effectiveness from both a moisture retention and physical properties standpoint in order to develop a laboratory-based curing evaluation protocol that has application in the field.

**Evaluation of the Maturity Method for Flexural Strength Estimation in Concrete Pavement**  
*Partnered Pavement Research Center*  
The objective of the work presented in this report is to provide Caltrans with information regarding the accuracy and feasibility of the maturity method for the measurement of concrete flexural strength of pavement slabs.

**Construction and Traffic Analysis of I-15 Concrete Pavement Reconstruction Project**  
*California DOT*  
A construction productivity monitoring study was conducted to analyze productivity for the four construction activities; demolition, milling, Asphalt Concrete (AC) paving, and Portland cement concrete (PCC) paving.

**Evaluation, Refinement and On-Site Demonstration of Innovative Concrete Technologies**  
*FHWA*  
This research seeks to evaluate and refine innovative materials and construction techniques that will provide a durable long life pavement and develop strategies for deploying these technologies to state highway agencies on active field projects.
### Track 4 – Optimized Surface Characteristics for Safe, Quiet, and Smooth Concrete Pavements

| **Studded Tire Wear on Portland Cement Concrete Pavement in the Washington State Department of Transportation (WSDOT) Route Network** | **Field Performance of High Friction Surfaces**  
*Virginia Tech Transportation Institute*  
This research describes an evaluation of high friction surface (HFS) systems. The goal of this evaluation was to develop guidance for agencies when considering whether an HFS was an appropriate solution when addressing specific instances of low skid resistance and/or especially high friction demand. |
| --- | --- |
| *Washington State Transportation Center*  
This research used Washington State Pavement Management System (WSPMS) data to explore studded tire wear on Washington State Department of Transportation (WSDOT) roads. | **Control of Pavement Smoothness in Kansas**  
*Kansas DOT*  
This report highlights the development of the smoothness specification for Portland Cement Concrete Pavement (PCCP) beginning in 1985. The implementation of the smoothness specification resulted in a dramatic improvement in PCCP smoothness. |
| **Tire-Pavement Noise Results From California PCCP and HMA Pavements**  
*California DOT*  
This research seeks to evaluate tire-pavement noise characteristics of concrete pavements using the on-board sound intensity (OBSI) method. Continued data analysis will seek to answer questions about acoustic durability of different types of concrete pavements. |
Stringless Portland Cement Concrete Paving

**Cable Concrete Consultation**

This research provides an overview of stringless paving, a technology that eliminates the installation and maintenance of stringlines and has the potential to decrease the need for surveying and increase the smoothness of the pavement profile. The benefits that can result from stringless paving include increased production, decreased construction time, and reduced potential for errors.

Evaluation of Longitudinal Joint Tie Bar System

**Colorado DOT**

This study evaluated the longitudinal joint tie bar system currently used by CDOT, examining the criteria for proper use of tie bars and determining the maximum number of lanes that can be tied together without negatively impacting the concrete pavement structure. Tie bar design tables with recommended bar size and spacing were provided for each combination of pavement base types, CDOT concrete mixes, and weather stations.
Mitigating Transverse Joint Faulting in Jointed Concrete Pavement with Polyurethane Foam
Louisiana Transportation Research Center
A case study was conducted to assess the effectiveness of reducing transverse faulting on jointed concrete pavement with polyurethane foam (PF) on a principal arterial roadway. The entire project was measured for faulting and roughness by a high-speed profiler before and after the PF fault correction process, and as a result, noticeable improvements in ride quality and fault reduction were realized.

Report of Practical Findings: Improved Overlay Design Parameters for Concrete Airfield Pavements
Innovative Pavement Research Foundation
The Innovative Pavement Research Foundation (IPRF), in cooperation with the Federal Aviation Administration (FAA), initiated a series of projects, including two consecutive full-scale accelerated testing experiments, to improve understanding of the influence of various design parameters on unbonded concrete overlays of airfield pavements, providing a basis for future improvements of design procedures.
Analysis of Continuously Reinforced Concrete Pavement Behavior Using Information in the Rigid Pavement Database

*Texas DOT*

To keep track of the performance of PCC pavement in the state and develop information that will be required for the calibration of to-be-developed mechanistic CRCP design procedures, TxDOT initiated a research study based on its rigid pavement database. Microscopic behavior and distress types in continuously reinforced concrete pavement (CRCP), as well as crack width, were investigated in detail.

Characterization of Illinois Aggregates for Subgrade Replacement and Subbase

*Illinois Center for Transportation*

The overall objective of this project was to characterize strength, stiffness, and deformation behavior of three crushed and uncrushed aggregate materials commonly used in Illinois for subgrade replacement and subbase. The goal has been to develop aggregate thickness correlations with aggregate properties to modify and improve IDOT’s Subgrade Stability Manual based on both laboratory and field performance.
**Track 11 – Concrete Pavement Economics and Business Management**

**Life Cycle Cost Analysis of Dowel Bar Retrofit**  
*California DOT*  
This project presents the results of a Life Cycle Cost Analysis (LCCA) project comparing DBR with grinding and asphalt overlay. The performance assumptions were based on observed performance in the field and under heavy-vehicle simulator loading. Costs were collected from industry and Caltrans construction cost records and analysis was performed using Caltrans LCCA procedures based on use of the Federal Highway Administration’s (FHWA’s) software RealCost.

**Track 12 – Concrete Pavement Sustainability**

**Using Recycled Concrete in MDOT’s Transportation Infrastructure - Manual of Practice**  
*Michigan Tech University*  
This document is intended to help guide MDOT engineers in using crushed concrete aggregate (CCA) in the State's transportation infrastructure, with particular focus on pavement applications. Information is provided on the influence of processing and production of CCA on the physical, mechanical, and chemical characteristics of CCA, and on the use of CCA in base layers, asphalt paving layers, and concrete paving layers.