The spirit of collaboration

Guiding the National CP Road Map Program

Tom Cackler, Director
National Concrete Pavement Technology Center, Iowa State University

National CP Road Map Program
Executive Committee Web Meeting
September 19, 2011
Meeting Agenda

1. Update on Concrete Pavement Technology Training
2. Review of CP Road Map New Track Structure – Task Order #4
3. Future MAP Brief Topics – Task Order #5
4. States Highlighted in E-News
5. Review of the Research Database
6. Face to Face Meeting
2011 / 2012
TECHNICAL TRAINING OPPORTUNITY

One day training workshops or seminar,
10 topics to choose from!

Concrete Pavement Technology For NC² Member States

National Concrete Pavement Technology Center
2011/2012 Technical Training Opportunity In Concrete Pavement Technology for NC² Member States

Overview

Workshop Background

The TTCC pooled fund, TPF 5 (159), that supports the participation of its members in the National Concrete Consortium is offering technology transfer materials and technical training through the National Concrete Pavement Technology Center (CP Tech Center). Michigan Tech Transportation Institute (MTTI) has also offered to partner with the CP Tech Center on both the financing and delivery of the training program through their UTC program, University Transportation Center for Materials in Sustainable Transportation Infrastructure. The CP Tech Center has been authorized to contact member states to identify their interest in having a course(s) conducted in their state. The CP Tech Center is offering a limited curriculum of courses for 2011/2012 that are based on materials that the CP Tech Center has developed and are ready to use.

All handout materials, presenters, their travel and related support costs will be provided at no cost to the state. The CP Tech Center would request that each state furnish a facility for the training and provide any meals for the participants.

Training Opportunities

The curriculum that is available for 2011/2012 is for a one day training workshop or seminar on the following choices:

1. IMCP Manual, Integrated Materials and Construction Practices for Concrete Pavement: You may select specific subjects within the manual for emphasis if that is of interest.
2. Concrete Pavement Preservation Training
3. Design and Construction of Concrete Overlays
4. Roller Compacted Concrete
5. Concrete Pavement Surface Characteristics
6. Permeable Concrete Design and Construction
7. Concrete Paving Mixture (COMPASS Software explanation)
8. Bituminous Concrete Design and Construction
9. Concrete Paving Process (Quality Assurance Training)
10. Early Age Cracking
11. Cement Based Integrated Pavement Solutions

The CP Tech Center will arrange for subject matter experts to teach each course and provide all the training materials. The CP Tech Center asks that each ACPA State Chapter partner with their DOT representative to do the following:

1. Select the specific subject(s) for the training
2. Identify the desired date for the training
3. Arrange for the training venue
4. Arrange for meals and break materials (You may want to charge a nominal registration fee for this if desired.)
5. Identify the training audience (DOT, City, County, Industry, Consultants) and send out the invitations. Upon concurrence from each state the Center will provide a description of the training and a detailed technical agenda. Target approximately 30 to 40 as the desired minimum class size.

Who to Contact

If you have interest in holding a training event, please contact: Dale S. Harrington P.E.: 515-290-4014; dharrington@snyder-associates.com who will be coordinating the training delivery on behalf of the CP Tech Center and MISTI.

National Concrete Pavement Technology Center
## Training by CP Tech Center for 2011 / 2012

<table>
<thead>
<tr>
<th>States</th>
<th>State Chapters Workshop</th>
<th>CP Road Map Pool Fund Workshop</th>
<th>TTCC Pooled Fund States Workshop</th>
<th>No. of Workshops or Seminars Eligible Training</th>
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Update on Concrete Pavement Technology

• Interested States:
  → Colorado
  → Pennsylvania
  → Michigan
  → California
Meeting Agenda

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2. Review of CP Road Map New Track Structure – Task Order #4
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6. Face to Face Meeting
Refreshing the CP Road Map

Technical Advisory Committee

- Ahmad Ardani – FHWA, Turner Fairbanks, CP Road Map Technical Contact
- Brett Trautman – Missouri DOT and Chairman of NC2
- Tyson Rupnow – Louisiana DOT
- Tommy Nantung – Indiana DOT
- Roger Schmitt – Florida DOT and TRB representative
- Gordon Smith & John Cunningham – ICPA
- Jerry Voigt – ACPA
- Rob Rasmussen and Dave Merritt – The Transtec Group, Inc.
- Tom Cackler, CP Tech Center
- Dale Harrington – Snyder & Associates, Representing the CP Tech Center
## Review of CP Road Map New Track No. 1

<table>
<thead>
<tr>
<th>Original CP Road Map</th>
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<tr>
<td>Track 1. Performance-Based Concrete Pavement Mix Design System (MD)</td>
<td>Track 1. Materials and Mixes for Concrete Pavements</td>
</tr>
<tr>
<td>MD 1. PCC Mix Design System Development and Integration</td>
<td>1-1. Performance-Based Mix Design and Specifications</td>
</tr>
<tr>
<td>MD 2. PCC Mix Design Laboratory Testing and Equipment</td>
<td>1-2. Materials Selection and Testing</td>
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<td>MD 3. PCC Mix Design Modeling</td>
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<td>MD 4. PCC Mix Design Evaluation and Implementation</td>
<td>1-4. Materials Proportioning</td>
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<td>1-5. Mixture Evaluation</td>
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<td>1-6. Post-Construction Pavement Materials Evaluation</td>
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### Track 1 - Materials and Mixes for Concrete Pavements

- Now covers both concrete materials and mix designs, with an emphasis still placed on performance-based mixture designs.
- Incorporates much of the old CP Road Map Track 12 - Advanced Concrete Pavement Materials.
## Review of CP Road Map New Track No. 2

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<td>DG 4. Improved Mechanistic Design Procedures</td>
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Review of CP Road Map New Track No. 3

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<td>ND 1. Field Control</td>
<td>3-1. Quality Assurance</td>
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</table>

- Track 3 - Intelligent Construction Systems and Quality Assurance for Concrete Pavements
  - Track and Subtracks have been renamed to reflect current industry practice.
  - Emphasis has been placed on quality assurance, an umbrella term that has traditionally been associated with QA/QC.
## Review of CP Road Map New Track No. 4

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<td><strong>Track 4. Optimized Surface Characteristics for Safe, Quiet, and Smooth Concrete Pavements</strong></td>
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<td>SC 1. Concrete Pavement Texture and Friction</td>
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<td>SC 3. Tire-Pavement Noise</td>
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<td>SC 4. Other Concrete Pavement Surface Characteristics</td>
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<td>4-5. Integration of Concrete Pavement Surface Characteristics</td>
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<td>SC 6. Evaluation of Products for Concrete Pavement Surface Characteristics</td>
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<td>SC 7. Concrete Pavement Surface Characteristics Implementation</td>
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<td><strong>Track 5. Concrete Pavement Equipment Automation and Advancements</strong></td>
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<td>EA 1. Concrete Batching and Mixing Equipment</td>
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<td>EA 3. Concrete Pavement Curing, Texturing, and Jointing Equipment</td>
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<td>EA 5. Concrete Pavement Reconstruction Equipment</td>
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<td>EA 6. Concrete Pavement Restoration Equipment</td>
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## Review of CP Road Map New Track No. 6

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<td>**Track 6. Innovative Concrete Pavement Joint Design,</td>
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<td>Rehabilitation Innovations</td>
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<td>IJ 3. Innovative Joints Implementation</td>
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Review of CP Road Map New Track No. 7

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<td>Track 7. High-Speed Concrete Pavement Rehabilitation and Construction (RC)</td>
<td>Track 7. Concrete Pavement Maintenance and Preservation</td>
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<td>7-1. Optimization and Automation of Pavement Maintenance</td>
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<td>RC 1. Rehabilitation and Construction Planning and Simulation</td>
<td>7-2. Optimized Concrete Pavement Preservation</td>
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<td>RC 3. Fast-Track Concrete Pavements</td>
<td>7-3. Distress Identification and Preservation Treatment</td>
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- Track 7 - Concrete Pavement Maintenance and Preservation
  - New focus is on maintenance and preservation as these are key areas of research given the current economic climate.
  - Incorporates items from Table B - Concrete Pavement Maintenance and Rehabilitation from the original CP Road Map database.
Review of CP Road Map New Track No. 8

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<td>Track 8. Concrete Pavement Construction, Reconstruction, and Overlays</td>
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<td>8-4. Fast-Track Concrete Pavements</td>
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- Track 8 - Concrete Pavement Construction, Reconstruction, and Overlays
  - This is effectively Track 7 of the original CP Road Map, but now includes a subtrack devoted exclusively to concrete overlays.
  - This track relates to pavements that are beyond maintenance and preservation.
  - Although “high-speed” is no longer present in the title, this track still emphasizes rapid construction/reconstruction.
Review of CP Road Map New Track No. 9

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<td>9-4. Planning and Design of Accelerated Loading and Long-Term Data Collection</td>
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- Track 9 - Evaluation, Monitoring, and Strategies for Long Life Concrete Pavement
  - This track has effectively combined Tracks 8, 9, and 10 of the original CP Road Map.
  - The focus is still on long-life concrete pavements, but also incorporates methods for evaluating and monitoring pavement performance through accelerated loading and advanced data collection techniques.
### Track 10 - Concrete Pavement Foundations and Drainage

This is a new track that focuses on foundations and drainage issues previously outlined in Table A of the original CP Road Map database.

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<td><strong>Track 10. Concrete Pavement Foundations and Drainage</strong></td>
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<tr>
<td>PP 1. Technologies for Determining Concrete Pavement Performance</td>
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<td>PP 2. Guidelines and Protocols for Concrete Pavement Performance</td>
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Review of CP Road Map New Track No. 11

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<td>BE 5. Concrete Pavement Decisions with Environmental Impact</td>
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- **Track 11 - Concrete Pavement Economics and Business Management**
  - The only change was the elimination of the Subtrack “Concrete Pavement Decisions with Environmental Impact,” which is now covered within the updated Track 12 Sustainability.
Review of CP Road Map New Track No. 12

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<td>Table C: Environmental Concrete Pavement Advancements</td>
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<td>12-8. Concrete Pavement Decisions with Positive Environmental Impact</td>
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<td>12-9. Sustainable Concrete Pavement Technology Transfer and Implementation</td>
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• Track 12 - Concrete Pavement Sustainability
  o This is effectively Track 13 from the original track structure, which was not included in the original CP Road Map, but added later.
  o This track incorporated items from Table C - Environmental Concrete Pavement Advancements.
Meeting Agenda

1. Update on Concrete Pavement Technology Training
2. Review of CP Road Map New Track Structure – Task Order #4
3. Future MAP Brief Topics – Task Order #5
4. States Highlighted in E-News
5. Review of the Research Database
6. Face to Face Meeting


Introduction

The Concrete Pavement (CP) Road Map is a comprehensive and strategic plan for concrete pavement research that guides the investment of research dollars. It is a living plan with broad stakeholder involvement. For the last five years, it has tracked and facilitated technologies that have been helping the concrete pavement community meet the paving needs of today, and the as-yet unimagined paving challenges of tomorrow. In short, the CP Road Map is guiding the industry work towards a new generation of concrete pavements for the 21st century.

The project to develop the Long-Term Plan for Concrete Pavement Technology began in 2001 through an agreement between the Innovative Pavement Research Foundation and a team led by Iowa State University’s Center for Portland Cement Concrete Pavement Technology (PCC Center). They developed a database of existing research and gathered input, face-to-face, from the highway community. The team identified gaps in research that became the basis for problem statements, which are organized into a cohesive, strategic research plan.

CP Road Map Update

As the original CP Road Map has evolved, areas for improvement have been identified in order to help the concrete pavement industry meet the challenges of and achieve the industry’s full potential. Consequently, the CP Road Map has been updated to reflect progress made to date on various tracks, and the track structure was revised to serve as a better reflection on current practices. In addition, an emphasis has been placed on increasingly important areas of research such as sustainability and pavement preservation and maintenance. The updated CP Road Map has also incorporated items originally referenced only in database tables into the formal track structure.

In updating the original CP Road Map, maintaining the total number of tracks at 12 while introducing a variety of new subtracks and problem statements was a primary objective. It was also critical to maintain cohesion with problem statements that are cross-referenced between multiple tracks, and also reflect current industry practices and research completed to date, with irrelevant or outdated problem statements removed altogether. In addition, the “phasing” structure of the original CP Road Map has been omitted in order to remove the impression that certain research must occur before other research has been completed. The following table illustrates key differences between the original and updated CP Road Map.

<table>
<thead>
<tr>
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<tr>
<td>Track 1. Performance-Based Concrete Pavement Mix Design</td>
<td>Track 1. Materials and Mixes for Concrete Pavements</td>
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<td>System (MD)</td>
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<td>MD 1. PCC Mix Design System Development and Integration</td>
<td>1.1. Performance-Based Mix Design and Specifications</td>
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<td>MD 2. PCC Mix Design Laboratory Testing and Equipment</td>
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<td>MD 3. PCC Mix Design Modeling</td>
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<td>MD 4. PCC Mix Design Evaluation and Implementation</td>
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<td>1.5. Mixture Evaluation</td>
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<td>1.6. Post-Construction Pavement Materials Evaluation</td>
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Review of MAP Brief Subjects

- MAP Brief 7: Full-Depth Reclamation for Concrete Pavements (Track 7: Concrete Pavement Maintenance and Preservation)
- MAP Brief 1-4: Potential Materials Incompatibilities in Concrete Pavements (Track 1: Materials and Mixes for Concrete Pavements)
- MAP Brief 7-2: Partial-Depth Repair for Concrete Pavements (Track 7: Concrete Pavement Maintenance and Preservation)
- MAP Brief 6-1: Preventing Joint Deterioration in Concrete Pavements: A Summary of Current Knowledge (Track 6: Innovative Concrete Pavement Joint Design, Materials, and Construction)
- MAP Brief 1-3: Fly Ash as a Supplementary Cementitious Material in Concrete Mixtures (Track 1: Materials and Mixes for Concrete Pavements)
- MAP Brief 5-2: Intelligent Compaction for Concrete Pavement Bases and Subbases (Track 5: Concrete Pavement Equipment Automation and Advancements)
- MAP Brief 3-1: Smart Cure: An Integral Part of an Intelligent Construction System (Track 3: Intelligent Construction Systems and Quality Assurance for Concrete Pavements)
Review of MAP Brief Subjects (cont.)

- MAP Brief 1-2: Deleterious Chemical Effects of Deicing Solutions on Concrete Pavements (Track 1: Materials and Mixes for Concrete Pavements)
- MAP Brief 5-1: Stringless Concrete Paving (Track 5: Concrete Pavement Equipment Automation and Advancements)
- MAP Brief 8-1: Roller-Compacted Concrete Pavements (Track 8: Concrete Pavement Construction, Reconstruction, and Overlays)
- MAP Brief 13-1: Two-Lift Concrete Paving (Track 12: Concrete Pavement Sustainability)
- MAP Brief 1-1: Job-Specific Optimization of Paving Concrete with COMPASS (Concrete Mixture Performance Analysis System) (Track 1: Materials and Mixes for Concrete Pavements)
- MAP Brief 4-1: Diamond Grinding to Reduce Tire-Pavement Noise in Concrete Pavements (Track 4: Optimized Surface Characteristics for Safe, Quiet, and Smooth Concrete Pavements)
- MAP Brief 7-1: Use of Nonwoven Geotextiles as Interlayers in Concrete Pavement Systems (Track 7: Concrete Pavement Maintenance and Preservation)
Future MAP Brief Topics – TOPR No. 5

• MAP Brief Topics
  → Full Depth Reclamation (Done)
  → Introducing CP Road Map 2\textsuperscript{nd} Edition
  → Precast Pavement
  → Precast Pavements
  → Joint Performance
  → Concrete Pavement Joint Rehab with Thin Concrete Overlays

• Alternate Subjects
  → Selection of Subbases
  → Cross-Stitching of Longitudinal Cracks
  → Slab Stabilization
  → Full Depth Repairs
  → Pavement Milling
  → Pervious Pavements

• Other Suggestions
Meeting Agenda

1. Update on Concrete Pavement Technology Training
2. Review of CP Road Map New Track Structure – Task Order #4
3. Future MAP Brief Topics – Task Order #5
4. States Highlighted in E-News
5. Review of the Research Database
6. Face to Face Meeting
States Highlighted in E-News

1. California (July-August 2011)
2. New York (June 2011)
3. FHWA's Turner-Fairbank Highway Research Center (May 2011)
4. Texas (April 2011)
5. Iowa (March 2011)
6. Mississippi (February 2011)
7. Virginia (January 2011)
8. Washington (November 2010)
9. Pennsylvania (October 2010)
10. Minnesota (September 2010)
11. Wisconsin (July 2010)
12. Michigan (June 2010)
13. Indiana (May 2010)
Meeting Agenda

1. Update on Concrete Pavement Technology Training
2. Review of CP Road Map New Track Structure – Task Order #4
3. Future MAP Brief Topics – Task Order #5
4. States Highlighted in E-News
5. **Review of the Research Database**
6. Face to Face Meeting
The Long-Term Plan for Concrete Pavement Research and Technology (CP Road Map) is a holistic, strategic plan for concrete research and technology transfer and serves as a framework for stakeholders committed to innovation and implementation of new knowledge and approaches. It is more than just a listing of 250 project statements that outline research needs.

The mission of the CP Road Map is to bring together Federal, State, and industry partners to solve concrete pavement problems using pooled resources. The objective is to provide timely pavement solutions and accelerate the adoption of new, proven emerging technologies.

The goals of the CP Road Map are straightforward and direct:
- Prioritization
  - Identify research gaps
  - Address research gaps
- Leverage funds for research
- Implementation
  - Connect people and groups
  - Facilitate collaboration and coordination
  - Demonstrate funding
- Publications
  - Develop training documents
  - Disseminate concrete pavement research news

This document gives brief information on how the CP Road Map works; how it benefits Federal, State, and industry partners; what has been accomplished; and what activities are currently in progress.

How does the CP Road Map work?
Funded initially by FHWA, national concrete pavement stakeholders consisting of StateDOTs, FHWA, and industry collaborated in developing the CP Road Map. This strategic plan has provided significant benefits for agencies needing cost-effective, sustainable, adaptable, 21st century pavement solutions.

The CP Road Map is a living research and technology document that needs administrative people to keep it moving forward. These people make up the operations support group.

The CP Road Map’s operations support group is implementing a system to help agencies and industry partners meet their research goals efficiently. It tracks national concrete pavement research and helps Federal, State, industry, and academic partners work together to leverage resources and avoid costly duplication of research activities.

Pooled Fund TPF-5(185) — with sponsorship from FHWA and the States of New York, Virginia, Iowa, Michigan, Mississippi, and Pennsylvania — currently provides funding for the operations support group. These partners are committed to the vision and opportunities afforded by the CP Road Map and are seeking additional States to join the partnership. Increasing the number of States participating in the Pooled Fund could decrease the amount of money each State needs to contribute.

Current participants in TPF-5(185) include FHWA and the States of New York, Virginia, Iowa, Michigan, Mississippi, and Pennsylvania.

How does the CP Road Map benefit State DOTs?
Why should you dedicate some of your limited funds to financing the operational work needed to manage the CP Road Map?

Here’s how the CP Road Map could work for you: As a manager at a State DOT, you have a concrete pavement-related issue that needs to be researched. Before you begin, you need answers to questions like, What’s been done on this topic recently? Is there research on this topic going on now, in another State, TRB committee, or at AASHTO? Is the research a good idea and can the objective be met? Does other research need to precede it? Is anyone else interested in this topic who might want to collaborate or leverage funds? Who are the researchers best able to answer the need?

"The CP Road Map is a good avenue for information and a sounding board when information outside of the realm of each individual DOT’s jurisdiction is needed in efforts to optimize the value of research." — John Stanton, Michigan DOT
This document will help answer these questions. It provides an overview of the CP Road Map program, examples of priority research (organized by research track), and a detailed database of research (in the appendix).

You can also review the CP Road Map website (www.cproadmap.org) or consult directly with a track research coordinator (contact information on the website). The main thing is, you don’t have to start from scratch.

**Benefit now from training and technology transfer.** The operations support group is helping agencies implement technical advances and innovations that will improve their concrete pavements today. The group is identifying key technology transfer needs, then identifying unique training resources across the country on topics like the state-of-the-art of concrete pavement overlays, concrete mixture quality control, pavement surface texturing to reduce tire-pavement noise, and concrete pavement maintenance practices. The current Pooled Fund States would like to expand the emphasis on education and technology transfer in the future.

**Leverage your research dollars.** A major element of the CP Road Map is identifying intersecting needs, then helping organizations collaborate even when they have different institutional approaches to funding, scheduling, contracting, etc.

**Influence the direction of concrete pavement research.** States and industry who contribute to the Pooled Fund also have the opportunity to participate in committee meetings and influence the priority direction of national concrete pavement research and technology transfer. The operations support group helps TRB committees, AASHTO committees, State DOTs, and industry funders of research and technology transfer find opportunities to address CP Road Map priorities.

**Participate in the development of new training opportunities.** Participation in the Pooled Fund provides participants with the opportunity to influence the Road Map’s direction in terms of the training opportunities that result from national concrete pavement research. Beginning in 2011, the CP Road Map will begin to develop and implement national training programs on topics identified by the Pooled Fund participants.

**What has the CP Road Map produced?**
The CP Road Map tracks national research activities on a monthly basis. Focusing on one State each month, the operations support group contacts DOT, industry, and university representatives from that State to gather information about recently completed, ongoing, and upcoming research. Based on these visits, the operations support group develops and distributes the following products:

- CP Road Map E-News
- Moving Advancements into Practice (MAP) Briefs
- National Concrete Pavement Research Database

**CP Road Map E-News**
This monthly electronic newsletter provides updates on concrete pavement research around the country and the world. Each issue contains links to four to six research projects, training opportunities, or new tech transfer pieces of interest to the concrete pavement community. One State is also featured in the “Updates from the States” section of the E-News each month. These updates provide an in-depth look at each State’s concrete pavement research program.

View the CP Road Map E-News at www.cproadmap.org/publications/e-news.cfm

**Accomplishments**

- 12 E-News issues published, each with links to a minimum of four research efforts of interest
- 12 State highlights
  - Indiana
  - Michigan
  - Wisconsin
  - Minnesota
  - Pennsylvania
  - Washington
  - Virginia
  - Mississippi
  - Iowa
  - Texas
  - New York
  - FHWA Turner-Fairbank Highway Research Center

**Topics covered in each issue**

- August 2010 Special Issue: Updates from the International Technology Scanning Tour on Long-Life Concrete Pavements
  - Two lift concrete paving
  - Concrete pavement design catalogues
  - High-quality concrete pavement foundations
  - Improved concrete mixture designs
  - Geotextile interlayers for cement-bound layers
  - Exposed aggregate concrete pavement surfacing
- September 2010
  - Indiana evaluates in situ subgrade stiffness
  - Wisconsin DOT evaluates dowel bar retrofit performance
  - Iowa investigates improved concrete overlay construction
  - Ontario quantifies highway pavement sustainability
  - Ready Mixed Concrete Foundation investigates effect of pavement type on fuel consumption and emissions
  - Update from Minnesota
- October 2010
  - CPTP publishes tech brief on performance of sealed and unsealed concrete joints
  - Iowa investigates F-T durability of low-permeability concrete
  - Louisiana evaluates titanium dioxide photocatalyst coating
  - Quebec documents continuously reinforced concrete with glass fiber reinforced polymer bars
  - Update from Pennsylvania
November 2010
- Wisconsin investigates test procedures for deicing chemicals
- FHWA conducts interlaboratory study on measuring the coefficient of thermal expansion of concrete
- Wisconsin research evaluates open-graded base course with dowelled and non-dowelled transverse joints
- Malaysia research investigates roller-compacted concrete
- Toronto evaluates permeable pavements in cold climates
- Update from Washington

Moving Advancements into Practice (MAP) Briefs

These four-page technical briefs highlight new technologies that can be used now to improve concrete paving practices. As of June 2011, MAP Briefs have been developed on twelve concrete paving-related topics, with a thirteenth MAP brief currently in progress. The following is a list of the MAP brief topics.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Track Assignment</th>
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<tbody>
<tr>
<td>Avoiding incompatibilities in concrete mix (June 2011, in progress)</td>
<td>Track 1: Mix design</td>
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<tr>
<td>Partial-depth repair</td>
<td>Track 7: High-speed rehabilitation and construction</td>
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<tr>
<td>Preventing joint deterioration</td>
<td>Track 6: Joint innovation</td>
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<td>Fly ash as an SCM</td>
<td>Track 5: Equipment advancements</td>
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<td>Intelligent compaction for concrete pavements</td>
<td>Track 3: Intelligent construction</td>
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<td>Track 2: Innovation</td>
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<td>Effects of chemical devisors on concrete pavements</td>
<td>Track 1: Mix design</td>
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<tr>
<td>Strengthened concrete paving</td>
<td>Track 6: Equipment advancements</td>
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<td>Roller-compacted concrete</td>
<td>Track 8: Long-life pavements</td>
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<tr>
<td>Two-lift concrete paving</td>
<td>Track 13: Sustainability</td>
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<tr>
<td>COMPRASS mix design tool</td>
<td>Track 1: Mix design</td>
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<tr>
<td>Diamond grinding</td>
<td>Track 4: Surface characterics</td>
</tr>
<tr>
<td>Nonwoven geotextile interlayers</td>
<td>Track 7: High-speed rehabilitation and construction</td>
</tr>
</tbody>
</table>

Examples of two MAP briefs

View the MAP briefs online at www.cproadmap.org/publications/index.cfm#MAP.
Examples of CP Road Map research

The following section contains brief information about recent and ongoing research that impact the concrete paving industry. Research is categorized by CP Road Map track.

Track 1: Performance-Based Concrete Pavement Mix Design

The following research projects are categorized under Track 1.
- TPF-5(205) Implementation of Concrete Pavement Mixture Design and Analysis (MDA) Track of Concrete Pavement Road Map (ongoing)
- TPF-5(179) Evaluation of Test Methods for Permeability (Transport) and Development of Performance Guidelines for Durability (ongoing)
- FHWA Computer-Based Guidelines for Job-Specific Optimization of Paving Concrete (COMPASS) (complete)

TPF-5(205) Implementation of Concrete Pavement Mixture Design and Analysis (MDA) Track of Concrete Pavement Road Map

Partners: IA (lead State), KS, MI, MO, NY, OK, TX, WI

Progress (per latest quarterly report):
- Ongoing work:
  - Investigations into the development of alternate methods for calculating mix proportions
  - Investigations of on-site analysis tools
  - Assessing requirements for the air void system
  - Preparation of Guide Specification
- Completed work
  - Investigation of acoustical methods to determine set time

FHWA Computer-Based Guidelines for Job-Specific Optimization of Paving Concrete (COMPASS)

- Deliverables: final report and software program
- Provides guidance for:
  - Choosing materials
  - Optimizing gradations
  - Proportioning mix designs
  - Optimizing mix designs for job-specific needs

TPF-5(178) Evaluation of Test Methods for Permeability (Transport) and Development of Performance Guidelines for Durability

- Objective: develop a test procedure that directly evaluates the permeability (transport properties) of concrete and relates these to anticipated performance with the use of exposure conditions.
- Research team: Tommy Nantung (Indiana DOT), Kartik Obha (National Ready-Mixed Concrete Association), Jan Olek and Jason Weiss (Purdue University)
Track 3: High-Speed Nondestructive Testing and Intelligent Construction Systems

The following research projects are categorized under Track 3.
- SHRP 2 R06(E) Real-Time Smoothness Measurements on Portland Cement Concrete Pavements During Construction (ongoing)
- FHWA SmartCure Practical Enhancements for Field Application (ongoing)

FHWA SmartCure Practical Enhancements for Field Application

The SmartCure System uses measuring devices and computer software to provide continuous, real-time, and site-specific recommendations for concrete pavement curing.

Schematic of SmartCure system devices in the field

Screen shot of SmartCure readings of ambient conditions

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

The following research projects are categorized under Track 4.
- TPF-5(063) Improving the Quality of Pavement Profiler Measurement (ongoing)
- NCHRP 01-43 Guide for Pavement Friction (complete)

Measuring Noise Using On-Board Sound Intensity (OBSI) — Track 4

OBSI Testing

CP Tech Center OBSI Noise Catalog

Diamond Grinding
98 dBA, 98 dBA

101 dBA, 104 dBA
Monitor Real-Time Surface Texture and Relate to Noise
(Track 4)

Surface Characteristics Publications

How to Reduce Tire-Pavement Noise: Best Practices for Constructing and Texturing Concrete Pavement Surfaces

Guide Specifications for Texture and Noise (Diamond Grinding, Turf Drag, Longitudinal Tining, and Transverse Tining)

Guide for Selecting the Right Texture for the Right Situation

Surface Characteristics Publications (cont.)

Technical Briefs
- Diamond Grinding to Reduce Tire-Pavement Noise in Concrete Pavements
- What Makes a Quieter Concrete Pavement?
- The Language of Noise and Quieter Pavements
- Measuring and Analyzing Pavement Texture
- Tire-Pavement Noise Test Protocols
- Variability of Pavements and Noise
- Advanced Pavement Texture and Noise Specifications

Track 5: Concrete Pavement Equipment Automation and Advancements

The following research projects are categorized under Track 5.
- Iowa State University 2009 research and publication of Stringless Portland Cement Concrete Paving (complete)
- Final Report on National Open House Two-Lift Concrete Paving for Interstate 70 in Kansas (complete)

Stringless Portland Cement Concrete Paving

Stringless paving technology

Measuring “attitude”
Track 6: Innovative Concrete Pavement Joint Design, Materials, and Construction

The following research projects are categorized under Track 6.

Innovative Concrete Pavement Joint Design, Materials, and Construction Pooled Fund

Objectives:
- Identify the failure mechanisms occurring in the joints of concrete pavements in various northern States.
- Develop strategies to prevent the deterioration of new pavements in the future.

Track 7: High-Speed Concrete Pavement Rehabilitation and Construction

The following research projects are categorized under Track 7.
- National CP Tech Center / FHWA Concrete Overlays Field Application Program (ongoing)
- TPF-5(165) Development of Design Guide for Thin and Ultrathin Concrete Overlays of Existing Asphalt Pavements (ongoing)
- Illinois Center for Transportation research and publication of Design and Concrete Requirements for Ultrathin White-topping (complete)

Concrete Overlay Research Program

Overlay Field Application Program

As part of this project, an expert team makes project field visits to assist State DOTs with design and construction of concrete overlays.

Joint Deterioration: Types
1. Air void/water
2. Mechanical

Top left and right: Joint deterioration related to the air void system or water (freeze-thaw related). Shadowing (top right) indicates water saturation.

Bottom left: Joint deterioration possibly related to mechanical failure.

TPF-5(165) Improving Concrete Overlay Construction

Track 11: Concrete Pavement Business Systems and Economics

The following research projects are categorized under Track 11.

- NCHRP 10-75 Guide for Pavements-Type Selection (ongoing)
- TPF-5(159) Technology Transfer Concrete Consortium (ongoing)

Transportation Curriculum Coordination Council (TTCC)

The TTCC is a Federal/State/industry partnership that supports the training of highway construction personnel.

The goals of the TTCC are:

- Develop and maintain a national curriculum for various transportation disciplines
- Identify training and certification requirements
- Coordinate/facilitate training efforts

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<td>FHWA-NHI-131126I</td>
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</table>

Track 13: Concrete Pavement Sustainability

The following research projects are categorized under Track 13.

- TPF-5(129) Recycled Unbound Pavement Materials (MultiROAD Study) (ongoing)
- CP Tech Center Briefing Document (complete) and Manual of Practice (ongoing) on Building Sustainable Pavements with Concrete

Concrete Pavement Sustainability

- Must include concrete pavement design, materials construction, use, maintenance, renewal, and recycling
- Must reduce costs, improve the environmental footprint, and increase benefits to society over the life cycle

Objective:

To identify and conduct research and transfer technology that enhances concrete pavement sustainability through the pavement’s life cycle

Sustainability: Cradle-to-Cradle Life Cycle

“Since its inception in 2005, the CP Road Map has had a significant impact by facilitating and setting direction for concrete pavement research. It has been invaluable to FHWA as a source of input to our internal program planning. Now that research products have begun to emerge, the focus of the CP Roadmap support effort has shifted toward technology transfer with plans for training courses and webinars on proven, ready to use new technologies.” — Michael Trentacoste, FHWA
Research Database

**Track 1: Materials and Mixes for Concrete Pavements**

- TPF-5(205) Implementation of Concrete Pavement Mixture Design and Analysis (MDA) Track of Concrete Pavement Road Map (ongoing)
  - Project Lead: Mark Dunn, Iowa DOT
  - Objective: develop tools to help specify and achieve significant improvements in the quality and uniformity of concrete mixtures.

- TPF-5(179) Evaluation of Test Methods for Permeability (Transport) and Development of Performance Guidelines for Durability (ongoing)
  - Project Lead: Tommy Nantung, Indiana DOT
  - Objective: develop a test procedure that directly evaluates the permeability (transport properties) of concrete and relates these to anticipated performance with the use of exposure conditions.
Track 1: Materials and Mixes for Concrete Pavements

• FHWA Computer-Based Guidelines for Job-Specific Optimization of Paving Concrete (COMPASS) (complete)
  → Project Lead: Fred Faridizar, FHWA
  → Objective: software developed that provides guidance for choosing materials, optimizing gradations, proportioning mix designs, and optimizing mix designs for job-specific needs.

• Develop/Improve American Association of State Highway and Transportation Officials Concrete Coefficient of Thermal Expansion Test (ongoing)
  → Project Lead: Richard Meininger, TFHRC
  → Objective: TFHRC has been working on the refinement of the current test method (AASHTO T 336) and carrying out a ruggedness test in conjunction with other laboratories.
Track 1: Materials and Mixes for Concrete Pavements - FHWA

- Pavement Mix, Lab of the Future; Development of Concrete Pavement Road Map Track 1 Lab Protocols
- Develop/Improve American Association of State Highway and Transportation Officials Concrete Coefficient of Thermal Expansion (CTE) Test
- Greatly Increased Use of Fly Ash in Hydraulic Cement concrete for Pavement Layers and Transportation Structures
- Extending the Season for Concrete Construction and Repair, Phase III
- Turner-Fairbank Highway Research Center Staff Alkali Silica Reaction (ASR) Research into Rapid Tests and Gel Identification
- Increased Use of Fly Ash and Other Recycled Materials in Concrete Pavement Mixtures
- Fundamental Materials Characterization Using X-Ray Computed Tomography
- Ultra-High Performance Concrete Program (UHPC)
- High-Performance Stress-Relaxing Cementitious Composites for Crack Free Pavements and Transportation Structures
Track 2: Performance-Based Design Guide for New and Rehabilitated Concrete Pavements

- Guidance for Design of Concrete Overlays Using Existing Methodologies (ongoing)
  - Project Lead: Dale Harrington, CP Tech Center
  - Objective: development of a guide (available later this year) that provides straightforward and simple guidance for concrete overlay design, with an overview of various design methods.

- TPF-5(165) Development of Design Guide for Thin and Ultrathin Concrete Overlays of Existing Asphalt Pavements (ongoing)
  - Project Lead: Tom Burnham, MnDOT
  - Objective: creation a unified national design guide for thin and ultrathin concrete overlays of existing asphalt pavements. A user-friendly design guide software program and user’s manual will also be developed under this study.
Track 2: Performance-Based Design Guide for New and Rehabilitated Concrete Pavements - FHWA

- Pavement Shear Strain Response to Dual and Wide Base Tires
- Integrated Software to Optimize Design, Construction, Evaluation and Performance of Concrete Pavements
- A Fresh Look Towards Revamping Falling Weight Deflectometer Testing and Analysis to meet Mechanistic-Empirical Design and Analysis
- Relationships Between Laboratory Measured and Field Derived Properties of Pavement Layer
- Implementing Mechanistic Empirical Pavement Design and Darwin-ME
Track 3: Intelligent Construction Systems and Quality Assurance for Concrete Pavements - FHWA

- Computer-based Guidelines for Curing Concrete
- Upgrade HIPERPAV III
- Use of Radio Frequency Identification Tags in Pavements
- Improved Methods For Determination of Pavement Remaining Life
- Improved Reliability Modeling And Analysis for Primary Pavement Distress Models of Mechanistic-Empirical Design Guide
Track 4: Optimized Surface Characteristics for Safe, Quiet, and Smooth Concrete Pavements – FHWA

• Relating Ride Quality And Structural Adequacy For Pavements
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 (ongoing)

→ Project Lead: Peter Taylor, CP Tech Center & Purdue University

→ Objectives

• Determine the causes of anomalous concrete joint deterioration nationwide.
• Quantify any contributions to joint deterioration due to deicing chemicals and develop estimates of service reduction and life cycle costs.
• Develop recommendations based on research results for minimizing future joint deterioration on both existing pavements and new construction including possible repair methodologies and specification modifications.
Track 7: Concrete Pavement Maintenance and Preservation – FHWA

• Support for the Continued Development Of Constructability Analysis for Pavement Rehabilitation Strategies
Track 8: Concrete Pavement Construction, Reconstruction, and Overlays

• Concrete Pavement Joint Rehabilitation with Thin Concrete Overlays

  → Project Lead: Dale Harrington, CP Tech Center

  → Objective: to address potential applicability of thin concrete overlays as a longer term solution for pavement suffering from Joint Deterioration. Phase 2 is a brainstorming session with committee on many unanswered subjects and to construct three pilot projects to learn solutions.

• Illinois Center for Transportation research and publication of Design and Concrete Requirements for Ultrathin Whitetopping (complete)
Track 9: Evaluation, Monitoring, and Strategies for Long Life Concrete Pavement – FHWA

- Optimization of Data Collection for Pavement Management
- Long-Term Pavement Performance Traffic Data Collection Activities
- Creating Smart Pavements that Monitor and Report on Pavement Condition
Track 11: Concrete Pavement Economics and Business Management

- NCHRP 10-75 Guide for Pavement-Type Selection (complete)
  - Project Lead: John P. Hallin, Applied Research Associates
  - Objective: develop a guide for Pavement-Type Selection that includes processes for consideration in making decisions regarding pavement-type selection, as well as agency-based and contractor-based processes.

- TPF-5(159) Technology Transfer Concrete Consortium (ongoing)
  - Project Lead: Mark Dunn, Iowa DOT
  - Objective: identify, support, facilitate, and fund concrete research and technology transfer initiatives. A Transportation Curriculum Coordination Council (TCCC) has been established to develop and maintain a national curriculum for various transportation disciplines, identify training and certification requirements, and coordinate/facilitate training efforts.
Track 11: Concrete Pavement Business Systems and Economics – FHWA

- Standardized Methods Life-Cycle Cost Analysis
- Addressing Needed Research to Implement Jointed Plain Concrete Pavements Performance-Related Specifications
- Nanoscale Sensors for Structural Health
- Nanoscale Approaches for Inhibiting Corrosion: Multifunctional Nanomaterials and Processes for Infrastructure Repair and Corrosion Inhibition
- CP Road Map Operations Support
Track 12: Concrete Pavement Sustainability

• TPF-5(129) Recycled Unbound Pavement Materials (MnROAD Study) (ongoing)
  → Project Lead: John Siekmeier, MnDOT
  → Objective: monitor the performance of several test cells at the MnROAD constructed using recycled materials in the granular base layers to determine their effects on pavement performance.

• Development of Sustainable Concrete Pavements: Manual of Practice (ongoing)
  → Project Lead: Peter Taylor, CP Tech Center
  → Objectives: develop a manual of practice that will educate practicing engineers about sustainability as it is applied to concrete pavements. The manual is part of an implementation package designed to identify and conduct research and transfer technology that enhances concrete pavement sustainability through the pavement’s life cycle.
Track 12: Concrete Pavement Sustainability - FHWA

• Fly Ash Workshop at Turner-Fairbank Highway Research Center

• Develop and Deploy a Frame Work for the Proper Use and Proportioning of SCMs Into Concrete Mixtures for Pavement and Structures

• FHWA Sustainable Pavements Program
Future Meeting Schedule

• Electronic Meetings
  →Proposed: January 10, 2012 at 10:00 am CST

• Physical Meeting
  →Proposed: April 3, 2012 in Chicago