CP Tech Center Technology Deployment

NATIONAL CONCRETE CONSORTIUM

April 22-24, 2014
Jacksonville, FL 32207

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Technology Deployment

- **Technical Documents**
  - What will be available
  - What is planned in the future
- **Training & Technical Assistance**
  - States who where provided assistance in last 12 months
  - Programs scheduled for the future

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Long-Term Plan for Concrete Pavement Research and Technology—The Concrete Pavement Road Map (Second Generation): Volume I, Background and Summary

PUBLICATION NO. FHWA-HRT-11-065

MARCH 2012

U.S. Department of Transportation
Federal Highway Administration

Research, Development, and Technology
Turner-Fairbank Highway Research Center
6300 Georgetown Pike
McLean, VA 22101-2296

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CP Road Map Interactions

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

- **Accomplished by -**
  - Contact with Federal/State research agencies:
    - » FHWA
    - » DOT
    - » Universities
    - » Industry
  - Construction of database

- **Encourages Research/Technology Transfer by-**
  - – Help guide concrete pavement research investments identified as important for accomplishing customer-driven goals
  - – Does not regulate research

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Summary of Research Achievement Through the Concrete Pavement Road Map

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shaping the future of **concrete pavement**

it's your move!

Transportation Research Board

January 12, 2014

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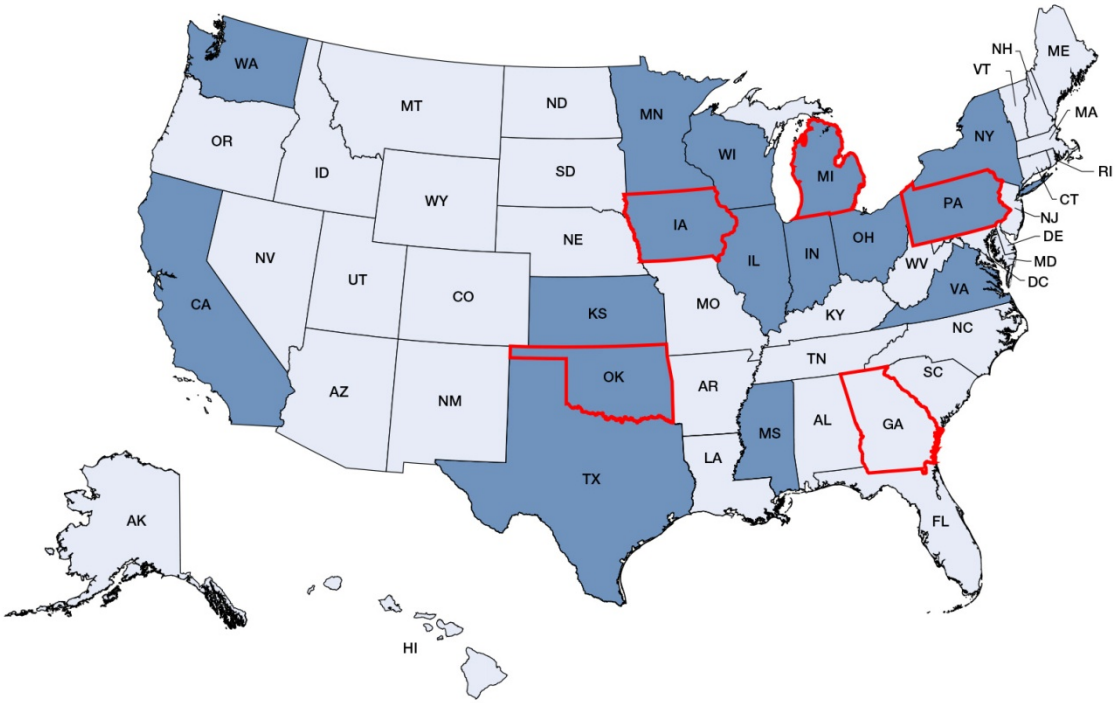
CP Road Map Highlighted States Interactions

E-New Research States

- California
- FHWA's TFHRC
- Illinois
- Indiana
- Iowa
- Kansas
- Michigan
- Minnesota
- Mississippi
- New York
- Ohio
- Oklahoma
- Pennsylvania
- Texas
- Virginia
- Washington
- Wisconsin



TPF-5(286) Pool Fund Members

- FHWA
- Georgia
- Iowa
- Michigan
- Oklahoma
- Pennsylvania

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Next Generation Concrete Pavement Road Map Pooled Fund

1. One workshop on the subject of state choosing will be held for each of the participating TPF states.

2. Develop model specifications to assist the state's in implementing new technologies.

3. New user friendly database format will be developed. Database will identify ongoing research and research gaps in the subjects
   - Concrete overlays;
   - Performance Engineered Mixtures; and
   - Preservation techniques

4. E-News and Map Brief

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2014/2015 Technical Training In Concrete Pavement Technology for NC^2 Pool Fund Member States

Training Opportunities

The curriculum for the training is for a one day training workshop on the following choices, or a mixture of topics for one training event:

- IMCP Manual, Integrated Materials and Construction Practices for Concrete Pavement
- Concrete Pavement Preservation Training
- Design and Construction of Concrete Overlays
- Roller Compacted Concrete (RCC)
- Concrete Pavement Surface Characteristics
- Pervious Concrete Design and Construction
- Concrete Paving Mixture (COMPASS Software explanation)
- Quality in Concrete Paving Process (Quality Assurance Training)
- Early Age Cracking
- Cement Based Integrated Pavement Solutions (IPS)

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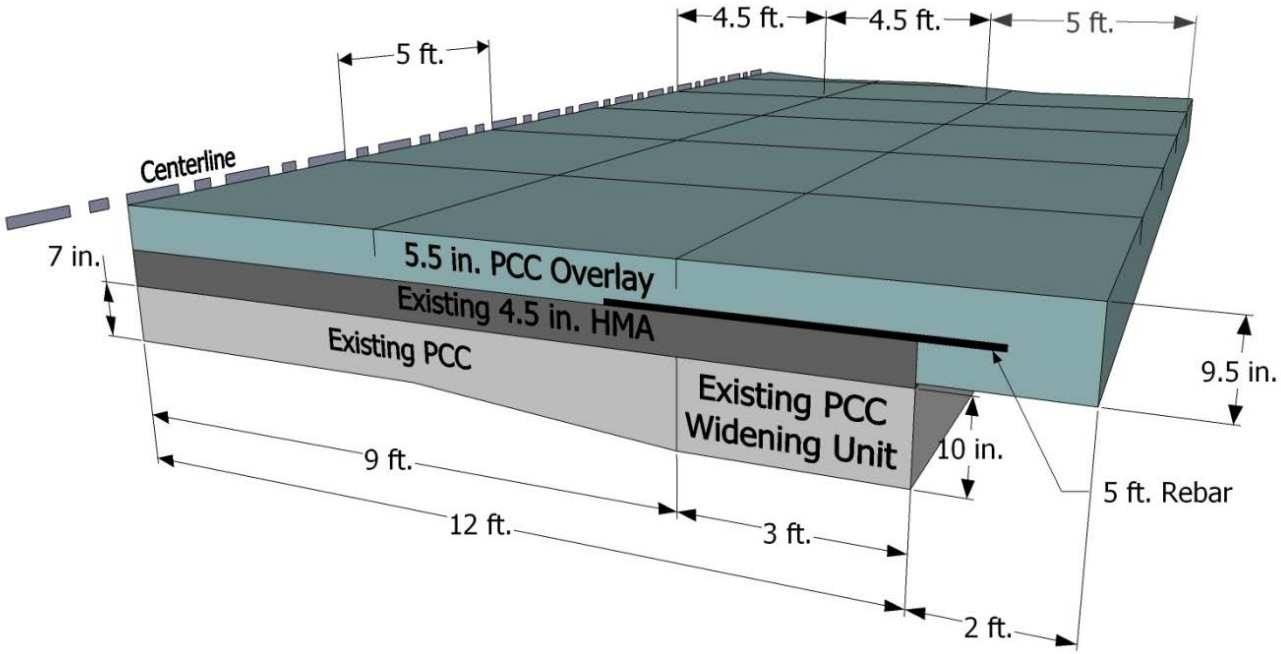
- Specifications for PCC Overlays
  - Develop a draft specification
  - Easily modified for use with local PCC specs
  - Encourage use of PCC overlays by more state and local governments



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CP Road Map/CP Tech Center Data Base

- Research Database
  - List of recently completed research
  - Categorized by Track #
  - Includes:
    - State
    - Title
    - Project description
    - Link to report

Research Database

State	Title	Description	Keywords	Contact	Sponsors	Researchers; Report Authors	University(s) or other Agency involved with this project	Start Date	End Date	Links
MI	Pavement Subgrade MR Design Values for Michigan's Seasonal Changes	The resilient modulus (MR) of roadbed soil and the modulus of subgrade reaction (k) play a major role in the design of asphalt and rigid pavement systems. Currently, the various Regions of the Michigan Department of Transportation (MDOT) use different empirical procedures to determine the MR and k values of the roadbed soils. Consistent, uniform, economical and implementable procedures for determining MR and k values of the roadbed soils that meet the requirements of the three design levels of the M-E PDG were developed in this study and presented in this report.	Roadbed soils, resilient modulus, gradation, soil classification, cyclic load tests, deflection tests, backcalculation of layer moduli, pavement design	Dave Weber	Michigan DOT	Gilbert Baladi, Tyler Dawson, Colin Sessions	Michigan State University		Jul-09	http://www.michigan.gov/mdot/0%2C1607%2C7-151-9622_11045_24249-221730--%2C00.html
MI	Durability Study of the US-23 Aggregate Test Road and Recent JPCP Projects with Premature Joint Deterioration	Materials related distress (MRD) characterized by "starburst" type corner spalling at the longitudinal centerline joint, and occasional transverse joint spalling have developed at a rapid rate in a number of JPCP projects constructed since 1999. The main objective for this project was to isolate the major cause(s) for suspected freeze-thaw deterioration, and to provide recommendations for improved materials specifications in order to ensure long-term freeze-thaw resistance to severe surface exposure conditions (i.e. surface contact with either water or 3% NaCl) during repeated freezing and thawing.	Air-void analysis; concrete pavements, deicer scaling, joint associated deterioration; field performance; freeze-thaw durability	John Staton	Michigan DOT	Will Hansen, Youngjae Kang	The University of Michigan		Dec-10	http://www.michigan.gov/documents/mdot/MDOT_Research_Report_RC1534_342655_7.pdf
MI	Assessment of Pavement Acceptance Criteria and Quantifying its As- Constructed Material and Structural Properties	State Highway Agencies (SHAs) have long realized the importance of quality assurance (QA) to ensure longer pavement service life. Construction QA programs are intended to ensure that the quality of the materials and construction in highway projects is satisfactory. The intent of this research project is to assess existing pavement acceptance criteria, conduct a feasibility study to consider the need of using new criteria that relate to pavement performance including the use of non-destructive testing, and develop a process to quantify as-constructed material and structural pavement properties and relate them to pavement service life.	Quality assurance, acceptance criteria, as-constructed material and structural properties, MEPDG, risk analysis, end-result specifications, feedback to design.	Dave Smiley Robert Pena	Michigan DOT	Karim Chatti, Ph.D. Anshu Manik, Ph.D Imen Zaabar, Ph.D.	Michigan State University		Mar-11	http://www.michigan.gov/mdot/0%2C1607%2C7-151-9622_11045_24249-257443--%2C00.html
MI	Using Recycled Concrete in MDOT's Transportation Infrastructure – Manual of Practice	The Michigan Department of Transportation (MDOT) has used CCA since the 1980s; however, issues in the performance of some of the early projects currently limit its use to primarily bound and unbound drainable bases beneath concrete pavements. Although there are potentially some limitations associated with the us of CCA, the effective characterization of these materials during their production and throughout the design and construction process can help lead to their successful use and application. This document is intended to help guide MOOT engineers in using CCA in the State's transportation infrastructure, with particular focus on pavement applications. Information is provided by chapter on the processing and	crushed concrete aggregate (CCA), recycled concrete aggregate	John Staton	Michigan DOT	Tom Van Dam Kurt Smith Carrie Truschke Stan Vitton	Michigan Tech University		Aug-11	http://www.michigan.gov/documents/mdot/MDOT_Research_Report_RC1544_368544_7.pdf

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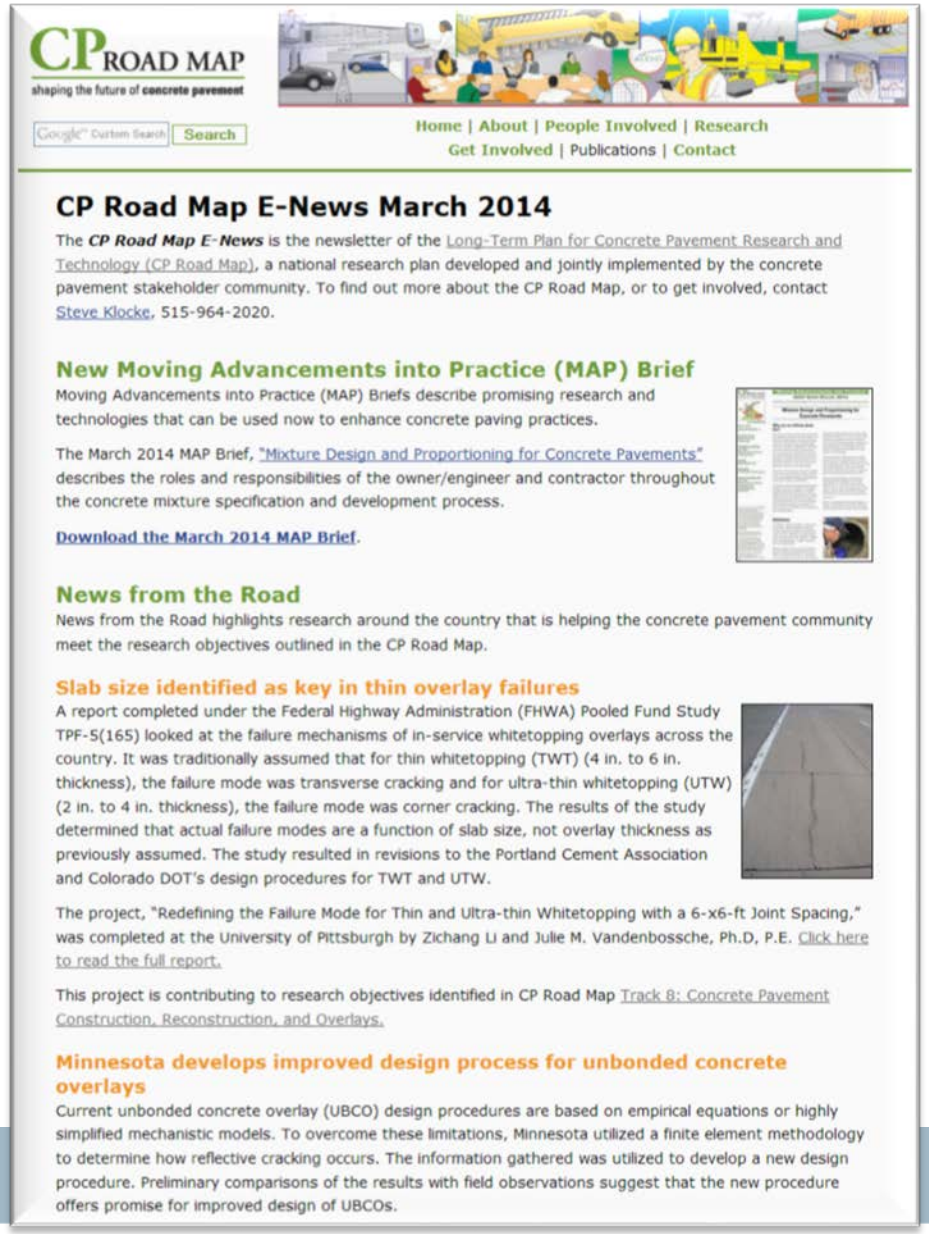
CP Road Map

E-News

- Bi-monthly newsletter highlighting research in the PCC paving industry
- Began in 2010
- Each newsletter includes:
  - Update from the States
  - News from the Road
  - MAP Brief



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CP Road Map E-News March 2014

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 Steve Klocke, 515-964-2020.

New Moving Advancements into Practice (MAP) Brief

Moving Advancements into Practice (MAP) Briefs describe promising research and technologies that can be used now to enhance concrete paving practices.

The March 2014 MAP Brief, "Mixture Design and Proportioning for Concrete Pavements" describes the roles and responsibilities of the owner/engineer and contractor throughout the concrete mixture specification and development process.

Download the March 2014 MAP Brief.

News from the Road

News from the Road highlights research around the country that is helping the concrete pavement community meet the research objectives outlined in the CP Road Map.

Slab size identified as key in thin overlay failures

A report completed under the Federal Highway Administration (FHWA) Pooled Fund Study TPF-5(165) looked at the failure mechanisms of in-service whitetopping overlays across the country. It was traditionally assumed that for thin whitetopping (TWT) (4 in. to 6 in. thickness), the failure mode was transverse cracking and for ultra-thin whitetopping (UTW) (2 in. to 4 in. thickness), the failure mode was corner cracking. The results of the study determined that actual failure modes are a function of slab size, not overlay thickness as previously assumed. The study resulted in revisions to the Portland Cement Association and Colorado DOT's design procedures for TWT and UTW.

The project, "Redefining the Failure Mode for Thin and Ultra-thin Whitetopping with a 6-x6-ft Joint Spacing," was completed at the University of Pittsburgh by Zichang Li and Julie M. Vandenbossche, Ph.D, P.E. Click here to read the full report.

This project is contributing to research objectives identified in CP Road Map Track 8: Concrete Pavement Construction, Reconstruction, and Overlays.

Minnesota develops improved design process for unbonded concrete overlays

Current unbonded concrete overlay (UBCO) design procedures are based on empirical equations or highly simplified mechanistic models. To overcome these limitations, Minnesota utilized a finite element methodology to determine how reflective cracking occurs. The information gathered was utilized to develop a new design procedure. Preliminary comparisons of the results with field observations suggest that the new procedure offers promise for improved design of UBCOs.

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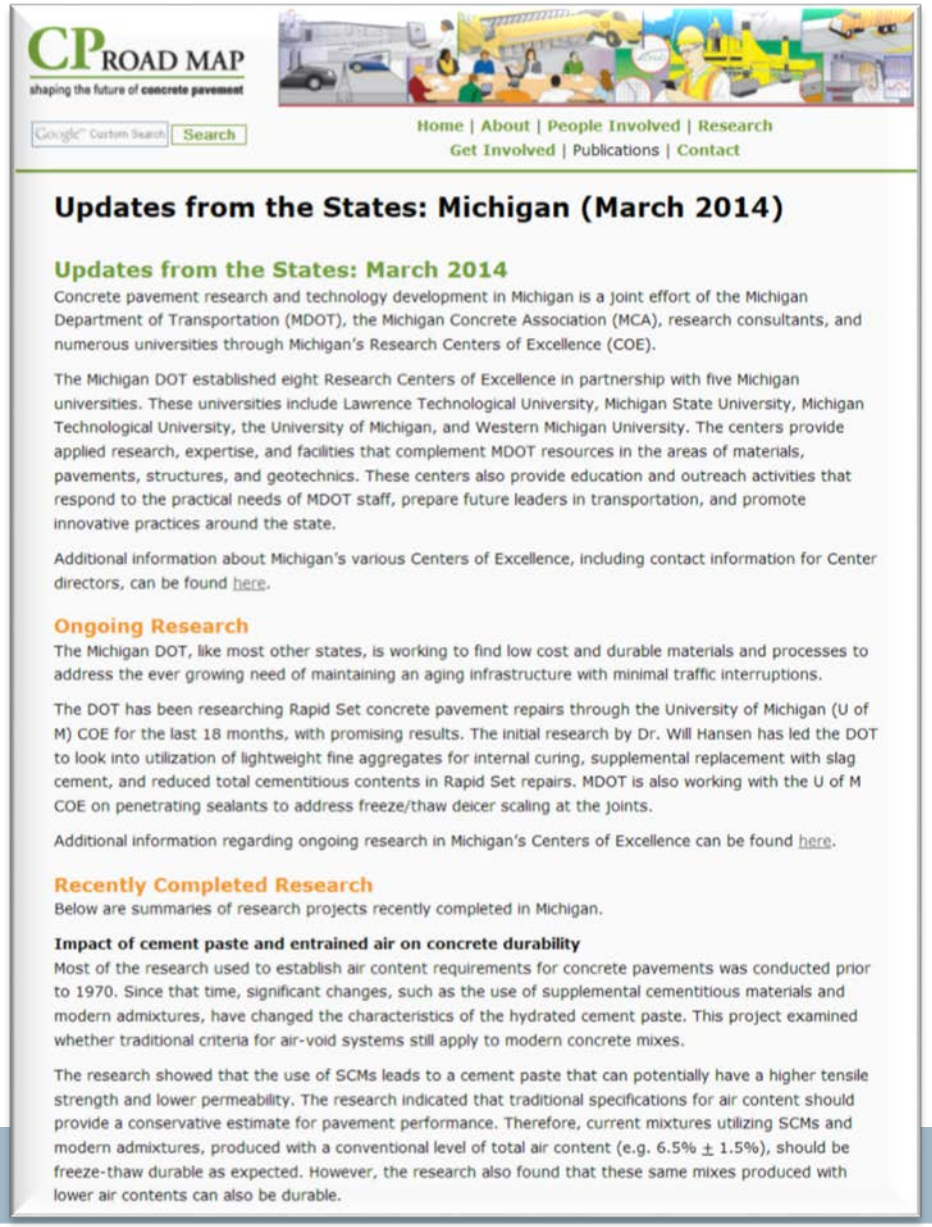
Update from the States

- Highlight the research of a single pooled-fund state in each newsletter.
  - Recently completed
  - Ongoing
  - Future needs
- Includes all topics related to PC Concrete.
- Information provided directly by the states.



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Updates from the States: Michigan (March 2014)

Updates from the States: March 2014

Concrete pavement research and technology development in Michigan is a joint effort of the Michigan Department of Transportation (MDOT), the Michigan Concrete Association (MCA), research consultants, and numerous universities through Michigan's Research Centers of Excellence (COE).

The Michigan DOT established eight Research Centers of Excellence in partnership with five Michigan universities. These universities include Lawrence Technological University, Michigan State University, Michigan Technological University, the University of Michigan, and Western Michigan University. The centers provide applied research, expertise, and facilities that complement MDOT resources in the areas of materials, pavements, structures, and geotechnics. These centers also provide education and outreach activities that respond to the practical needs of MDOT staff, prepare future leaders in transportation, and promote innovative practices around the state.

Additional information about Michigan's various Centers of Excellence, including contact information for Center directors, can be found here.

Ongoing Research

The Michigan DOT, like most other states, is working to find low cost and durable materials and processes to address the ever growing need of maintaining an aging infrastructure with minimal traffic interruptions.

The DOT has been researching Rapid Set concrete pavement repairs through the University of Michigan (U of M) COE for the last 18 months, with promising results. The initial research by Dr. Will Hansen has led the DOT to look into utilization of lightweight fine aggregates for internal curing, supplemental replacement with slag cement, and reduced total cementitious contents in Rapid Set repairs. MDOT is also working with the U of M COE on penetrating sealants to address freeze/thaw deicer scaling at the joints.

Additional information regarding ongoing research in Michigan's Centers of Excellence can be found here.

Recently Completed Research

Below are summaries of research projects recently completed in Michigan.

Impact of cement paste and entrained air on concrete durability

Most of the research used to establish air content requirements for concrete pavements was conducted prior to 1970. Since that time, significant changes, such as the use of supplemental cementitious materials and modern admixtures, have changed the characteristics of the hydrated cement paste. This project examined whether traditional criteria for air-void systems still apply to modern concrete mixes.

The research showed that the use of SCMs leads to a cement paste that can potentially have a higher tensile strength and lower permeability. The research indicated that traditional specifications for air content should provide a conservative estimate for pavement performance. Therefore, current mixtures utilizing SCMs and modern admixtures, produced with a conventional level of total air content (e.g. 6.5% ± 1.5%), should be freeze-thaw durable as expected. However, the research also found that these same mixes produced with lower air contents can also be durable.

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News from the Road

- Highlight recently completed research from around the country.
- Focus on core areas of the CP Road Map including:
  - Concrete Overlays
  - Performance Engineered Mixtures
  - Preservation Techniques

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News from the Road

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The project, "Mechanistic Modeling of Unbonded Concrete Overlay Pavements," was completed at the University of Minnesota by Roberto Ballarini. The project was funded through FHWA Pooled Fund Study TPF-5(165). Click here to read the full report.

This project is contributing to research objectives identified in CP Road Map Track 8: Concrete Pavement Construction, Reconstruction, and Overlays.

FHWA investigates accelerated test method for ASR

The "concrete prism test" (ASTM C1293) is considered the most reliable test for determining alkalai-silica reaction Alkali-Silica Reaction (ASR) susceptibility of concrete material combinations; however, the test is time consuming, taking one to two years to complete. Faster test methods, such as the accelerated mortar-bar method (ASTM C1260), can significantly reduce testing time but are not always representative of actual field performance.

A new technique, nonlinear impact resonance acoustic spectroscopy (NIRAS), aims to improve the results of the accelerated test methods. The NIRAS method is a non-destructive test that detects changes in an object's resonance frequency when it is struck. Concrete pavements with ASR develop internal micro-cracks that decrease the overall stiffness of the material, thus changing the resonance frequency. The results of the NIRAS testing indicate that the test can more accurately distinguish between reactive and non-reactive aggregates.

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MAP Brief

- Moving Advancements into Practice (MAP)
- Provides detailed information on a core topic of the CP Road Map
- Past topics included:
  - Mixture design & proportioning
  - PCC pavement sustainability
  - Full-depth repairs
  - Partial depth repairs
  - Precast concrete pavement
  - Preventing joint deterioration

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www.cproadmap.org

March 2014
ROAD MAP TRACK 1

PROJECT TITLE
Mixture Design and Proportioning

TECHNICAL WRITER
Peter Taylor
National Concrete Pavement Technology Center

EDITOR
Sabrina Shields-Cook

SPONSOR
Federal Highway Administration

MORE INFORMATION
Peter Taylor
National Concrete Pavement Technology Center
ptaylor@iastate.edu
515-294-8103

The Long-Term Plan for Concrete Pavement Research and Technology (CP Road Map) is a national research plan developed and jointly implemented by the concrete pavement stakeholder community. Publications and other support services are provided by the Operations Support Group and funded by TPF-5(286).

Moving Advancements into Practice (MAP) Briefs describe innovative research and promising technologies that can be used now to enhance concrete paving practices. The Jan-Feb 2014 MAP Brief provides information relevant to Track 1 of the CP Road Map: Materials and Mixes for Concrete Pavements

This MAP Brief is available at www.cproadmap.org/publications/MAPbriefMarch2014.pdf.

"Moving Advancements into Practice"

MAP Brief March 2014

Describing promising technologies that can be used now to enhance concrete paving practices

Mixture Design and Proportioning for Concrete Pavements

Why are we talking about this?

The topic of mixture design and proportioning is gaining attention recently, despite the relatively small number of people actually involved in doing mixture proportioning with any regularity. Traditionally, specifications for mixtures tended to be prescriptive and restrictive, meaning that concrete providers had little freedom or incentive to optimize or improve their products. It was generally sufficient to use the same mix as yesterday, last year, or the last project.

Education is this field has also been limited, with many misconceptions being accepted as fact, potentially leading to inappropriate responses to failures or problems.

The push toward performance-based specifications, however, combined with tighter budgets and greater attention to sustainability, there is a growing pressure to better understand the parameters that influence critical performance for concrete mixtures. This tech brief summarizes research currently underway with the aim of improving this understanding.

Definitions

The phrase "mixture design" is often used to describe a sheet that lists the amount of each material in a batch by pounds per cubic yard. The definitions being adopted in the paving community separate "design" from "proportioning," roughly along the lines of responsibility.

Mixture design is the process of determining the required and specifiable characteristics of a concrete mixture; i.e., choosing what is required to survive the environment and provide the required service life. That means the engineer or owner will select the performance needed from the mixture to meet structural and durability requirements. Such parameters will generally include a required strength, permeability, air-void-system, and shrinkage.

Some prescriptive limitations may still be imposed (such as supplementary cementitious materials content) to ensure that a long life will be achieved. These are normally selected because they are easier to measure than the associated performance metric.

Mixture proportioning is the process of determining the quantities of concrete ingredients; i.e., choosing what and how much to use to meet the requirements of the design. This is where individual products are selected and their relative amounts are calculated.

There is a perception that proportioning is simply a computational exercise. While numerical approaches provide a good starting

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Technical Documents

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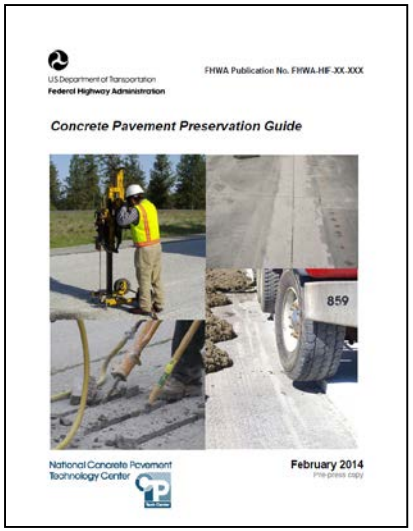
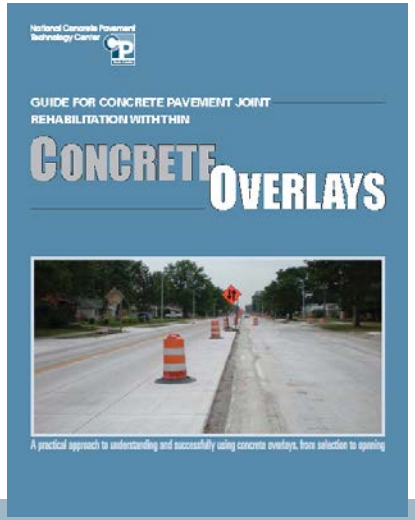
Technical Documents Available in 4 to 6 Weeks



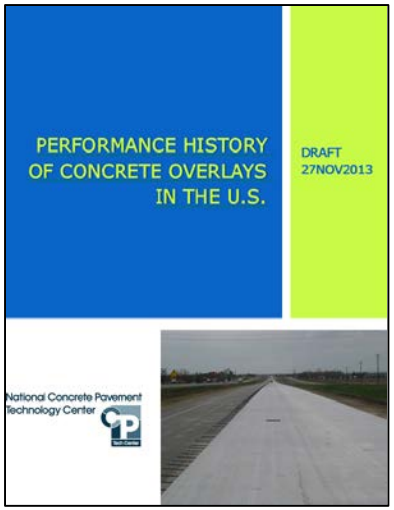
Updated Preservation Guide (250+/- pages)

Updated Concrete Overlay Guide (150 +/- pages)

Concrete Overlay Solutions for Joint Performance (30 pages)



Performance History of Concrete Overlays



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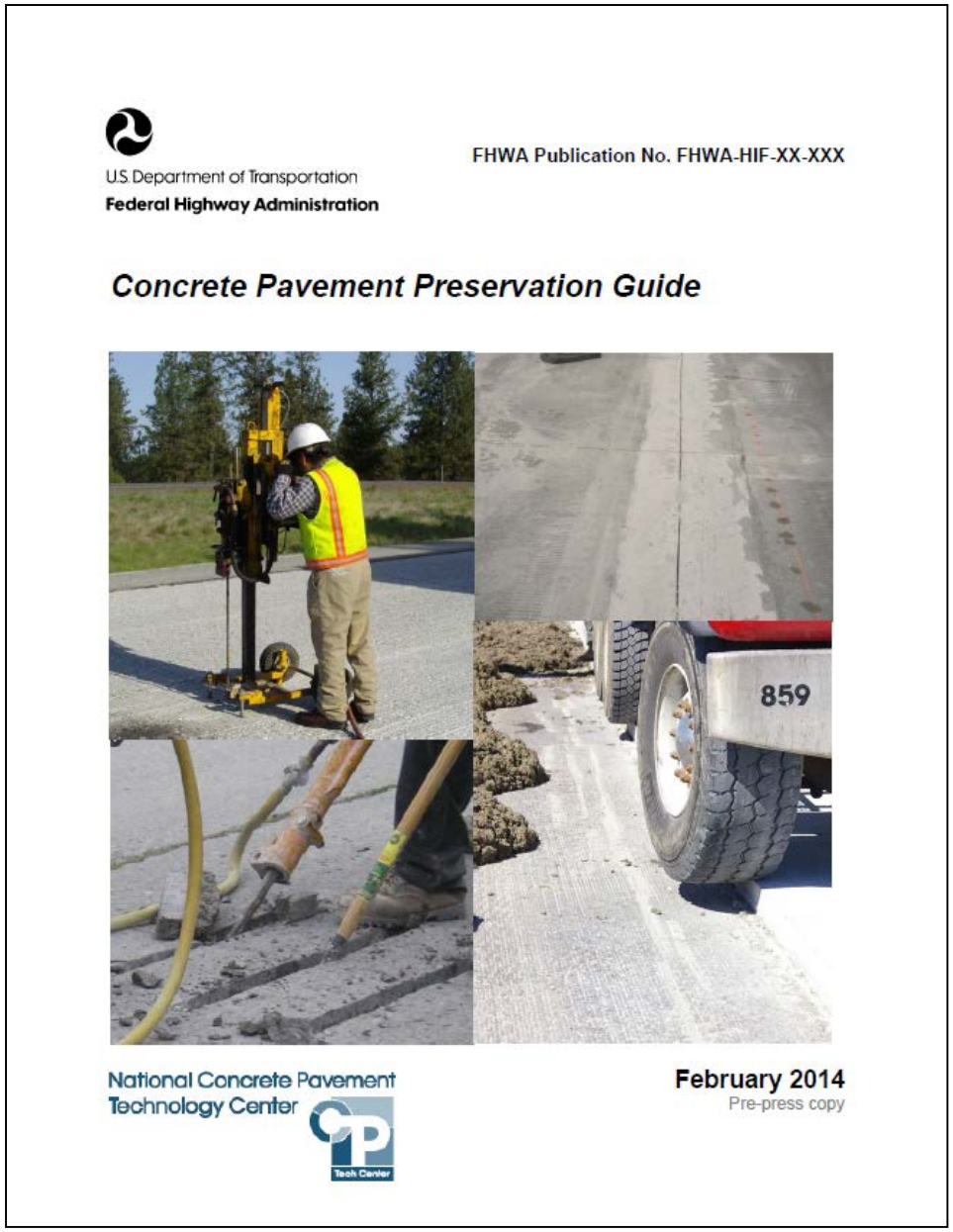
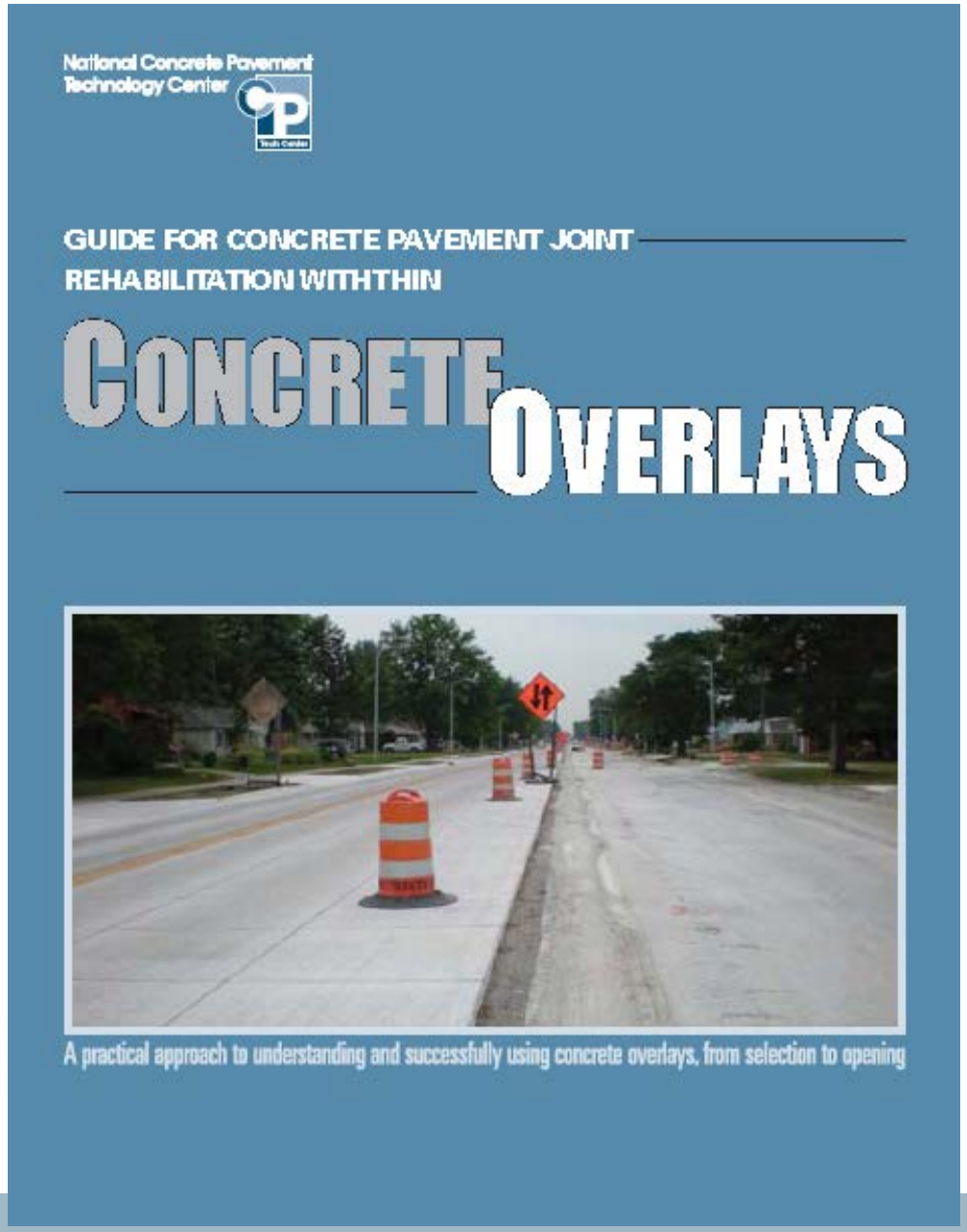
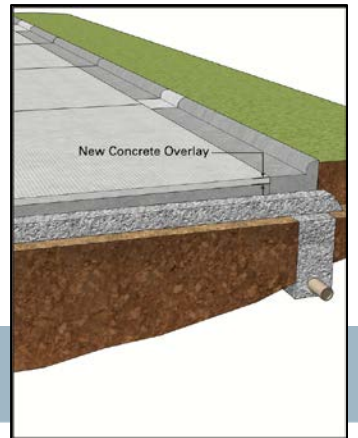


Update Concrete Pavement Preservation Manual-Winter 2014

- Contains 12 Chapters on Preservation Techniques
- Added Overlay Chapter
- Working on 11 Training Modules and Instructor Guide
- Plan on 20 future workshops in next two years.
- Technical Assistance to State DOTs



- Guide for Concrete Pavement Joint Rehabilitation with Thin Concrete Overlays will be available winter 2014.
- Guide demonstrates potential applicability of thin concrete overlays as a longer term solution (15 years and greater).
- Previous US experiences with thin concrete overlays are highlighted along with adapted practices to provide solutions for pavements with joint deterioration.



New Concrete Overlay Guide

Update 2008 Overlay Guide - Winter 2014

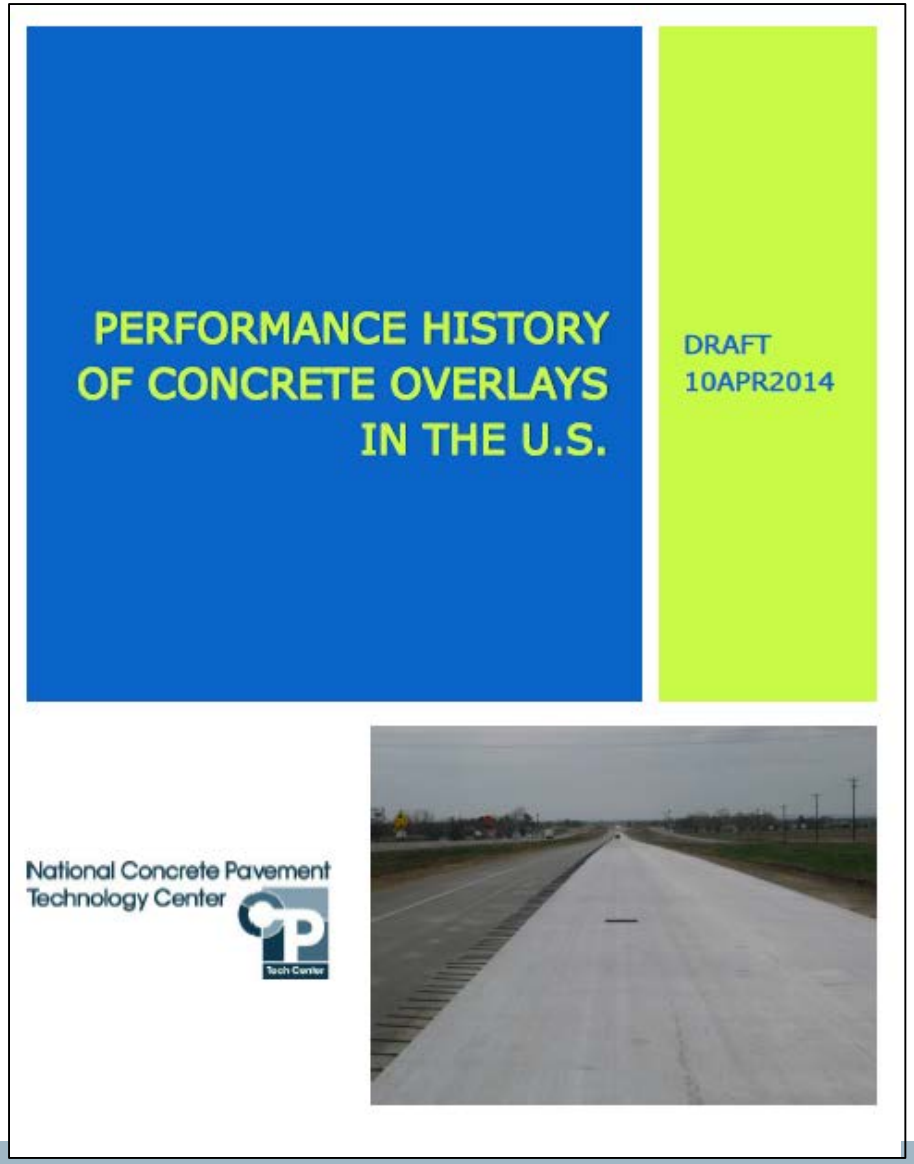
Contents

1. Introduction
2. Evaluations
3. Applications
4. Design
5. Materials
6. Work zones
7. Construction

New Items

- Synthetic Fibers
- Evaluation Flow Chart
- Geotextile Interlayer
- 3 D Survey
- Stringless Paving
- Plate Dowels

Overlay Synthesis Progress Update



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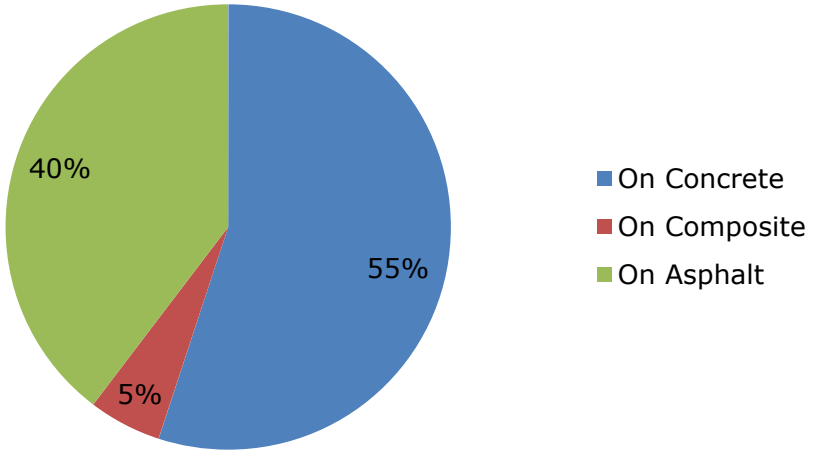
Performance History of Concrete Overlays in the U.S.

- Document concrete overlay history and performance
- Draw from ACPA's *National Concrete Overlay Explorer* and other sources
  - Concrete overlay demographics and statistics



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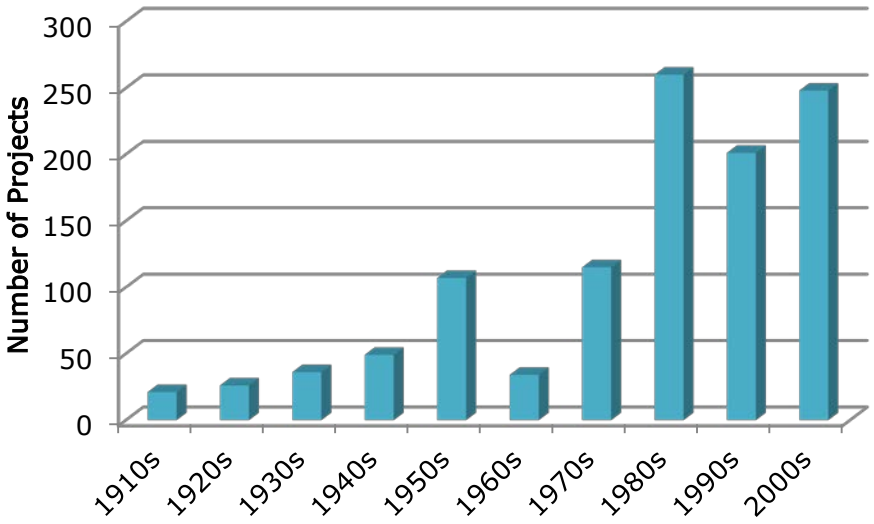
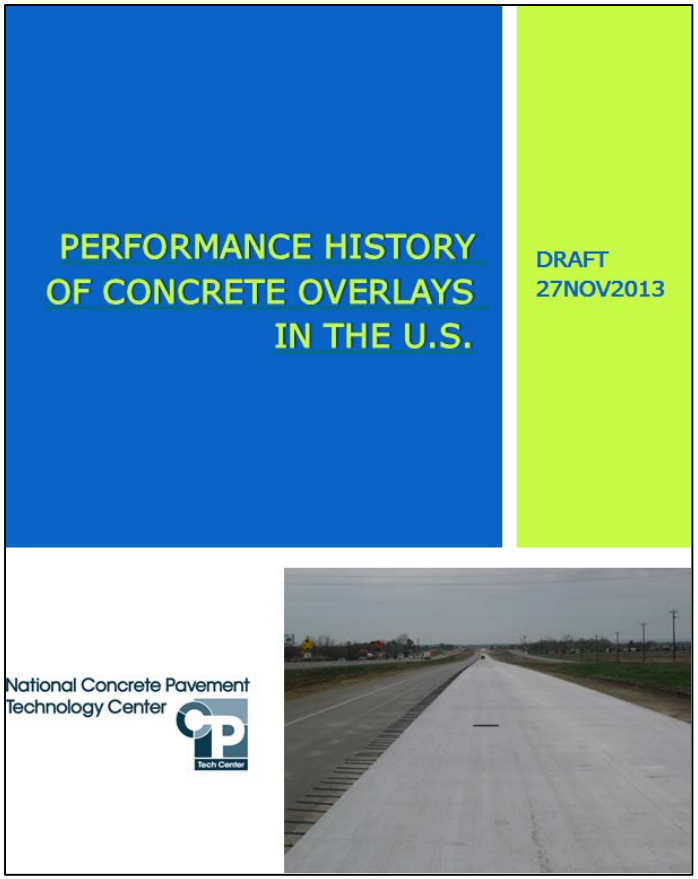
Performance History of Concrete Overlays in the U.S.

- Twelve in-depth case studies
- Approximately 30 pages





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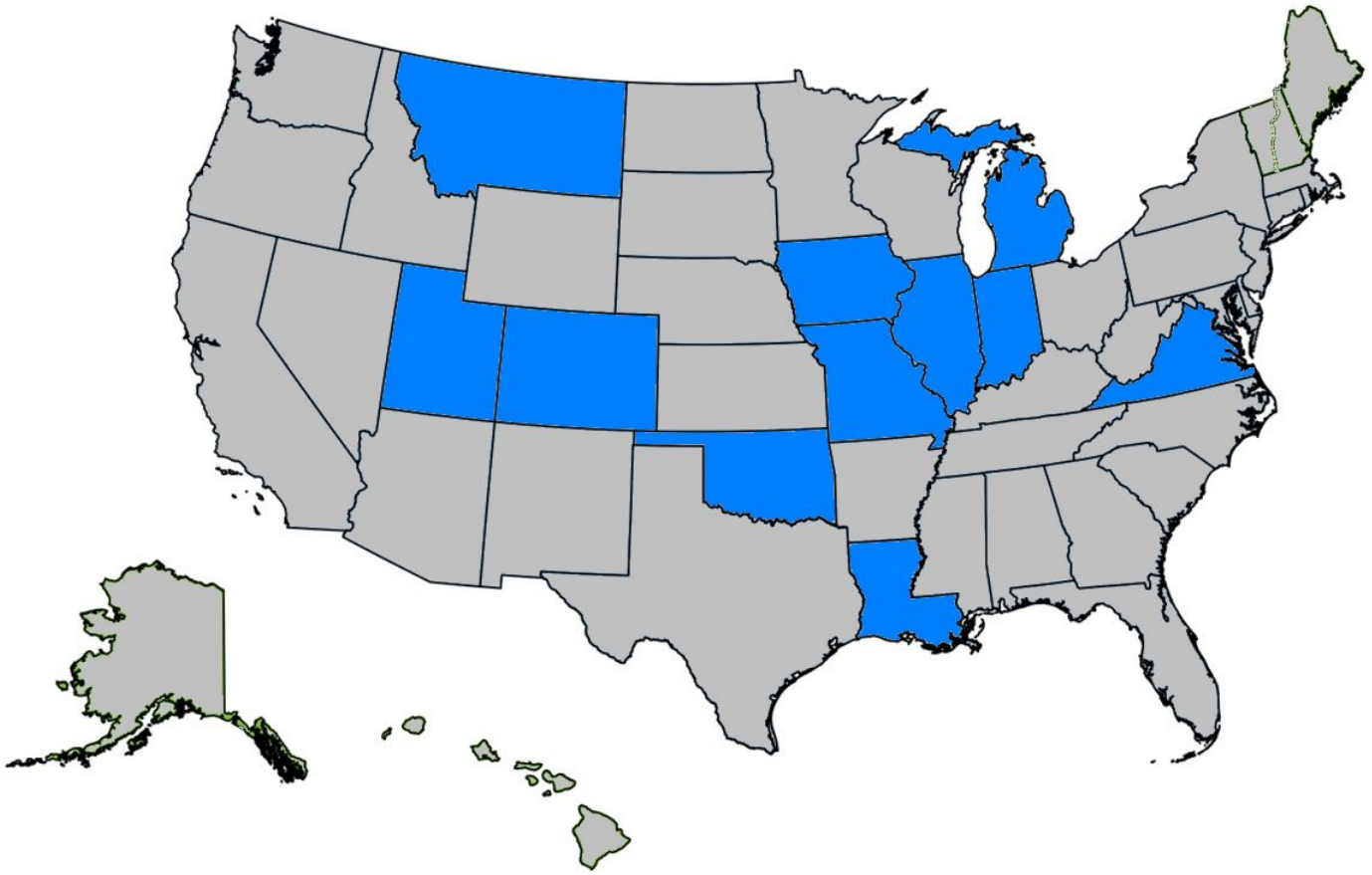
Projects Selected

				Existing Pavement Type and *Overlay Type*			Functional Classification			
Project	State	Route	Year Constructed	Asphalt	Composite	Concrete	Interstate or Freeway or Expressway	Principal or Minor Arterial	Major or Minor Collector	Local
1	OK	US-69	2001	*Bonded*				☑		
2	MT	US-16	2001	*Bonded*					☑	
3	IL	Plank Rd	1974	*Unbonded*						☑
4	MO	I-55	2002	*Unbonded*			☑			
5	UT	SR-89/114	2001		*Bonded*					☑
6	CO	US-287A	2000		*Bonded*			☑		
7	IN	I-69	1986		*Unbonded*		☑			
8	OK	?	20XX		*Unbonded*					
9	IA	V-63	2002			*Bonded*				☑
10	LA	LA-30/22	1992			*Bonded*			☑	
11	MI	?	?			*Unbonded*				
12	NC	I-85	1998			*Unbonded*	☑			

Performance History States



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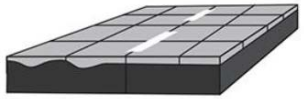
Case History #1

Overlay Type: Bonded concrete overlay on asphalt pavement	
Overlay Thickness:	*Click here for a Google Map view of the project*
Location: US 69 southbound lanes in Pittsburg County, Oklahoma	
Year Constructed: 2001	

Current Traffic:

ADT – 16,000 (two directional movements)

% trucks – 30% (discuss if there is any unusual loading like in a heavy industry, etc.)

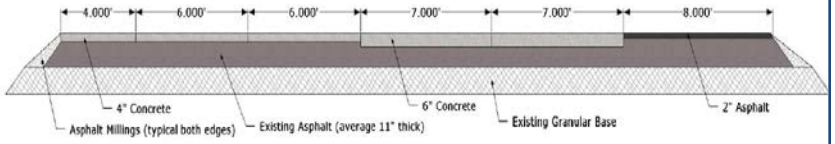
Year – 2011; Estimated ESALs since construction through 2013 (assumed 2% growth, 50% directional, 75% design lane and a truck factor of 1.4 – 10,120,178

Pre-Construction

Current (2010)

Contractor:
Engineer:
Owner:
Project Length:
Overlay Joints:

- Spacing –
- Dowel bars – N/A
- Tie bars –
- Joint sealing –
- Subdrains –



Typical Section

Comments:
Causes of deterioration in asphalt were thought to be?
Status of stripping?

Subbase Type	
Design Procedure	Unknown
Design Details	Transverse joints sawed T/3 x 1/8” at 6’ c/c; unsealed joints
Fibers Used/Type/Dosage	Yes/Macro/3 lb per yd^3
Construction Details	Constructed one lane at a time with traffic adjacent to the paving operation
Pre-Overlay Repairs	None
Approximate Cost per Mile	$600,000
Observed Distress(es)	38 slabs (less than 1%) with visible cracks and joint spalling at Centerline
Repairs to Date	None
0	Click here for a digital plan set (example) Click here for specifications (example)
Bid Tabulations	Click here for bid tabulations (example)

Performance History of Concrete Overlays in the U.S.

- Bonus on-line content
  - Digital library of recent (2012, 2013 & 2014) concrete overlay projects
  - Organized by type of concrete overlay
    - ➢Plans
    - ➢Specifications
    - ➢Bid tabulations

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Performance History of Concrete Overlays in the U.S.

- Currently 70% complete
- Estimated completion Spring 2014

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Guides Request

GUIDES REQUEST

State	Concrete Overlay Guide	Concrete Preservation Guide	Overlays for Joint Performance	Performance History of Concrete Overlays	Contact
Alabama					
California					
Colorado					
Florida					
Georgia					
Idaho					
Illinois					
Illinois Tollway					
Indiana					
Iowa					
Kansas					
Louisiana					
Michigan					
Minnesota					
Missouri					
Nebraska					
Nevada					
New York					
North Carolina					
North Dakota					
Ohio					
Oklahoma					
Pennsylvania					
South Dakota					
Texas					
Utah					
Washington					
Wisconsin					

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Technical Documents
What is Planned in the Future (2014/2015)

Concrete Overlay Plan Guidance

Concrete Overlay Guide Over Cement Treated Asphalt Millings (35 pages)

Concrete Pavement Distress Guide
- **Types**
- **Causes**

Manual on 3D Engineered Model (50 pages)

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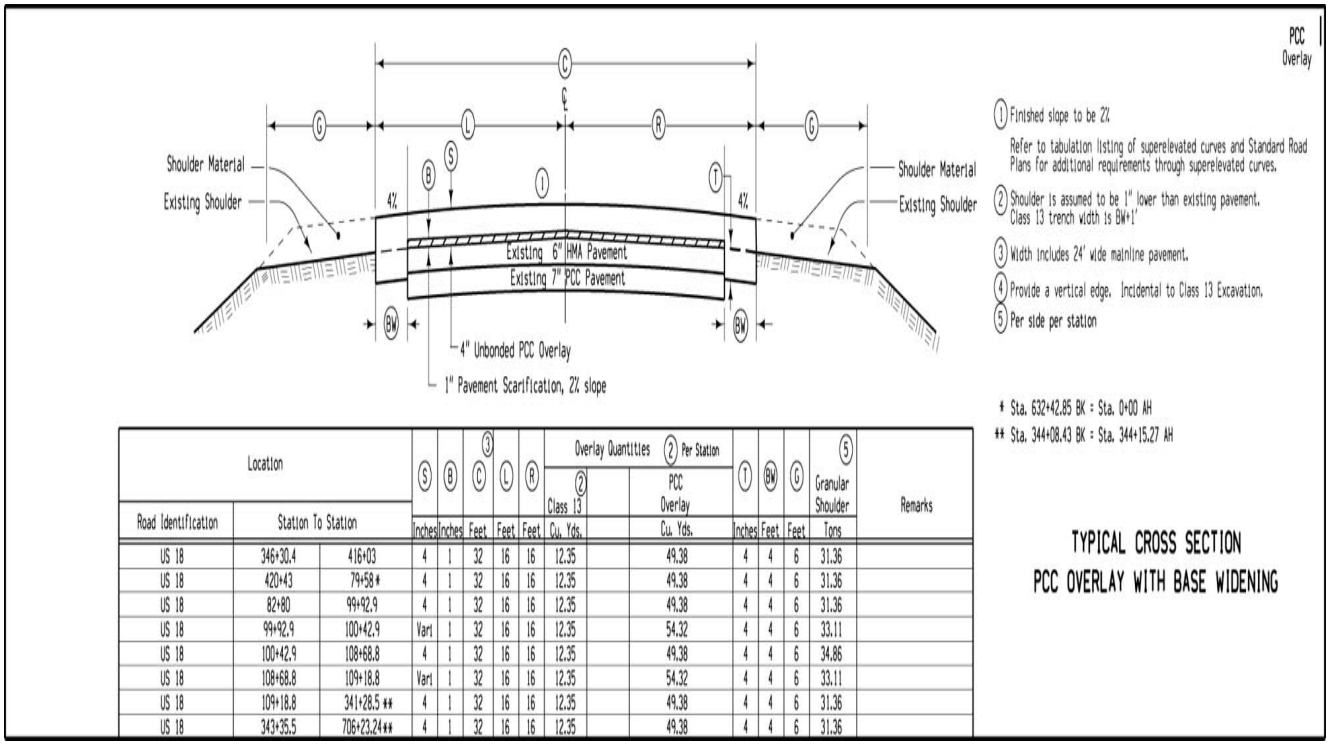
Concrete Overlay Plan Guidance



Location			Overlay Quantities (2) Per Station												Remarks
			(S)	(B)	(3) (C)	(L)	(R)	(2) Class 13	PCC Overlay	(T)	(BW)	(G)	(5) Granular Shoulder		
Road Identification	Station To Station		Inches	Inches	Feet	Feet	Feet	Cu. Yds.	Cu. Yds.	Inches	Feet	Feet	Tons		
US 18	346+30.4	416+03	4	1	32	16	16	12.35	49.38	4	4	6	31.36		
US 18	420+43	79+58*	4	1	32	16	16	12.35	49.38	4	4	6	31.36		
US 18	82+80	99+92.9	4	1	32	16	16	12.35	49.38	4	4	6	31.36		
US 18	99+92.9	100+42.9	Vari	1	32	16	16	12.35	54.32	4	4	6	33.11		
US 18	100+42.9	108+68.8	4	1	32	16	16	12.35	49.38	4	4	6	34.86		
US 18	108+68.8	109+18.8	Vari	1	32	16	16	12.35	54.32	4	4	6	33.11		
US 18	109+18.8	341+28.5 **	4	1	32	16	16	12.35	49.38	4	4	6	31.36		
US 18	343+35.5	706+23.24**	4	1	32	16	16	12.35	49.38	4	4	6	31.36		

- Guidance Specification (CP Road Map)

Concrete Overlay Over Cement Treated Asphalt Millings

National Concrete Pavement Technology Center

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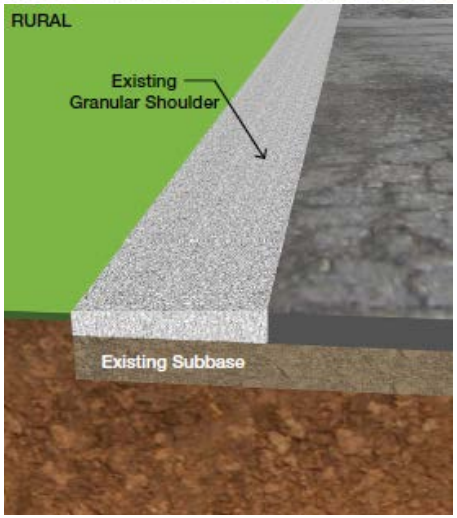

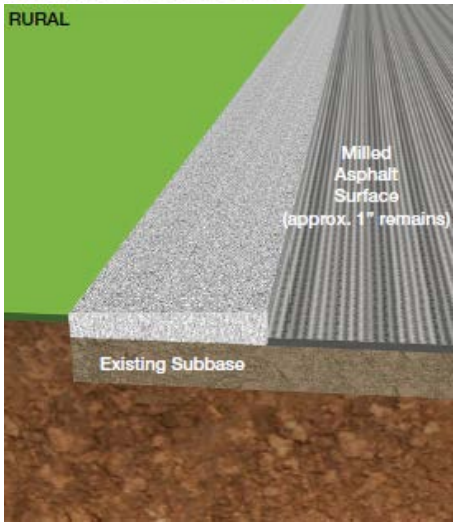

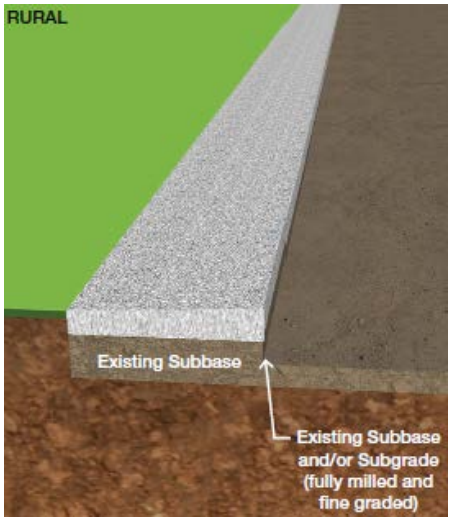

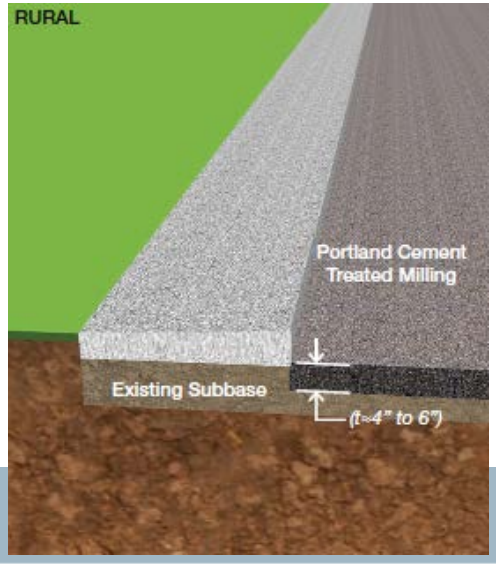

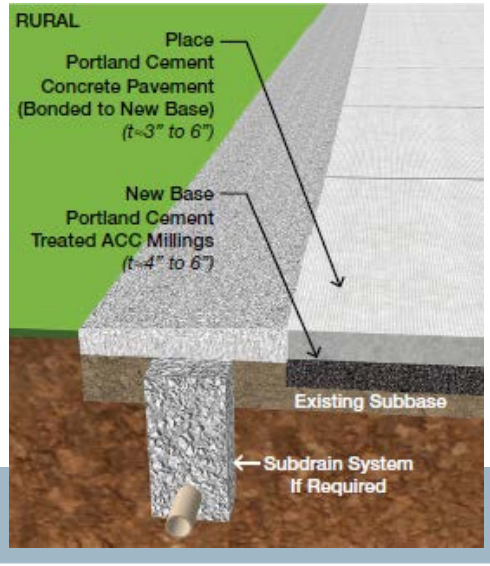

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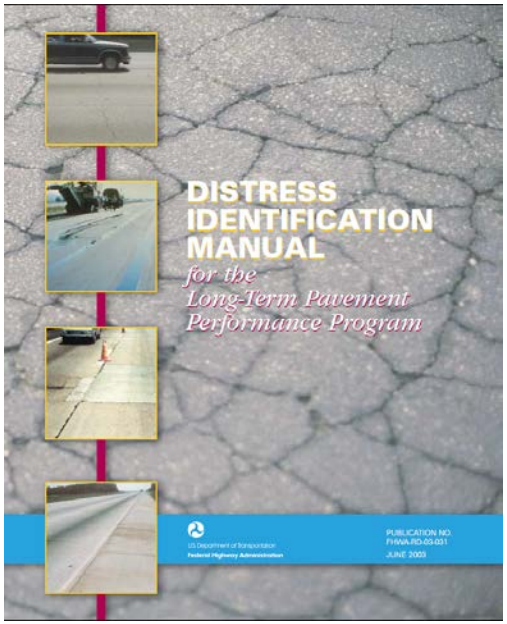
Concrete Pavement Distress Manual

Provide State DOT with reference document to identify concrete pavement distress and the causes of the distress. Include technical solutions.

- Identifications methods and techniques already established by FHWA- Distress Identification Manual –(June 2003 last Updated)
- Needs to Identify Causes and Solution Options
- (Will require TAC to accomplish)



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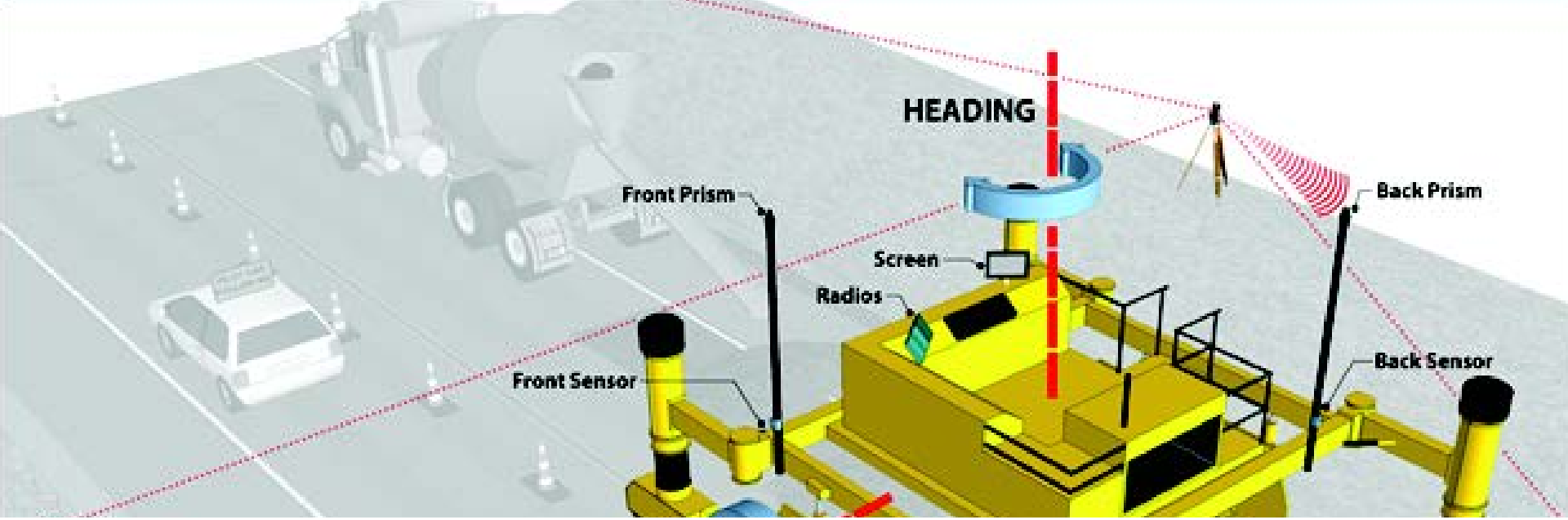
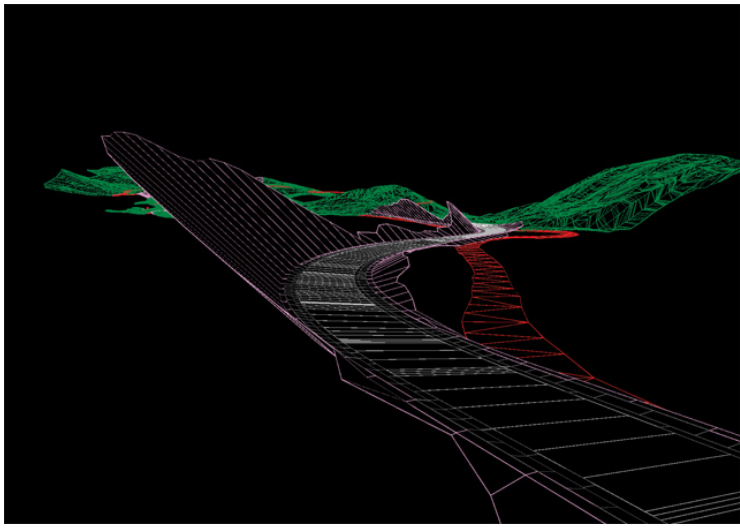


3D Engineered Models for Construction

Introducing resources to help organizations make the transition from 2D plans to 3D engineered models in highway projects

U.S. Department of Transportation
Federal Highway Administration

3D Projects



- Create 4 Web-based Training Modules on the Use of 3D Engineered Models
- Staff Technical Support Services Center (TSSC)
- Create an Implementation Manual on the use of 3D Engineered Models

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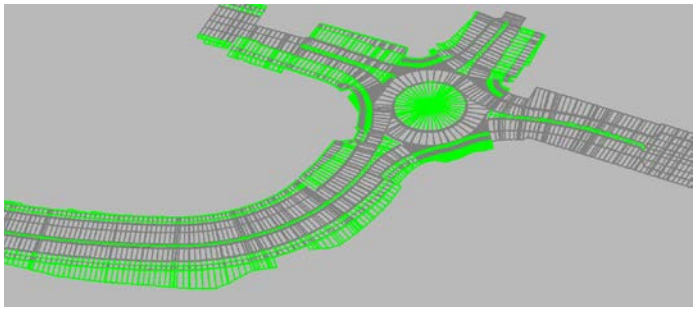
-Every Day Counts Program- Provide Technical Support Services on 3D Engineered Models

- Develop 4 Modules for Web Based Training on
  - Introduction to 3D Models
  - Surveying / 3D Models
  - Highway Design / 3D Models
  - Highway construction / 3D Models
- Includes:
  - Website Development
  - Marketing Plan
  - Technical Support Center



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Technical Support Services Center

- Link on FHWA's 3D website
- Resource for organizations using 3D Engineered Models and Automated Machine Guidance
- https://www.fhwa.dot.gov/construction/3d/

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New 3D Engineered Modeling Resources

- **Website** (mid-January 2014)
  - Presentations
  - Case studies
  - Technical papers, reports
  - Sample models
  - Webinars
  - FAQs
  - More
  - Regularly updated
- **Technical Support Services Center** (contact via website)
- **Four web-based training modules** (late summer 2014)

www.fhwa.dot.gov/3d/
Search "fhwa 3d"

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3D Implementation Manual

- Implementation Best Practices from the Iowa DOT Experience (50 Pages)
- Encourage Organizations to Create 3D Engineered Models and Provide Data to Contractors

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Technology Training

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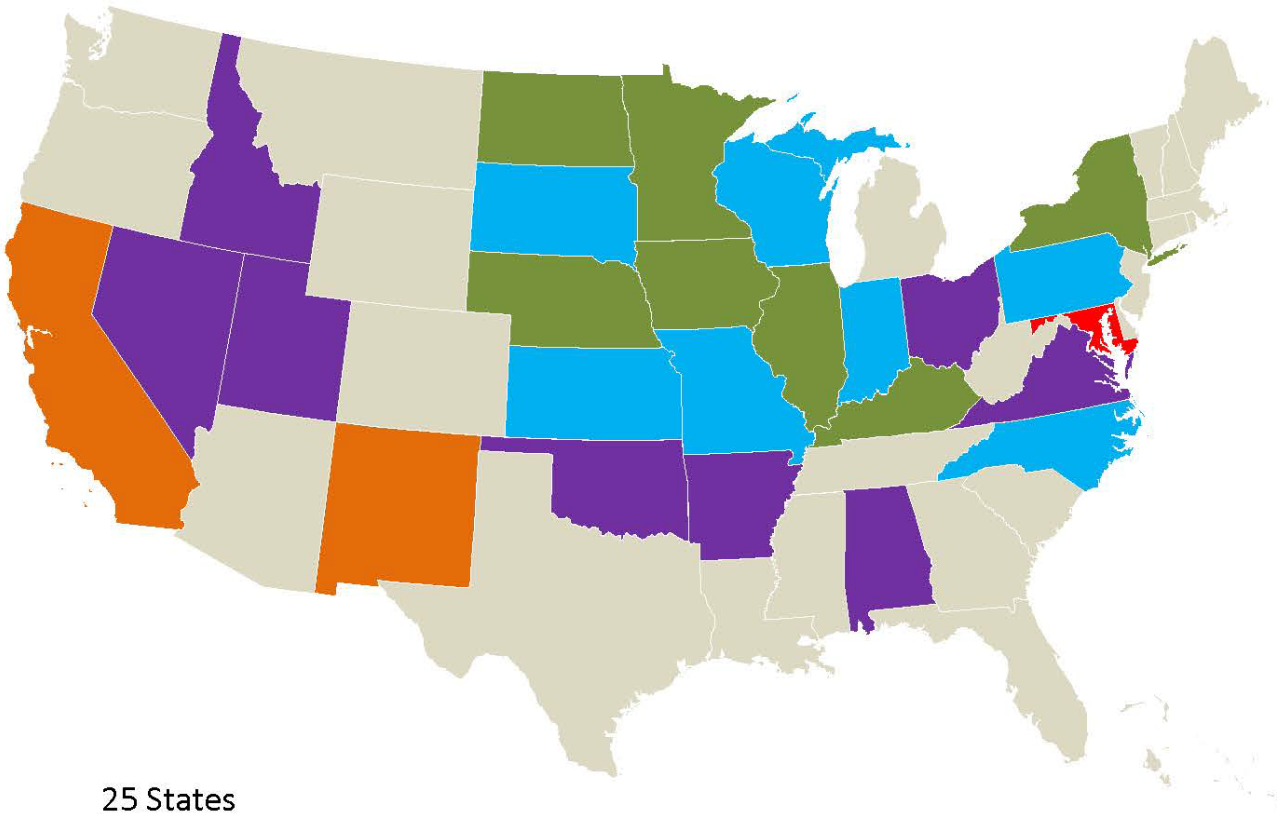
April 2013 to April 2014
Technical Assistance to States
(Site Visits, Workshops, Evaluations, Consultations)



25 States

- Durability & Performance Mixtures
- Joint Performance & Preservation
- Sustainability
- CP Tech Center Research
- Overlays

CP Tech Center

Illinois Toll Way Open House
August 20-21, 2013

To demonstrate sustainable concrete paving practices in the Tollway's capital program:

- Use of FRAP and RAP
- Ternary mix designs
- Two lift concrete paving
- Construction challenges
- Bidding results
- Project site tour
- Attended by 120 people

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Training & Technical Assistance Programs Scheduled for Future

- **Concrete Overlay Field Application Program**
  - Webinars
  - Site Visits
  - Workshops
  - On call technical assistance
- **Concrete Preservation**
  - Modules for web-based training
  - Conduct workshops
  - On call technical assistance
- **CP Road Map Training for 5 pool funded states**
  - Choice of 10 subjects or combination of subjects
- **Joint Performance Workshops** (limited to 2 before June 30. 2014)
  - Field Review
  - Workshops

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Training & Technical Assistance Request

TRAINING & TECHNICAL ASSISTANCE REQUESTS

State	Overlay Filed Application	Concrete Perservation	Joint Performance	Concrete Technology Deployment (CP Road Map 6 States Only)	Contact
Alabama					
California					
Colorado					
Florida					
Georgia					
Idaho					
Illinois					
Illinois Tollway					
Indiana					
Iowa					
Kansas					
Louisiana					
Michigan					
Minnesota					
Missouri					
Nebraska					
Nevada					
New York					
North Carolina					
North Dakota					
Ohio					
Oklahoma					
Pennsylvania					
South Dakota					
Texas					
Utah					
Washington					
Wisconsin					

CP Tech Center