PEM is not over…

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Associate Director

IOWA STATE UNIVERSITY
Institute for Transportation

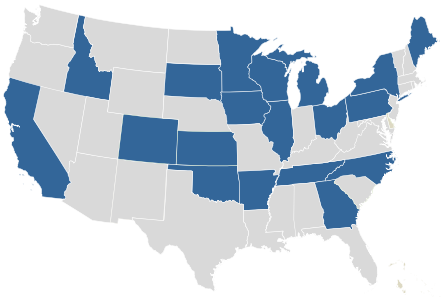
National Concrete Pavement Technology Center
Tech Center

NCC Spring Meeting 2022
Together again!

Performance Engineered Mixtures (PEM)

- A broad initiative with a goal of implementing performance specifications for concrete, including an increased emphasis on durability

ACPA
AMERICAN CONCRETE PAVEMENT ASSOCIATION



SCA
SLAG CEMENT ASSOCIATION

PCA Since 1916
America's Cement Manufacturers™

U.S. Department of Transportation
Federal Highway Administration

RMC RESEARCH & EDUCATION FOUNDATION

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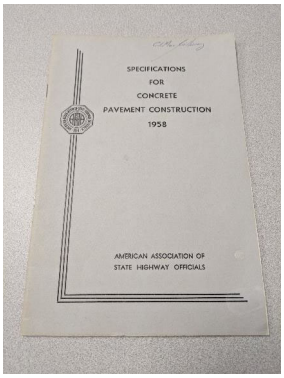
PEM?

A program to develop a better specification for concrete mixtures

- Understand what makes concrete “good”
- Specify the critical properties and test for them
- Prepare the mixtures to meet those specifications



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What do we need?

- Transport properties (permeability)
- Aggregate stability
- Cold weather resistance
- Strength
- Shrinkage
- Workability

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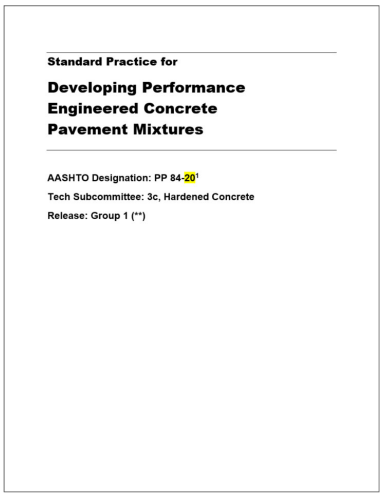
A Better Specification

- The right properties measured at the right time
  - Prequalification
  - Process control
  - Acceptance
- A buffet of approaches
  - Prescriptive: w/cm, paste volume
  - Performance: Formation factor



Standard Practice for

Developing Performance Engineered Concrete Pavement Mixtures

AASHTO Designation: PP 84-20[1]

Tech Subcommittee: 3c, Hardened Concrete

Release: Group 1 (**)

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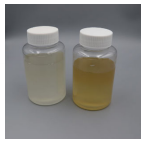
Proportioning/Mix Optimization



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Our PEM Team

- FHWA - Gina Ahlstrom, Mike Praul, Robert Conway
- Researchers – Jason Weiss, Tyler Ley
- Consultants – Tom VanDam, Cecil Jones
- CP Tech – Peter Taylor, Gordon Smith, Jerod Gross

U.S. Department of Transportation
Federal Highway Administration

Oregon State University

OSU

NCE

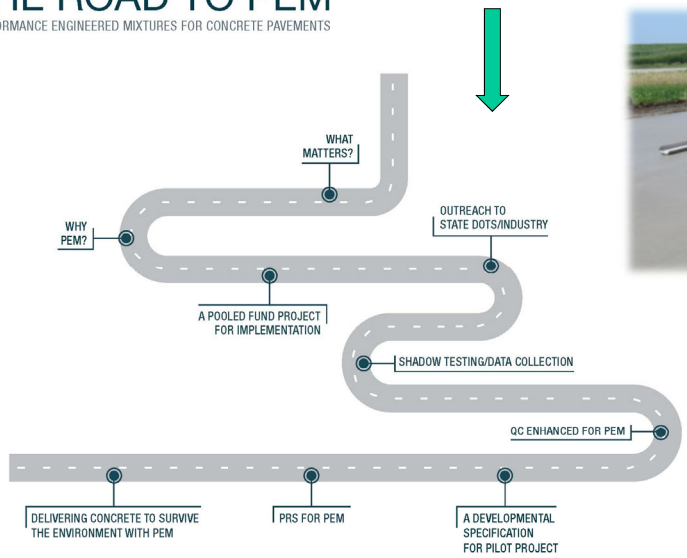
Diversified Engineering Services, Inc

National Concrete Pavement Technology Center

Iowa State University
Institute for Transportation

THE ROAD TO PEM

PERFORMANCE ENGINEERED MIXTURES FOR CONCRETE PAVEMENTS



CP Tech Center

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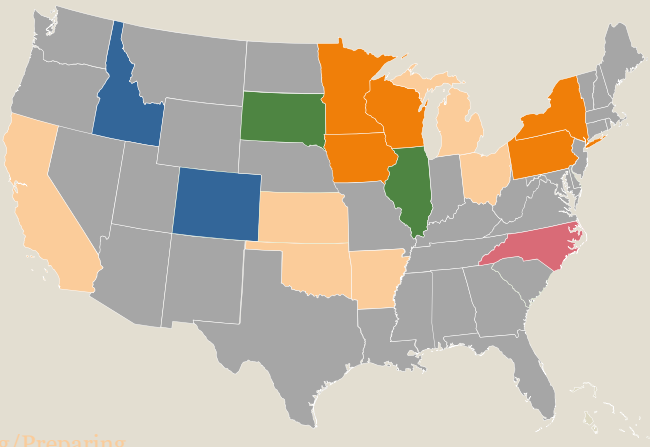
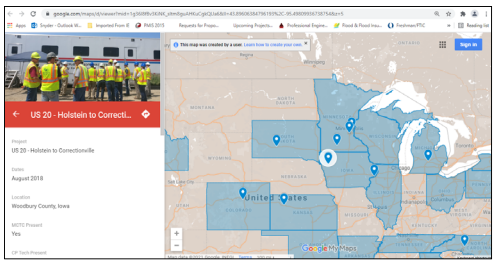
Implementation Incentive Funding



A, B, C, D
A, B, D
A, B
Considering/Preparing
No applicable project

PEM Updates

- August 2021 - Tennessee DOT PEM Workshop
- September 2021 Webinar - Advancements in PEM
- January 2022 - PP 84 becomes R 101 (publication in April 2022)
- March 2022 – Georgia DOT PEM Workshop
- PEM TRB Circulars (NY, IA, MI, NC)
- 2022 MCTC PEM visits: NY, MN, ID



cptechcenter.org/pem

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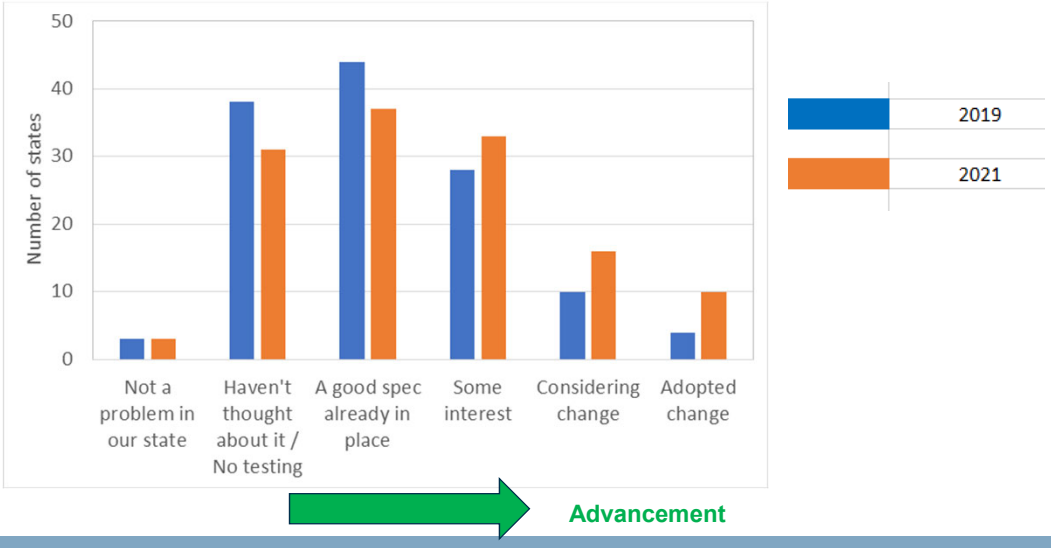
Slide 9

PM(28 Image provided by CP Tech Center under FHWA contract.
Praul, Michael (FHWA), 2/1/2018

PEM State Specifications



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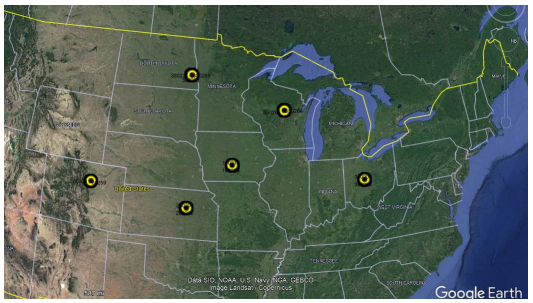
PEM SPS-2 Samples

Summer 2021, 101 cores, 6 states:

- Colorado, Iowa, Kansas
  Ohio, North Dakota, Wisconsin



SPS-2 Data:

- Air, cement type, cement amount, SCM, w/cm, # aggregates, distress type / performance noted

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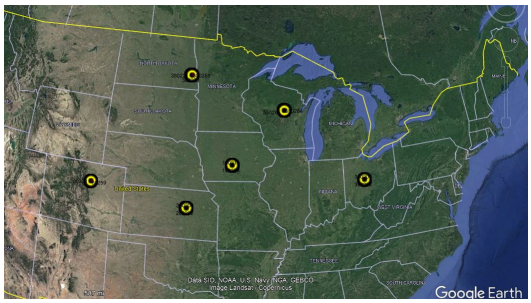
PEM SPS-2 Samples

Testing the following:

- Hardened Air
- Oxychloride
- Porosity
- Resistivity
- Distress / performance



Final report to include individual state agency data and testing summaries

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PEM 2

- Continue to assist state agencies on specification improvements and procedures to enhance performance
- Continue shadow and pilot projects
- Continue to offer program training
- Explore operational innovations to advance reliability of concrete pavements

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Steps to Long Life

Target performance

Workability
Durability
Strength

Design Levers

Gradation
Paste Volume
Cementitious
Admixtures

Measure!

Batching

Uniformity – Water
– Cementitious system
– Aggregates
Mixing – Time
– Energy

Measure!

Transportation

Mixing
Workability
– Time and weather
– Added water / admixtures
Uniformity

Measure!

Placement

Handling / Vibration
- Bleeding
- Segregation
- Air void system
- Water movement

Finishing

Surface finish
Curing
Sawing

Resistivity Webinar

Resistivity Testing – What Do I need to Know and How do I Use It?

Over the last few years many state highway agencies have begun using the resistivity test methods. This webinar will provide an overview of how the test is preformed, what are common interferences, and how to use the data.

Jason Weiss, Oregon State University

Thursday April 28, 2022 Noon – 1 pm Central Time

Invitation coming soon…

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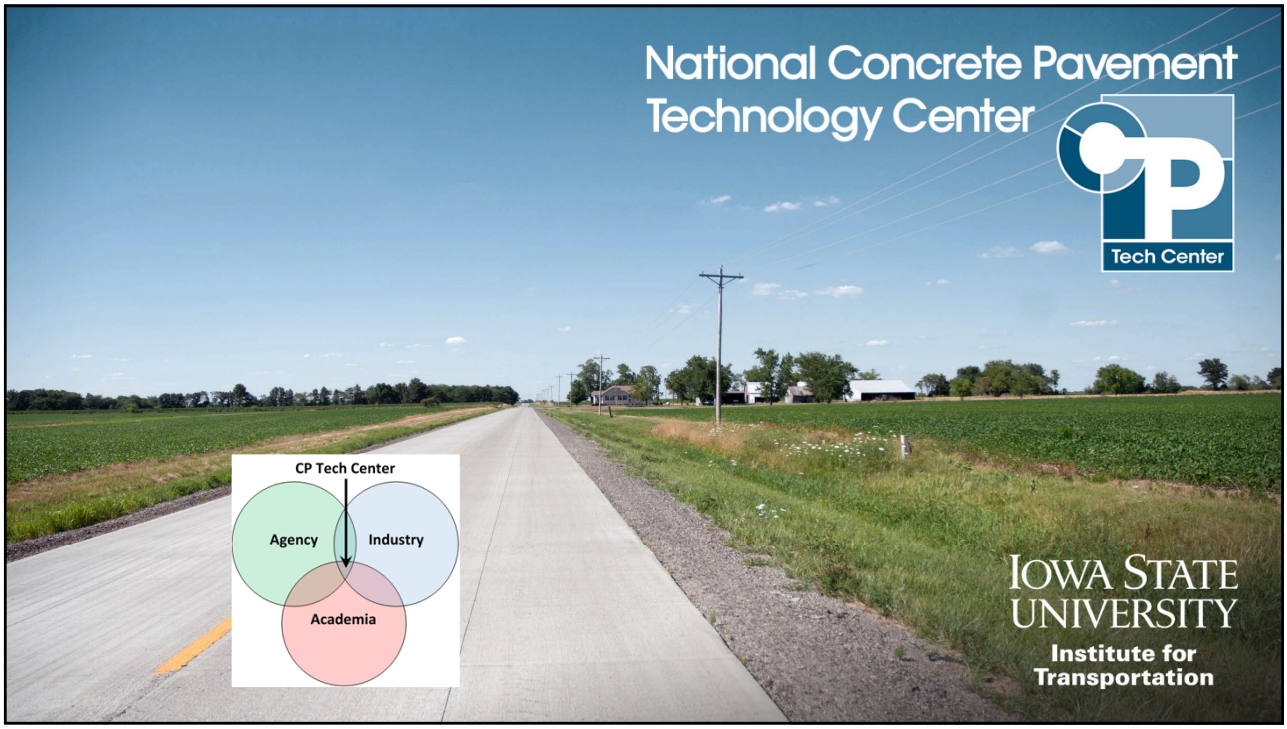
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