National Concrete Consortium (NCC) E-News December 2018

In association with the CP Road Map Program

The **NCC E-News** is the newsletter of the Long-Term Plan for Concrete Pavement Research and Technology (CP Road Map), a national research plan developed and jointly implemented by the concrete pavement stakeholder community. To find out more about the CP Road Map or to get involved, contact Dale Harrington (515-290-4014).

Moving Advancements into Practice (MAP) Brief


"Moving Advancements into Practice"
MAP Brief December 2018
Performance Experience and Lessons Learned from the SPS 2 Test Sections of the Long Term Pavement Performance Program (LTPP)

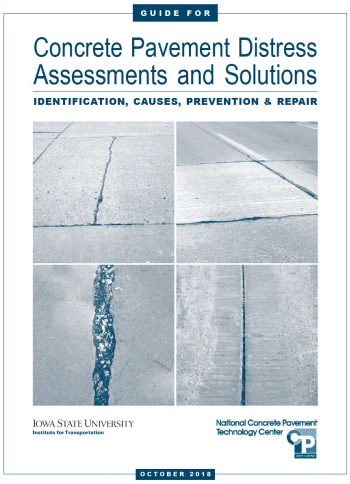
Moving Advancements into Practice (MAP) Briefs describe promising research and technologies that can be used now to enhance concrete paving practices.

The December 2018 MAP Brief, *Performance Experience and Lessons Learned from SPS 2 Test Sections of the Long-Term Pavement Performance Program (LTTP)*, provides a summary of the performance and lessons learned from the SPS-2 test sections, which represents the nation's largest study of concrete pavement performance. The MAP Brief also includes highlights from the SPS-2 Tech Days.

Download the December 2018 MAP Brief.

Latest CP Tech Center Publications

Publications - Guide for Concrete Pavement Distress Assessments and Solutions



The 500-page *Guide for Concrete Pavement Distress Assessments and Solutions* is intended to assist with pavement preservation by helping to identify the causes and remedies for concrete pavement distress. By understanding the basic principles of concrete pavement preservation, engineers will be able manage their pavement networks to provide safe and dependable roadways while minimizing disruptions to the public for repair and maintenance activities. The number of failure mechanisms that may occur in concrete are fairly limited. However, most distress is a combination of more than one mechanism, exhibiting an array of different forms. This manual goes into the details of the different types of distress observed in the field.

The guide took nearly three years in its development, with eight authors and a Technical Advisory Committee consisting of eight State DOTs, seven industry representatives, and an FHWA representative. They shared their knowledge and experience to help agency transportation engineers,

technicians, and construction personnel understand concrete pavement distress, including what causes the distress and how to prevent and repair it.

Click here to view the report.

Training - Webinar Training on Microfibers for Concrete Pavements

Presenters Jeff Roesler (University of Illinois Urbana-Champaign) and Amanda Bordelon (Utah Valley University)

This three-webinar series was sponsored by the CP Tech Center and funded by the TTCC pooled fund project. All of the series are available on the CP Tech Center website. The series cover the following topics:

- October 24, 2018 - Fiber Reinforced Concrete Overview
- November 7, 2018 - Effects of Macrofibers on Behavior and Performance of Concrete Slabs and Overlays
- December 5, 2018 - Overview of Macrofiber Software and Guidelines for Concrete Overlay Design

Click here to view the webinars.

NCC State Survey

Member states of the National Concrete Consortium (NCC) have the ability to poll other member states regarding specifications, materials, construction, research, or other issues related to concrete paving.

At the September 18, 2018 NCC fall meeting, Maria Masten, P.E., Concrete Materials Engineer with the Minnesota Department of Transportation and Chairperson of NCC presented the *NCC State Reports Fall 2018 - QC/QA State Practices, Tolerances, Quality Plans, Plant Certification, E-Construction, and PEM Status*.

Click here to access the presentation.

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. The research projects and the summaries described herein are the products of the researchers and sponsors.

Quantifying the Effects of Preservation Treatments on Pavement Performance (report date: October 2018)

This report presents a framework for quantifying the effects of preservation treatments on pavement performance, along with a guidance document to facilitate implementation of the framework. The proposed framework uses performance measures that quantify the changes in pavement performance in terms of condition (e.g., cracking and faulting of concrete pavements and cracking and rutting of asphalt pavements), service life, and life-cycle costs. Applicability of these measures was demonstrated using in-service pavement performance data. The guide also identifies alternate pavement performance measures (e.g., friction and composite pavement condition indices) and describes a process for assessing their appropriateness for use in quantifying the effects of preservation treatments on pavement performance. In addition, incorporating these measures in asset management systems would provide a means for selecting the

appropriate preservation treatments and optimizing the allocation of resources.

This project is the NCHRP Research Report 858. The research reported herein was performed under NCHRP Project 14-33 by Amec Foster Wheeler Environment and Infrastructure, Inc. (Amec Foster Wheeler) and R. Gary Hicks, LLC. Dr. Gonzalo R. Rada, senior principal at Amec Foster Wheeler, was the principal investigator. The other authors of this report are Dr. James M. Bryce, senior consultant, and Dr. Beth A. Visintine, senior engineer at Amec Foster Wheeler, and Dr. R. Gary Hicks and Dr. DingXin Cheng of R. Gary Hicks LLC. Click here to access the full document.

This project is contributing to objectives identified in CP Road Map Track 7: Maintenance and Preservation.

Jointed Plain Concrete Pavement Design and Construction Review (report date: February 2018)

An experimental research study was conducted to develop optimized concrete mixtures for jointed plain concrete (JPC) pavements and field evaluation of newly constructed JPC pavement sections along South Dakota highways. Using South Dakota aggregates, different concrete mixtures were assessed for optimum workability, durability, and cost. The optimized mixtures incorporated 1.5 in. aggregate top size and reduced cement content. Mixtures containing pea rock exhibited poor freeze-thaw durability. Mixtures with 1.0 in. aggregate top size and 65/35 coarse-to-fine aggregate ratio exhibited low workability.

A new laboratory technique that involves measuring the "specific work" of fresh concrete was developed to compare workability of different mixtures. Field data obtained from newly constructed JPC pavements demonstrated the following:

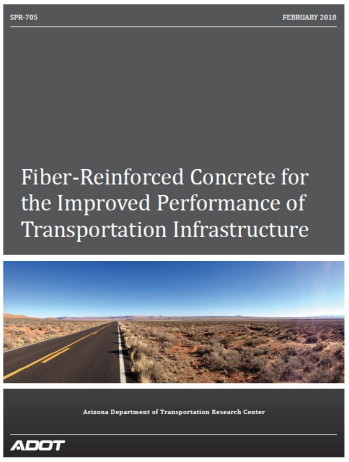
- Thicker concrete pavement results in greater change in joint gap width, while the presence of asphalt underlayment results in lesser change in joint gap width
- Unsealed transverse joints allow for significantly higher moisture ingress than silicone sealed or hot-pour sealed joints
- Silicone sealed joints exhibited the least moisture ingress
- Treating the freshly placed JPC pavement with 1.5 times the normal amount of curing compound had a significant effect on maintaining pavement smoothness with time
- High initial load transfer efficiency was achieved at joints with reduced dowel bar arrangements
- Joint faulting was negligible across joints with either standard dowel bar configuration or reduced dowel bar configuration

This project was sponsored by the Mountain-Plains Consortium (MPC) through project MPC-305. Authors were from the Department of Civil and Environmental Engineering, South Dakota State University: Nadim Wehbe, Ph.D., PE, Richard Reid, Ph.D., PE, Jason Stripling, PE, Brooke Edgar Hesham Mahgoub, Ph.D., and Mason Underberg, PE. This report is part of SDDOT Research Project SD2008-06. Click here to access the full document.

This project is contributing to objectives identified in CP Road Map Track 1: Material and Mixes for Concrete Pavements.

Fiber (Steel) Reinforced Concrete for Improved Performance of Transportation Infrastructure (report date: February 2018)

Steel fiber-reinforced concrete (SFRC) provides improved tensile performance of concrete. This improved performance can be used in slabs to reduce the volume of conventional steel reinforcement, create



longer spans, or reduce slab thickness.

Use of SFRC can lead to a reduction in structure weight and improvements in the safety and speed of construction. These benefits can result in cost savings in both the short term (construction labor) and the long term (improved quality and durability). To maximize the benefits of SFRC, it is necessary to establish optimal mix designs, identify target projects for implementation, and validate design procedures for SFRC. This project investigated the application of SFRC in pavements and bridge decks to reduce the amount of traditional steel used and to improve service level performance.

The project consisted of four main tasks. The first was a review of the literature on SFRC applications to elevated slabs and slabs-on-grade. This was followed by case studies on implementation of SFRC for pavement and bridge decks. Results of the case studies informed the development of an experimental test program. Finally, all results were compiled to develop design recommendations and an implementation plan. The report summarizes the project findings and provides recommendations for the implementation of SFRC in Arizona Department of Transportation infrastructure.

This project was sponsored by Arizona Department of Transportation and FHWA and written by the Texas A&M Transportation Institute. Authors: Anna C. Birely, Philip Park, Joshua A. McMahon, Xijun Shi, and Younho Rew. Click here to access the full document.

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

Reliable Early Opening Strength for Concrete Pavements and Patch Work (report date: February 2018)

The requirements for opening concrete pavement repairs to traffic vary greatly around the country. States and their transportation departments specify these different requirements for various reasons, including traffic opening requirements, environmental conditions, and locally available materials, among other factors. This project reviewed the practices and requirements for early-opening-to-traffic concrete used by state DOTs.

Transportation agencies have a need to specify the most efficient and effective early opening strengths and would benefit from understanding the latest thinking and practices adopted by similar agencies. Knowing the best approach to take can lead to dependable concrete, increased use of travel lanes, and a reduced cost of the materials and construction methods. A comprehensive literature review of state specifications and rehabilitation policy was completed. Current and former research on the use of high early strength concrete in pavement rehabilitation was reviewed as well as various material and equipment requirements specified by states in pavement rehabilitation. This report also reviewed responses from a recent National Concrete Consortium state survey which compiled responses on opening and rehabilitation criteria from states across the country.

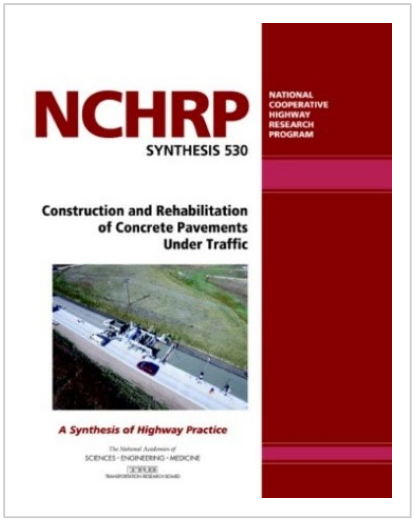
The current Louisiana opening specification for full-depth corner patching, full-depth jointed concrete patching, partial-depth patches of jointed concrete pavement, and continuously reinforced concrete pavement is an opening strength of 3,000 psi. The state of Louisiana also allows the use of the maturity method to determine concrete strength on a project by project basis, with the approval of the Chief Construction Engineer. The current specifications are based solely on compressive strength and are not necessarily based on the mechanics of materials. The authors recommend changing the 3,000 psi

requirement for early opening to traffic to the SHRP-206 findings of 2,000 psi. To gain the maximum benefit of early opening, the authors also recommend full adoption of the maturity method for estimating in-place strength.

This project was sponsored by Louisiana Department of Transportation and Development and FHWA and performed by the Louisiana Transportation Research Center. Authors: Zachary Collier, E.I., Amar Raghavendra, P.E., Tyson Rupnow, Ph.D., P.E. Click here to access the full document.

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

Construction and Rehabilitation of Concrete Pavements under Traffic (report date: 2018)



With advancements in materials, equipment, placement procedures, and project management techniques, the construction and rehabilitation of concrete pavements can be effectively accomplished under traffic. Many projects have been constructed under varying levels of traffic, ranging from temporary closures to the maintenance of high traffic volumes adjacent to or through the projects. However, the current state of the practice in constructing or rehabilitating concrete pavements under traffic relies primarily on a few high-profile and well-documented projects.

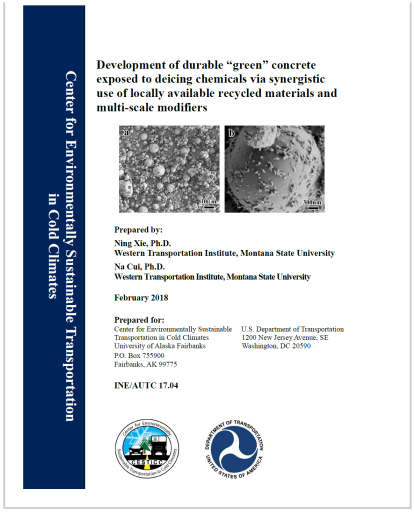
This study identified practices from projects representing a wider range of conditions and techniques. Information on existing practices and advancements in concrete pavement construction and rehabilitation was gathered through literature reviews and a survey of state transportation agencies, including that of the District of Columbia and the Illinois Tollway. Furthermore, sixteen case examples were reported to illustrate successful projects conducted under a variety of scenarios.

This project is the NCHRP Synthesis Report 530. The research reported was performed under NCHRP and written by Shreenath Rao, and Deepak Raghunathan of Applied Research Associates, Inc. Champaign, IL. Click here to access the full document.

This research is contributing to objectives identified in CP Road Map Track 7: Concrete Pavement Maintenance and Preservation.

Development of Durable "Green" Concrete Exposed to Deicing Chemicals via Synergistic use of Locally Available Recycled Materials and Multi-scale Modifiers (report date: February 2018)

From the economic and social perspectives, the use of waste materials would not be attractive until their costs and quality can satisfy the construction requirements. In this study, a pure fly ash paste (PFAP) was developed in place of ordinary Portland cement paste (OPCP). This PFAP was prepared at room temperature and without direct alkali activation. The samples were prepared using only the as-received class C coal fly ash (CFA), water, and a very small amount of borax ($Na_2B_4O_7$). On average, the PFAP featured 28-d compressive strength of about 36 MPa, and micro-nano hardness and elastic modulus 29% and 5%, higher than the OPCP, respectively. These mechanical and other properties of the PFAP make it a viable "green" construction binder suitable for a host of structural and non-structural applications. Advanced characterization of the raw material and PFAP pastes was



employed to elucidate the hydration mechanisms of this "green" binder. The obtained knowledge sheds light on the role of class C CFA in the hydration process and may benefit the expanded use of various CFAs in cementitious materials.

This project was sponsored by U.S. Department of Transportation and performed by the Center for Environmentally Sustainable Transportation in Cold Climates, University of Alaska Fairbanks. Authors are Ning Xie, Ph.D., and NaCui, Ph.D., of Montana University, Western Transportation Institute. Click here to access the full document.

This research is contributing to objectives identified in CP Road Map Track 1: Material and Mixes for Concrete Pavements.

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