National Concrete Consortium (NCC) E-News July 2017

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. If you'd like to find out more about the CP Road Map or learn how you can get involved, contact Program Manager Steve Klocke (sklocke@snyder-associates.com, 515-964-2020) or Dale Harrington (dharrington@snyder-associates.com, 515-964-2020).

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 July 2017 MAP Brief, *Developing a Quality Assurance Program (QAP) for Implementing Performance Engineered Mixtures for Concrete Pavements* describes a system for implementing Performance Engineered Mixes along with new test methods to better evaluate the overall quality and expected performance of the concrete pavement.

Download the July 2017 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.

Colorado Evaluates Pervious Concrete for Stormwater Management

Pervious concrete pavement (PCP) is gaining use as a stormwater Best Management Practice (BMP) for its ability to reduce pervious area, reduce direct runoff from developed sites, provide groundwater recharge, and filter out contaminants. The primary focus of this research was to evaluate the performance of a PCP which will be subjected to the freeze/thaw conditions in Colorado.

The researchers evaluated eleven different PCP mixtures with varying cement content and w/cm to develop a "base mixture" to carry out further analysis. This base mixture contained 525 lb/yd3 of cement with a w/cm of 0.30 and provided the optimal balance of compressive strength and porosity. Subsequent testing modified the base mixture by replacing a portion of the cement with fly ash. The results indicated that as fly ash replacement rates increased, the compressive strength and porous space of the PCP decreased; however, the freeze-thaw durability of the mixture improved (up to 30% fly ash replacement).

Based upon the results of this research, a PCP test section was constructed utilizing a mixture with 525 lb/yd3 cementitious material with 20% fly ash replacement, a w/cm ratio of 0.3, air

entraining agent (AEA), and a hydration stabilizer.

Test results of the mixture placed in the field indicated a 28-day compressive strength of 2503 psi and a 28-day porosity of 10.17%, which exceed the benchmarks of 2000 psi and 10%, respectively.

This research was sponsored by the Transportation Research Board (TRB) Committee AFN20 Standing Committee on Properties of Concrete and was completed by Hager, Durhan, and Rens. Click here to access the full document.

Pervious Concrete Pavement Test Section After Storm Event

This research is contributing to objectives identified in CP Road Map Track 12: Concrete Pavement Sustainability.

Washington State DOT Evaluates Performance of Performance-Based Mixes

The 2014 Washington State DOT (WSDOT) Standard Specifications revised the requirements for contractor mix designs for bridge decks to remove some of the more prescriptive requirements and replace them with performance-based requirements. The intent of these changes was to focus on the overall performance of the concrete rather than providing a recipe.

The previous specifications provided minimum requirements for cementitious content and required the use of fly ash. The performance-based specifications eliminated the cement and fly ash content requirements, replacing them with performance requirements for freeze-thaw durability, permeability, shrinkage, scaling, modulus of elasticity, and density.

To evaluate the effectiveness of these changes, WSDOT visually inspected the undersides of 28 bridge decks for cracks, 15 were constructed using the performance-based specification and 13 were constructed using the traditional WSDOT specification. In general, the bridges constructed with performance-based concrete exhibited fewer visible cracks than the traditional concrete.

Based upon this research, no significant changes to the performance-based bridge deck specifications were recommended.

This research was performed by the Washington State Department of Transportation, in cooperation with the Federal Highway Administration, by Ferluga and Glassford. Click here to access the full document.


Transverse Cracking on Underside of Bridge Deck

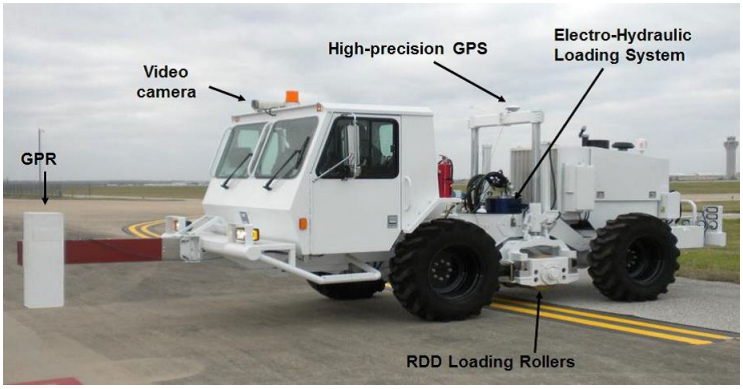
This research is contributing to objectives identified in CP Road Map Track 2: Performance-Based Design Guide for New and Rehabilitated Concrete Pavements.

Continuous Deflection Device to Select Rehabilitation Strategies for Concrete Pavement

The Texas DOT (TxDOT) has been actively developing and implementing non-destructive testing for several decades. Two devices that have been widely used include the Rolling Dynamic Deflectometer (RDD) and

Ground Penetrating Radar (GPR). The RDD utilizes both static and dynamic loading to measure pavement surface deflections. GPR has been used by TxDOT for measuring pavement layer thickness and for identifying defects within the pavement layers. Based upon the success of these two independent platforms, the TxDOT initiated a study to combine the two technologies into a single combined unit called the Total Pavement Acceptance Device (TPAD).

The TPAD is now fully operational and is being utilized to evaluate distressed concrete pavements. The system has three rolling geophones and collects data at 2 mph. Deflection data are reported for every two inches of travel, permitting the TPAD to provide a Load Transfer Efficiency (LTE) evaluation of every joint and crack in the pavement. The main application of the TPAD is to evaluate distressed pavements for rehabilitation or decide if the pavement is structurally inadequate and needs to be replaced.



TxDOT's Integrated GPR and Rolling Deflection Unit

TPAD Integrated Data Display

This project was completed by the Texas Transportation Institute and the Texas Department of Transportation by Scullion, T and DarHao, C. 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.

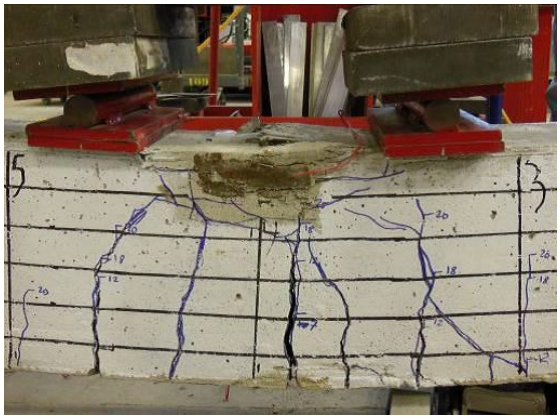
High-Performance Environmentally Friendly Concrete

Can a concrete mixture be designed to improve performance while at the same time being more environmentally friendly and less costly? This was the goal of the Missouri DOT (MoDOT) in the development of two new high-performance concrete (HPC) mixtures for pavements (Eco-Pave-Crete) and bridge infrastructure (Eco-Bridge-Crete).

The design of these mixes began by limiting the binder content to 540 lb/yd3 and 590 lb/yd3, respectively,

to reduce paste content and subsequently cost, CO2 emissions, and shrinkage. The mixtures were then optimized to provide high durability, low-shrinkage, and high resistance to early-age cracking. This optimization involved adjustments to the aggregate type and proportions, fiber use, and use of shrinkage-mitigating strategies such as lightweight sand (LWS) for internal curing and the use of expansive agents (EX).

The results of the research indicate that combination of shrinkage-reducing materials, including LWS and EX, coupled with fibers (synthetic or steel) is quite effective in providing a concrete mixture design with low cracking potential. The internal curing provided by the LWS reduces shrinkage and early-age shrinkage cracking and the incorporation of fibers results in greater splitting tensile and flexural strengths than a standard mix.



Crack Pattern of Beam Tested to Failure

This project was sponsored by the Missouri Department of Transportation and completed by Khayat, K., and Mehdipour, I. at the Missouri University of Science and Technology Center of Transportation Infrastructure and Safety/UTC program. Click here for the project abstract.

This research is contributing to objectives identified in CP Road Map Track 1: Materials and Mixes for Concrete Pavements and Track 12: Concrete Pavement Sustainability.

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