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.

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.

It should be noted that in addition to the NIRAS method, researchers at Clemson University have also developed the Miniature Concrete Prism Test (MCPT) for detecting ASR. While the work on this method has been completed the final report has not yet been published.

The "Accelerated Determination of ASR Susceptibility During Concrete Prism Testing Through Nonlinear Impact Resonance Ultrasonic Spectroscopy" project was conducted at the Georgia Institute of Technology by Krzysztof Lesnicki, et al. The project was funded by the FHWA. Click here to read the full report.

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

U.S. DOT studies the potential for high-volume fly ash concrete

Fly ash has been utilized as a partial replacement for Portland cement for many years to improve the material's strength and durability. Replacing cement with fly ash also reduces concrete's carbon footprint and makes beneficial use of an industrial by-product (currently 60 percent of fly ash is disposed of in landfills). Most concrete specifications limit fly ash substitution rates to 35 or 40 percent; however, recent studies have shown that excellent concrete can be produced with significantly higher cement replacement rates. Referred to as high-volume fly ash (HVFA) concrete, this material offers to further enhance the sustainability of concrete pavement. This project developed, tested, and evaluated HVFA mixtures with a 70 percent cement replacement rate.

While the HVFA concrete did have poor scaling resistance, the overall test results were favorable, indicating that the hardened HVFA concrete has comparable mechanical and structural properties and improved durability versus conventional concrete.

The "Development and Evaluation of High-Volume Fly Ash (HVFA) Concrete Mixes" project was completed through the Missouri University of Science and Technology by Jeffrey Volz et al. The project was sponsored by the U.S. Department of Transportation and the Missouri DOT. Click here to read the full report.

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

Texas investigates the use of manufactured sand for concrete pavements

With the depletion of natural sand sources in some locations, the use of manufactured fine aggregate (MFA) in concrete mixes has increased. However, because MFAs have properties that differ from natural sand, the resulting concrete pavement will also exhibit different attributes. This study identified which concrete properties are most significantly impacted and determined that if the MFA aggregates are properly evaluated, and the right proportions used, a good quality concrete can be produced. The research did recommend against using 100% limestone sand as it may cause workability and finishability related issues and will definitely cause loss of skid resistance.

This research, entitled "Use of Manufactured Sands for Concrete Pavement," was completed at the Center for Transportation Research at the University of Texas at Austin, by David Whitney, et al. The research was funded by the Texas Department of Transportation. Click here to read the full report.

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

Updates from the States: Michigan

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.

Read on for more information about concrete pavement research in the State of Michigan...

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