CP Road Map E-News June 2015

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 June 2015 MAP Brief, "Pavement Joint Deterioration: Recent Findings to Reduce the Potential for Damage" describes the causes of concrete pavement joint deterioration, ongoing research to study the problem, and recommendations for prevention.

Download the June 2015 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.

Spring 2015 National Concrete Consortium Meeting

The semi-annual meeting of the National Concrete Consortium took place April 21–23 in Reno, Nevada. The meeting was attended by 145 practitioners representing 27 of the 30 pooled-fund states.

Each NCC meeting highlights state practices on a particular subject. The theme for this meeting was 'curing.' Survey results of state DOTs on curing practices were shared. The discussion highlighted types of curing compounds and application rates utilized, use of evaporation retarders, problems with curling and warping, and experience with internal curing.

Other presentations included information on SCM's, assessing air void systems, results from projects utilizing internal curing, performance engineered mixes, and rapid setting patch materials. Attendees also toured the Nevada Cement Company plant and a local paving project.

The Fall 2015 National Concrete Consortium meeting is scheduled for September 15–17 in Milwaukee, WI. For additional details on the spring NCC meeting or the upcoming fall meeting click here.

Development and Evaluation of Vibrating Kelly Ball Test for the Workability of Concrete

Slipform concrete must be stiff so that the edges don't slump, yet it must flow under vibration to ensure a uniform pavement without voids. This prevents a unique challenge for measuring

the workability of a slipform mixture. Traditional measures of workability, such as the slump test don't apply because the mixture is so stiff. One novel approach to this dilemma is the development of the Vibrating Kelly Ball (or VKelly) test. This test was developed to quantitatively assess the responsiveness of a dry concrete mixture to vibration, as is desired of a mixture suitable for slipform paving.

The original Kelly Ball test was developed in the 1950s and consisted of a 6 inch diameter 30 lb. steel ball attached to a stem and frame. The ball was placed on the surface of the concrete and the depth of penetration was recorded. This test never found widespread usage and was discontinued by ASTM. The VKelly test consists of a Kelly ball apparatus with a vibrator attached. The overall weight of the VKelly apparatus is maintained at 30 lbs. The goal of this project was to assess the VKelly test in both the lab and field and validate the results using the Box Test.

Results of the test indicate that the VKelly test appears to be suitable for assessing a mixture's response to vibration (workability). The test identified a unique parameter, the VKelly index. Mixtures with a VKelly index in the range of 0.8 to 1.2 in./s1/2 seem to be suitable for slipform paving.

This project was sponsored by the FHWA and Pooled Fund Partners (Colorado, Iowa, Kansas, Michigan, Missouri, New York, Oklahoma, Texas, and Wisconsin) and was completed by P. Taylor, et al., at the National Concrete Pavement Technology Center at Iowa State University. Click here to access the full document.

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

Drinking Water Treatment Waste as a Low-Cost Curing Agent for Concrete

This paper presents results from a preliminary study that investigated the potential of using drinking water treatment waste sludge as an internal curing agent for concrete. The concept consists of using the high water content, primarily calcium carbonate material, as a concrete admixture. Two other commonly used internal curing agents, prewetted lightweight fine aggregate and a superabsorbent polymer, were investigated as a comparison. Cement mortars were tested for compressive strength, degree of hydration, and shrinkage. Micrographs of mortars containing the three different internal curing agents were compared visually to evaluate the distribution of internal curing agents and relative hydration.

Results show that drinking water treatment waste is an effective internal curing agent, improving cement hydration and compressive strength and mitigating autogenous shrinkage.

This report was completed by Q. Nowasell and J. Kevern and was published in the ACI Materials Journal, Volume 112 (January–February 2015). A full transcript of the report is may be obtained by clicking here.

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

MnROAD: Improving the Performance of Concrete Joints Using Geo-Composite Drain

Research conducted on MnROAD concrete test cells and some network test sections in Minnesota revealed widespread mid-depth scouring of the concrete pavement joints after only 12 years of service (Rohne & Burnham

Drainability Problems | GJD Installation | Close-up GJD Under Concrete Joint

2011). This phenomenon occurred less often in pavements that were supported by permeable asphalt stabilized bases (PASB) and some open graded aggregate bases (OGAB). Much slower draining bases are more typical in Minnesota however. To address this problem, a cost-effective subsurface drainage solution was investigated. This led to the concept of using geocomposite joint drains (GJD) directly under transverse joints.

The initial design was developed at MnROAD in 2013. It consisted of a geonet sandwiched between two non-woven geofabrics installed under the dowel bar baskets on top of a typical slower draining granular base. The 15-inch wide strips were anchored with the dowel basket to the base and daylighted to the ditch or embankment slope. The GJD material was found to be "laterally transmissive" as evident in the quantitative and qualitative evaluations done at MnROAD showing water from the pavement joints flowing to the daylighted outlets. The GJD concept shows potential to be used as an alternative to drainable base layers, as it is inexpensive in comparison to a PASB or OGAB, while still allowing the use of typical slower draining base layers that are stable during construction.

MnDOT has recently developed specification language for the implementation of geocomposite joint drain in lieu of PASB or OGAB, and continues to monitor the MnROAD test cell for lateral transmissivity and load transfer at the joints.

For more information, contact Dr. Bernard Igbafen Izevbekhai, P.E.

This research is contributing to objectives identified in CP Road Map Track 6: Innovative Concrete Pavement Joint Design, Materials, and Construction.

Effect of Materials and Age on the Coefficient of Thermal Expansion of Concrete Paving Mixture

This study examined the effect of the materials and age on the coefficient of thermal expansion (CTE) of concrete paving mixtures at 28 and 120 days. Concrete specimens were prepared in the laboratory by varying the mix design variables with different types of aggregate to produce different mixes using Portland cement. The microstructures of the concrete mixtures were also observed by scanning electron microscopy to determine the relationship between the volume change in concrete and the formation of microcracks. Statistical analyses of the experimental data suggested that the CTEs measured at 120 days are significantly lower than those measured at 28 days. An analysis of variance indicated that the mixture with granite results in significantly higher CTE reduction with time than the mixture with dolomite. The larger volume change with a higher CTE may be due to the formation of microcracks in concrete.

This study was completed by Kim, Yang, Nam, and Jeon and was published in the *International Journal of Road Materials and Pavement Design*, April 2015. A full transcript of the report may be obtained by clicking here.

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

Updates from the States: South Dakota

The South Dakota Department of Transportation conducts research to improve transportation technology. Specific goals include evaluation of new materials and methods, development of design and analysis techniques, and study of underlying causes of transportation problems.

The research effort addresses topics considered most important to the Department's mission of providing a transportation system for the state of South Dakota. Some of the responsibilities include developing annual research programs, administering contract research, conducting in-house research, and advising other SDDOT offices. The majority of SDDOT research is done through contracts with universities and other research partners.

Read on for more information about concrete pavement research in South Dakota...

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