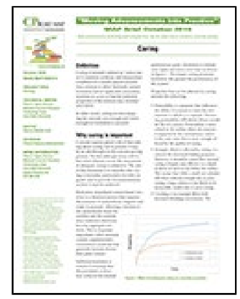
CP Road Map E-News October 2015

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 best practices and promising research that can be used now to enhance concrete paving.

The October 2015 MAP Brief, "Curing for Concrete Pavements," explains why proper curing is so important, how it should be accomplished, and the methods available.

Download the October 2015 MAP Brief.

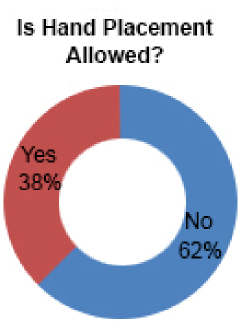
NCC State Survey Summaries

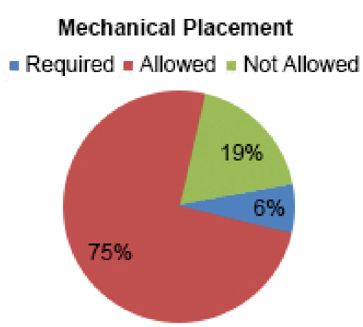
Member states of the National Concrete Consortium have the ability to poll other member states regarding specifications, materials, construction, research, or other issues related to concrete paving. This section highlights some of the questions posed and answers received through the NCC's ListServ feature.

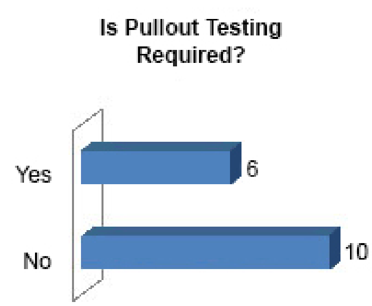
NATIONAL CONCRETE CONSORTIUM

Tie Bar Placement

Nebraska had several questions regarding the placement of tie bars.
Sixteen agencies responded. The first question asked whether agencies allowed hand placement of tie bars under any circumstances.The second question inquired whether agencies require mechanical placement of tie bars. The final question asked agencies if they conducted tie bar pullout tests. The results of the survey are below.







Skid Resistance

Pennsylvania polled the NCC group on whether state agencies had skid resistance requirements for new concrete pavements. Seventeen states responded. Thirteen states had no skid resistance requirements, though most of these indicated that they control skid resistance through their surface texturing specifications. Three states place restrictions on aggregates, generally using the acid insolubility test. Only California requires skid resistance testing on newly constructed pavements. California's specifications require that the new surface have a minimum coefficient of friction of at least 0.30. Several agencies did note that they regularly perform skid testing of their in-service pavements to identify potential problem areas.

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.

Fiber Reinforced Concrete for Concrete Pavement Slab Replacement

Unlike ordinary concrete pavement, replacement concrete slabs need to be open to traffic within 24 hours (sooner, in some cases); thus, high early strength concrete is used. However, it frequently cracks prematurely as a result of high heat of hydration, which leads the slab to develop plastic shrinkage. Fiber Reinforced Concrete (FRC) is known to provide good resistance to plastic shrinkage and has a proven record in the building industry, particularly with slab-on-grade application. This research project explored the potential use of FRC in concrete pavement slab replacement, particularly in controlling plastic shrinkage.

Five different fiber types—steel, glass, basalt, nylon, and polyethylene—were investigated. Additionally, the effect of fiber length was also investigated for the polyethylene fiber. The fibers were added at low-dosage amounts of 0.1% and 0.3% by volume. Restrained shrinkage tests were conducted to assess the cracking potential of the concrete mixtures and the ability for each fiber type to resist cracking. Results indicated that both polyethylene and nylon fibers provided the best resistance to early-age shrinkage. However, balling was a problem for nylon fiber reinforced concrete. Short fibers (< 1-in.) also had the best performance in resisting early-age shrinkage, while long fibers (> 1-in.) provided additional post-cracking capacity. For replacement slabs, it is recommended that a short polyethylene fiber be used to eliminate uncontrolled cracking.

Fiber Balls During Mixing | Pockets Due to Fiber Balling | Plain Concrete | Polypropylene Fiber Reinforced Concrete

Crack Width at 40X Magnification

This project was sponsored by the Florida Department of Transportation and completed by N. Suksawang, A. Mirmiran, and D. Yohannes at Florida International University. Click here to access the full document.

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

Ultra-Thin Whitetopping on Illinois Roadways and Parking Lots

A performance evaluation of ultra-thin whitetopping (UTW) pavements in Illinois was undertaken in 2012-2014 to evaluate current Illinois DOT (IDOT) design procedures and to determine design life criteria for future projects. This evaluation consisted of a visual distress survey of 20 existing UTW projects across the state to document and quantify distresses and falling weight deflectometer (FWD) testing of eight of these UTW projects to evaluate structural performance.

The findings of the visual distress surveys and FWD analysis largely agreed with each other and were studied to help provide a greater understanding of factors that affect UTW performance. From this analysis, a number of conclusions and recommendations were made regarding UTW pavement design and construction.

- Slab Thickness: Early pavement distresses were observed at one study location after just two years of service. Additional testing and investigation suggests the early-age distress may be due to variations in the thickness of the existing pavement, a deteriorating subgrade, or an unexpected increase in truck traffic. Considering that no premature failures were observed on the other 19 study locations, no change in the IDOT's design methods for UTW was recommended.
- Panel Size: Panel sizes of 5.5 foot to 6 foot are recommended for UTW roadways.
- Macro-Fibers: Macro-fibers proved very effective in providing extra structural capacity and maintaining joint load transfer efficiency. The report recommends their continued usage in UTW pavements of 4 inches or less and consideration for UTW sections up to 6 inches. The report recommended that if synthetic fibers are used, they be added at the batch plant and mixed with sufficient shearing force. Projects where synthetic macro-fibers were added directly in the ready-mixed trucks tended to produce fiber balls.
- Skewed Joints: Skewed joints were found to leave the pavement susceptible to faulting and acute corner and longitudinal distress. The report recommended the discontinuation of skewed joints on all concrete pavements.
- Saw-Cutting: Wide joints in UTW were found to lead to higher rates of joint deterioration. Thin, single-entry saw blades are recommended to cut joints in UTW pavements.
- Drainage: Surface drainage is especially important for UTW pavements. The cross slope of the pavement should be at least the minimum recommended for the functional class in order to keep surface water out of the joints which can deteriorate the asphalt-concrete bond under repeated loading.

This project was sponsored by the Illinois Department of Transportation and completed by D. King and J. Roesler at the University of Illinois at Urbana-Champaign. Click here to access the full document.

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

Precast Portland Cement Concrete Panels for Airfield Pavement Repairs

During the period November 2011 through August 2013, research was conducted to develop a precast panel repair system suitable for airfield pavement repairs. This investigation included the selection and refinement of a precast panel system, fabrication of precast panels, timed repair activities, and accelerated pavement testing. Simulated C-17 traffic was applied to three repair surfaces of various sizes to determine whether the precast panel repairs were suitable for emergency or contingency airfield operations.

This report presents the description of the process for selection and modification of a precast system, results of accelerated pavement testing including the passes-to-failure, surface deterioration, load transfer efficiencies, deflections, stress-strain measurements during trafficking, and three-dimensional finite element analyses.

Results indicated that the repairs were

(a) Saw cutting perimeter, (b) installing lifting eyes, (c) lifting pavement, (d) preparing dowel slots, (e) prepared repair area, (f)

capable of supporting anticipated contingency pass levels defined by the U.S. Air Force, but the precast panel system's dowel diameter should be increased to reduce stresses, decrease foreign object damage potential, and improve repair performance. Finally, the precast repair technology was compared to other expedient repair techniques in terms of repair speed, performance, and cost. Compared to other methods, the precast panel repair alternative provided similar return-to-service timelines and traffic performance at a slightly higher cost. Modifications to the system design and placement procedures are also recommended to improve the field performance of the panels.

This project was sponsored by the Florida Department of Transportation and completed by Sobanjo, Tawfiq, Twumasi-Boakye, and Inkoom at Florida State University and Sheldon Gibbs with Gibbs Group Engineers. Click here to access the full document.

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

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