National Concrete Consortium (NCC) E-News September 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. To find out more about the CP Road Map or to get involved, contact Steve Klocke or Dale Harrington (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.


"Moving Advancements into Practice"
MAP Brief September 2017
Concrete Pavement Recycling—
Project Selection and Scoping

The September 2017 MAP Brief, *Concrete Pavement Recycling – Project Selection and Scoping* provides guidance on identifying projects that may be good candidates for concrete recycling as well as considerations for uses of recycled concrete aggregate.

Download the September 2017 MAP Brief.

NCC State Survey Summaries

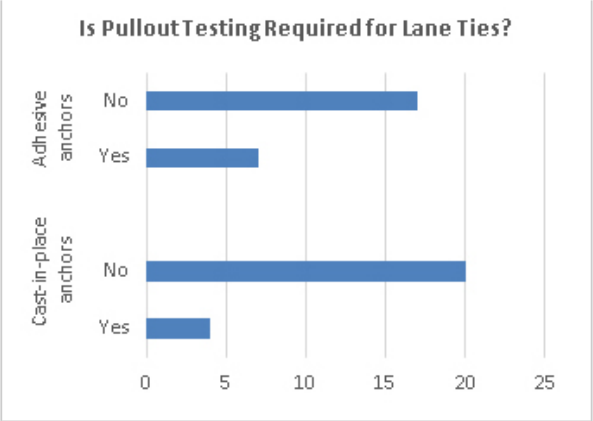
NATIONAL CONCRETE CONSORTIUM

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.

This section highlights some of the questions posed and answers received through the NCC's ListServ feature.

Tie Bar Pullout Testing

The Michigan Department of Transportation polled the NCC group regarding pullout testing for lane ties. Twenty-four agencies responded. Only four agencies responded that they require pullout testing for cast-in-place lane ties. A few more (7) agencies noted that they require pullout testing for tie bars that are drilled in and anchored with adhesive. For those agencies that do require testing of tie bars, the performance requirements varied widely.



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.

Use of Recycled Asphalt Pavement in Concrete

Pavement reconstruction and maintenance activities have resulted in large quantities of recycled asphalt pavement (RAP) stockpiles in many areas around the United States. Although a significant portion of this material is recycled into new HMA pavements, additional material remains available. The replacement of coarse aggregate in PCC with RAP has been proposed as a method that could provide economic and environmental benefits by providing a means to dispose of excess RAP and reducing the demand for virgin aggregates. This project validated previous investigations into the durability and mechanical properties of RAP-PCC and continued the investigation using advanced techniques to investigate the microstructure and crack propagation of RAP-PCC. Pavement performance evaluations and life cycle cost analysis were completed and guidelines to facilitate using RAP-PCC were developed.

The results of the research indicate that replacing virgin coarse aggregate with RAP had a detrimental effect on compressive strength, modulus of rupture, and split tensile strength, but improved the modulus of elasticity. A major weak point of the RAP-PCC system is the asphalt — cracks easily propagated through the asphalt layer around the RAP particles.

Agglomerated RAP particles in concrete cylinder

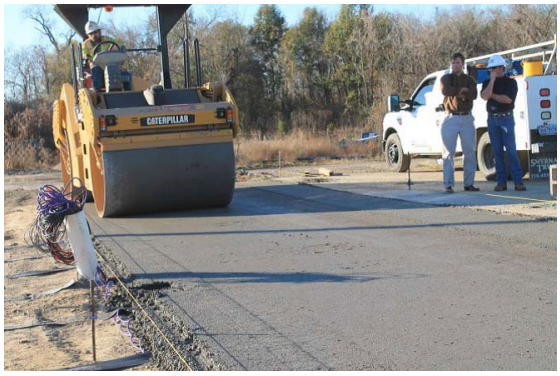
While the substitution of RAP appears to have detrimental effects on many of the mechanical properties of the concrete, there may still be practical uses and benefits to using RAP-PCC. The reduction in mechanical properties can be offset by using slightly thicker pavements. Even with the increased pavement thickness, the production of RAP-PCC pavements may have lower costs, consume less energy, and release fewer pollutants, greenhouse gases, and toxic materials than plain PCC pavement. Another opportunity is to use RAP-PCC as the bottom lift in a two-lift pavement where the reduced mechanical properties have less impact on the pavement performance but can still provide economic and environmental benefits.

This project was sponsored by the Texas Department of Transportation and was completed by Mukhopadhyay and Shi at the Texas A&M Transportation Institute. 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 and Track 12: Concrete Pavement Sustainability.

Roller Compacted Concrete over Soil Cement Under Accelerated Loading

Thin roller compacted concrete (RCC) pavements (i.e., pavements < 8") have drawn significant interest recently due to their potential in situations with low volume heavy-truck traffic. The objectives of this study were to determine the structural performance and load carrying capacity of thin RCC surfaces under accelerated pavement testing (APT) and for determining the applicability of adding a cement-treated or stabilized base to the pavement system.



Compaction of RCC

Six pavement sections 72 feet long and 13 feet wide were constructed. The test sections included three RCC thicknesses (4 in., 6 in., and 8 in.) and two base designs: a 12 in., 150 psi UCS cement-treated soil base and an 8.5 in. 300 psi UCS soil cement base over a 10 in. cement-treated subgrade. The pavements were tested using an ATLaS30, a heavy vehicle simulation device.


ATLaS30 testing device

All the RCC slab thicknesses (4 in., 6 in., and 8 in.) received a significant amount of heavy truck traffic. The thinner sections (4 in. and 6 in.) were able to be loaded to failure due to fatigue cracking. The results indicated that thin RCC pavements can provide outstanding load carrying capability for low-volume roads with significant heavy truck traffic.

The research also found that the pavement design procedures used for conventional PCC are not appropriate RCC pavements carrying mixed highway traffic. A new thickness design procedure specifically for the design of thin RCC pavements was developed.

This research was sponsored by the Louisiana Department of Transportation and Development and as completed by Zhong, Rupnow, and Mahdi at the Louisiana Transportation Research Center's Pavement Research Facility. Click here to access the full document.

This research is contributing to objectives identified in CP Road Map Track 8: Materials and Mixes for Concrete Pavements.

Cracking and Debonding of a Thin Fiber Reinforced Concrete Overlay

The use of fiber reinforcing in conjunction with concrete overlays has gained favor as it aids in minimizing crack widths, reduces surface spalling, and increases wear resistance.


Full-scale thin FRC overlay

Previous reports of field constructed fiber reinforced concrete (FRC) overlays indicate that the use of fiber reinforcement reduces the rate of debonding.

The objectives of this project were to determine the impact of incorporating fibers on bond by means of wedge splitting and shear bonding tests. Three different types of fibers (slender and long polymeric, long polymeric, and short steel) at two different dosage rates were evaluated.

Test results found that tensile interfacial energy increased with fiber-reinforcement. Bond tests indicated that interfacial fracture occurred through the overlay mixture and was proportional to the number of fibers that intersected the fracture path near the surface. Finite element analysis verified that crack width, vertical lift-off, and debonding length all decrease as the fracture energy across joints increases or as the interfacial

tensile bond increases.

This project was sponsored by the USDOT and the Mountain-Plains Consortium and was completed at University of Utah by Kim and Bordelon. Click here to access the full document.

This research is contributing to objectives identified in CP Road Map Track 8: Materials and Mixes for Concrete Pavements.

Load Transfer Restoration with Diamond Grinding on Rigid Pavements

This research paper evaluated the short- and long-term effects of load transfer restoration (also called dowel bar retrofit) with diamond grinding (LTR/DG). Dowel bar retrofit and diamond grinding are the two most commonly used concrete-surface pavement restoration treatments. These treatments are estimated to extend pavement life by 10–15 years; however, little research has been completed to predict the effect of LTR/DG on service life. This study evaluated field data from the Washington State Department of Transportation (WSDOT) for pavement sections receiving LTR/DG treatments from 1996–2006.

Roadway rehabilitated with LTR & DG

Researchers developed nonlinear regression models describing the initial effect of the LTR/DG and the performance loss in the years following the treatment. Findings indicated that the performance of LTR/DG is relatively constant until the pavement is about 30 years old, at which point it begins to rapidly decrease. Therefore, to achieve the greatest initial performance change, LTR/DG should be performed on pavements younger than 30 years.

This project was sponsored by TRB committee AFD50 – Standing Committee on Design and Rehabilitation of Concrete Pavements and completed by Montgomery, Labi, and Haddock. This paper was presented at the 96th Annual TRB meeting in January 2017. 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.

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