CP Road Map E-News March-April 2012

The ***CP Road Map E-News*** is the bi-monthly 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 Dale Harrington, dharrington@snyder-associates.com, 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-April 2012 MAP Brief, Concrete Pavement Sustainability: State-of-the-Practice, has recently been published. This MAP brief discusses full-depth repair as a rehabilitation technique for deteriorated concrete pavements.

Download the March-April 2012 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.

Louisiana researchers investigate thermal properties of concrete pavement

In the December 2011 report, *Determination of Coefficient of Thermal Expansion Effects on Louisiana's PCC Pavement Design*, Louisiana State University researchers measured typical coefficient of thermal expansion (CTE) values for PCC pavements constructed with various types of coarse aggregate. This study examined the relationship between the CTE and a variety of critical variables including concrete age, aggregate type, and mechanical properties. For each aggregate type, CTE tests were carried out on concrete specimens with different ages, aggregate proportions, and exposed to a range of relative humidities. Test results showed that aggregate type had a statistically significant impact on measured CTE values, and to a lesser extent, relative humidity. However, concrete age did not have a significant effect on the measured CTE. The researchers also evaluated the impact of CTE on important pavement performance parameters including cracking, roughness, and faulting, as predicted using the Mechanistic-Empirical Pavement Design Guide (MEPDG). One key finding was that maximum transverse joint spacing is directly dependent on aggregate type. Recommendations for future work include further evaluation using DARWin-ME and a more in-depth study focusing on nonlinear stress analysis as it relates to curling and failure of PCC pavements.

Download the report.

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

National CP Tech Center publishes feasibility study examining embedded sensors and systems in highway structures

A recent report published by the National Concrete Pavement Technology Center investigates the use of micro-electromechanical systems and sensors (MEMS) for health monitoring purposes in highway pavement structures. Recent advancements in MEMS technology have created a variety of opportunities for continuous, long-term, and real-time structural health monitoring (SHM) at low life cycle costs. In order to evaluate the feasibility of implementing this technology, the researchers conducted a state-of-the-art survey on MEMS devices and current vendors. In addition, a concrete slab was instrumented with the WAKE RFID wireless HardTrack Concrete Monitoring System, Sensirion Digital Humidity Sensor, and COMMAND Center concrete temperature and maturity meters in controlled laboratory and field studies. Test results showed that this system is fully functional both in the laboratory and in the field under severe weather conditions. However, although the future of MEMS technology is very promising, developments are still needed in many areas such as reliability and energy supply. In addition, the researchers have made numerous recommendations for future MEMS research including the development of a pavement strain monitoring system and an overweight/heavy vehicle pre-alert and detection system.

Download the report.

This research is helping to fill knowledge gaps outlined in CP Road Map Track 9: Evaluation, Monitoring, and Strategies for Long-Life Concrete Pavements.

Minnesota researchers develop new design procedures for unbonded concrete overlays

A recent University of Minnesota report evaluated existing design procedures for unbonded concrete overlays (UBCO) and introduced new concepts used to analyze the long-term performance of these overlay systems. Currently, UBCO design procedures are based on simplified mechanistic models or empirical equations. To improve upon these concepts, the research team has proposed a new approach based on fracture mechanics concepts known as the cohesive zone model (CZM). The CZM was applied to pavement analysis and design using the finite element method and relationships between ultimate load capacity, material properties, and geometry of both single-layer pavements and UBCOs were examined in detail. In addition, special attention was paid to test sections at the Mn/ROAD research facility in order to analyze reflective cracking commonly associated with UBCOs. The results of this study could eventually enable pavement designers to optimize the UBCO systems and effectively reduce overall thickness. A systematic study of UBCOs and experimental program to assess the accuracy of fracture mechanics predictions are strongly recommended by the researchers in the future.

Download the report.

This research can be categorized under CP Road Map Track 8: Concrete Pavement Construction, Reconstruction, and Overlays.

European Concrete Paving Association examines long-term sustainability of concrete pavements

The recent report, *Concrete Roads: A Smart and Sustainable Choice*, published by the European Concrete Paving Association (EUPave), draws on international experience in order to demonstrate that concrete pavements satisfy basic criteria for sustainable construction with respect to the environment, the economy, and society. Various metrics used to gauge the impact of concrete pavement on the environment, including carbon footprint, life cycle assessment, surface albedo, and overall impact on fuel consumption, are examined in detail. In addition, economic considerations that must be taken into account when choosing pavement type, such as the total cost of maintenance and long term

price stability, are compared. The impact of concrete pavements on the well-being of the traveling public must be considered as well, with ride comfort, noise, and safety of the utmost importance. Overall, this report clearly illustrates the strengths of concrete pavements from the perspective of sustainable development. Ongoing research will continue to address areas for improvement, but the long term benefits of concrete pavements when evaluating the entire life cycle are apparent.

Download the report.

This work is meeting research needs identified in CP Road Map Track 12: Concrete Pavement Sustainability.

Updates from the States: Ohio

The Ohio Department of Transportation (ODOT) administers concrete pavement research through the Office of Statewide Planning & Research. The research program is structured to be responsive to the department's business plan and strategic initiatives, as well as emerging topics and emergency concerns. Furthermore, concrete pavement research is structured to maximize investments, take advantage of new technologies, and produce practical results that have a strong possibility of implementation. All ODOT divisions, districts, and offices can submit strategic research plan problem statements that address specific needs within ODOT, relate to one or more of the strategic research focus areas, and are included in an approved division/office strategic research plan.

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

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The National Concrete Pavement Technology Center at Iowa State University provides operations support services to the CP Road Map program.

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