National Concrete Consortium (NCC) E-News July 2019

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 Dale Harrington (515-290-4014).

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.

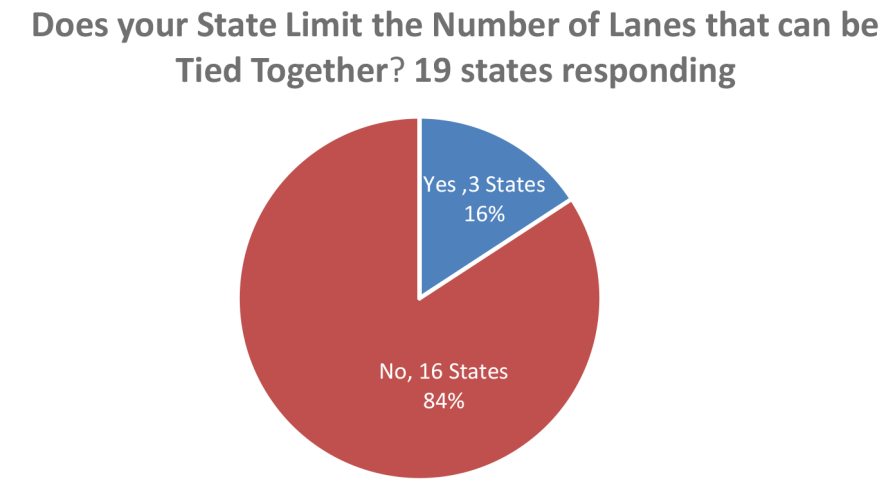
The July 2019 MAP brief, *Optimized Joint Spacing for Concrete Overlays with and without Structural Fiber Reinforcement*, summarizes field research in Iowa on optimized joint spacing, showing that thicker overlays (with or without fibers) exhibited increased percentages of joint activation. Also, the ratio of slab length to radius of relative stiffness appears to be a good indicator for joint activation behavior and can be used to help optimize joint spacing design for concrete overlays.

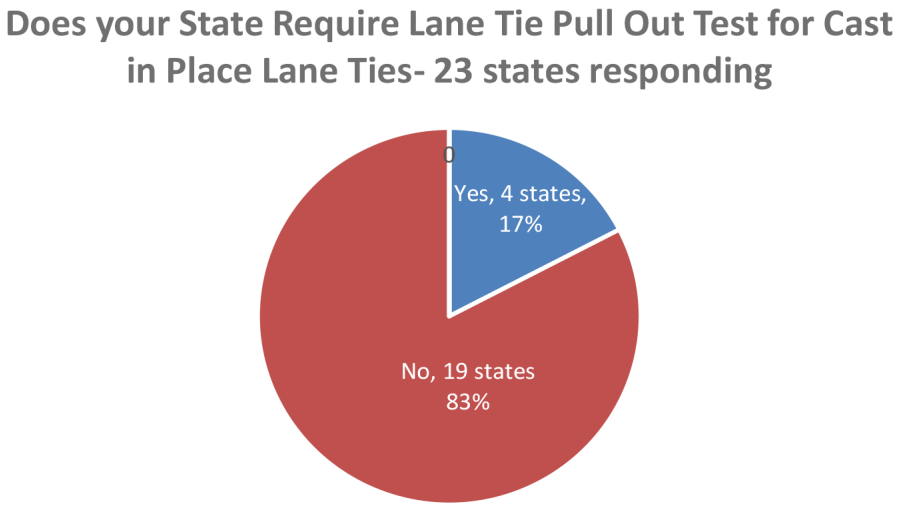
Download the July 2019 MAP Brief.

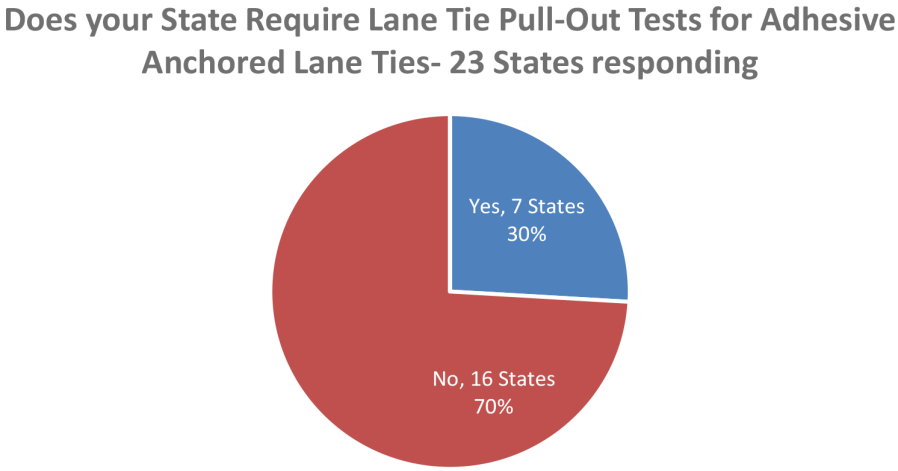
NCC State Survey

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.

The Missouri Department of Transportation polled the NCC group regarding limits placed on the number of lanes that can be tied (19 states responded) and the use of pull-out tests for lane ties (23 agencies responded).







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. The research projects and the summaries described herein are the products of the researchers and sponsors.

Premature Failure of Concrete Patching: Reasons and Resolutions (report date: March 2018)

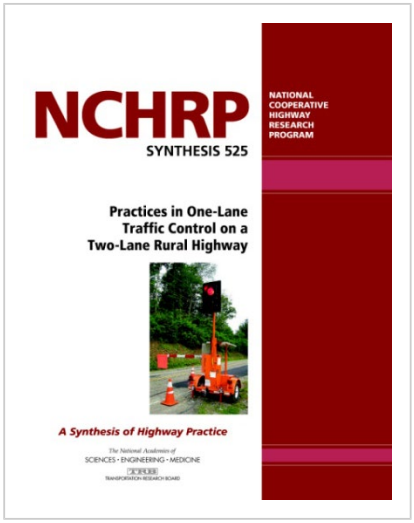
The performance of concrete patches in continuously reinforced concrete

pavement in Virginia varies from less than one year to many years. The purpose of this study was to determine the causes of premature repair failure in continuously reinforced concrete pavement. Four pavement sections were monitored for patching operations. Mixture designs had high cementitious material contents. The patches were typically constructed with a short lane-closure time, often at night, with only about five to eight hours of cure time before opening of the roadway to traffic. The strengths were determined using the temperature-matched curing system. The observations and testing indicated that the two most significant causes for premature failure were: (1) the use of high early-strength concrete mixtures with high cement contents that cause excessive thermal and shrinkage cracking, and (2) failure to assess the overall pavement condition, which could have led to an overlay with structural improvement rather than just patching. Some other areas of concern were cutting of the continuous reinforcement, reestablishing the continuity of the reinforcement in the patch, damaging concrete adjacent to the patch during concrete removal, poor concreting practice with respect to proper consolidation of the concrete near the joint, and opening to traffic before adequate concrete strength was achieved. Based on these findings, the study recommended revisions to future special provisions for concrete patching and the Virginia Department of Transportation (VDOT) Materials Division Manual of Instructions, Chapter 6.

This report was written by Michael M. Sprinkel, P.E., Associate Director, M. Shabbir Hossain, Ph.D., P.E., Associate Principal Research Scientist, Celik Ozyildirim, Ph.D., P.E., Principal Research Scientist, Virginia Transportation Research Council, Charlottesville, VA. Click here to access the full document.

This project is contributing to objectives identified in CP Road Map Track 7: Maintenance and Preservation.

Practices in One-Lane Traffic Control on a Two-Lane Rural Highway (report date: 2018)



Temporary traffic control, also known as maintenance of traffic, is critical to minimizing congestion and maintaining mobility during planned and unplanned activities as well as providing a safe work zone for both road users and workers. This synthesis identifies innovative practices and devices for establishing one-lane traffic control on rural two-lane highways.

A literature review and detailed survey responses from 45 (of 50) departments of transportation (90% response rate) are presented. Innovative examples of one-lane two-way traffic control operations at roundabouts and applications of temporary portable rumble strips and driveway assistance devices are also discussed in this synthesis, providing additional insights on the state of the practice. The information presented in this synthesis will be extremely useful to state agencies as they review their current practices regarding one-lane traffic control on two-way rural highways and assess what changes to their current procedures they can implement.

This project is NCHRP Synthesis 525. The research reported herein was performed under NCHRP Project 20-05 Panel, Topic 48-11 and written by Yashar Zeinali Farid, David A. Noyce, Madhav V. Chitturi, Yu Song, William F. Bremer, Andrea R. Bill, Traffic Operations and Safety (TOPS) Laboratory ,University of Wisconsinâ€“Madison, Madison, WI. Click here to access the full document.

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

Accelerated Testing of Full-Scale Thin Bonded Concrete Overlay of Asphalt (report date: July 2018)

A research study was conducted with the goal of determining the expected performance life of 4 in. to 7 in. thin bonded concrete overlay of asphalt (BCOA) in California. Eleven thin BCOA sections were built and tested with the Heavy Vehicle Simulators (HVS) in Davis, California. The performance of the sections in the HVS testing provided insight into the mechanics of the thin BCOA structures and the effects the different rapid-strength concrete materials, traffic, jointing, and base factors on their performance, including testing in both very wet and very dry conditions. Overall, the performance of the thin BCOA sections in the HVS testing was excellent. The 11 sections resisted the predefined HVS loading without cracking. In five of the sections, that loading was equivalent to six million single-axle loads and included load levels more than twice the legal limit in California, channelized traffic at the shoulder edge of the slabs, and a continuous water supply that simulated flooded conditions. The main conclusion from this research study is that a well-designed, well-built, thin bonded concrete overlay with half lane-width slabs placed on top of an asphalt base that is in fair to good condition can provide 20 years of good serviceability on most of California's non-interstate roadways.

This research was sponsored by the California Department of Transportation Division of Research, Innovation, and System Information and conducted by University of California Pavement Research Center Department of Civil and Environmental Engineering, University of California, Davis. The authors were Angel Mateos, John Harvey, Fabian Paniagua, Julio Paniagua, and Rongzong Wu. Click here to access the full document.

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

Curing Concrete Paving Mixtures (report date: November 2018)

Proper curing of a newly placed concrete pavement is an essential step to ensure that the concrete as designed, batched, and placed reaches its full potential. Improper curing can result in inadequate hydration and reduced concrete strength and can negatively affect the near surface concrete properties including increased permeability, decreased wear resistance, and increased risk of plastic shrinkage cracking. This Tech Brief focuses specifically on approaches commonly used for curing cast-in-place concrete pavements. The most common method is the application of membrane-forming curing compounds, although fogging, plastic sheets, wetted materials, and insulated blankets may also be used depending on the type of project and the ambient conditions during and after placement. Also discussed briefly is internal curing using prewetted lightweight aggregate. In the context of this Tech Brief, two curing steps are considered: (1) initial curing applied during or immediately after the concrete is placed under less-than-favorable conditions, and (2) conventional curing applied once the concrete has undergone initial set.

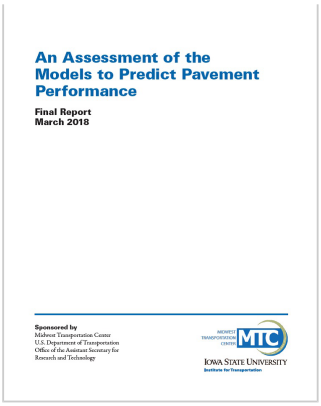
This tech brief was developed by FHWA and written by Tom Van Dam, NCE, and prepared under FHWA's Concrete Pavement Best Practices Program (DTFH61-14-D-00006). Applied Pavement Technology, Inc. of Urbana, Illinois served as the contractor to FHWA. Click here to access the full document.

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

An Assessment of the Models to Predict Pavement Performance (report date: March 2018)

Data collected by the Iowa Department of Transportation (DOT) regarding road

conditions across the state of Iowa were used to model pavement condition index (PCI). The data were for calendar year 2013, with the exception of updated PCI values from 2014 and 2015 and indicators of the resurfacing of road segments in 2014 and 2015. The data file provided by the Iowa DOT consisted of nearly 4,000 observations.



Eighteen different road conditions and measures were considered as possible model inputs. Of the 18 measures, 11 were used in the final prediction of PCI in 2014 and 2015 for portland cement, composite, and asphalt cement pavement types. These measures included International Roughness Index (IRI), friction value, age, average daily traffic, PCI value in 2013, number of lanes, daily temperature change, surface type, pavement thickness, speed limit, and reconstructed kips.

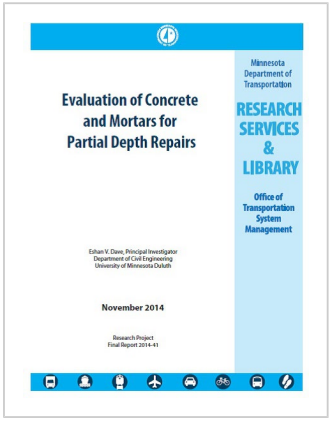
Series of multiple regression models were developed for the different pavement types, including aggregated pavement types with combined data.

The results reveal that all 11 variables except age have a statistically significant relationship with PCI. The efficacies of the derived models, as measured by R2 values, range from 61% to 83%. Additional analyses also show that the efficacies of the derived models, as measured by root mean square error (RMSE) values, range from 6.29 to 9.52. We can interpret the RMSE values as indicating that approximately 95% of all prediction values should fall within 12.58 and 19.04 of the PCI values predicted by the models. Therefore, it is concluded that linear predictive models, which involve distress and descriptive characteristics of road conditions, provide a reasonable basis for estimating PCI. However, these models can be further improved by examining nonlinear effects.

This research was sponsored by the Midwest Transportation Center at Iowa State University and the U.S. Department of Transportation, with the performing organization at the Department of Business Intelligence and Analysis, Heider College of Business, Creighton University, Omaha, Nebraska. Authors were William Duckworth, Ravi Nath, and Victor Ekpoke. Click here to access the full document.

This research is contributing to objectives identified in CP Road Map Track 11: Economic and Business Management.

Evaluation of Concrete and Mortars for Partial Depth Repairs (report date: November 2014)



Partial-depth patching mixes must rapidly gain strength to allow the roadway to be reopened to traffic quickly. A patch should also bond well to the substrate to prevent the patch from separating from the existing material and be durable enough to withstand harsh winters. The objective of the research described in this report is to develop improved guidelines for evaluation of pre-bagged commercial patching mixtures and to recommend effective construction practices. To achieve these objectives, 13 different cementitious materials were selected and tested to determine key properties including strength gain, shrinkage, bond strength, and durability. The impact of the proposed research will be a better performing patch material as well as performance criteria that can be used to compare the materials tested in this program to new materials that will certainly be developed in the future. This research was conducted in four main phasesâ€"a literature review and development of a testing plan and three phases of laboratory testing campaigns. The most commonly available acceptance specification for partial-depth patching materials is the ASTM C928. This specification was followed and the outcomes of each of the recommended tests were evaluated in context of the performance of the patching materials. Several additional tests were developed and conducted to evaluate the bonding properties of patching materials and correlations between lab measured properties were also evaluated. Through the aforementioned testing and analysis, a laboratory testing-based acceptance

procedure was developed for partial-depth patching materials to be used by MnDOT.

This research was sponsored by Minnesota DOT and performed by the University of Minnesota, Duluth, Department of Civil Engineering and Villanova University. The authors are Eshan V. Dave, Jay Dailey, and Eric Musselman. Click here to access the full document.

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

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