Updates from the States: Nebraska (April 2015)

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In the State of Nebraska, research is coordinated through the Nebraska Department of Roads (NDOR) Research Program. This program brings together people from various areas of the transportation industry (public and private) and uses their pool of knowledge and experience to prioritize statewide research ideas. A council made up of representatives from various transportation entities—cities, counties, consultants, contractors, FHWA, NDOR, and the University of Nebraska—prioritizes the research ideas.

Based on the proposals received, the Research Section submits a research program to the NDOR Research Advisory Committee (RAC). The RAC is made up of NDOR division heads and district engineers, as well as an FHWA representative. The RAC reviews and edits the proposed program and approves the research program for the next fiscal year. Furthermore, research results are implemented through new specifications, standard plans, test methods, new or revised procedures, computer programs, manual changes, or policy and procedure directives.

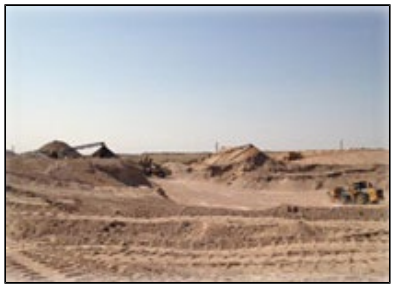
Although the majority of concrete materials research is conducted through in-house research, the majority of projects are conducted for the NDOR under contract by the University of Nebraska, other universities, or private organizations. Collaborative research also offers the NDOR the ability to further leverage state funds and includes partners such as the Transportation Research Board (TRB), Transportation Pooled Fund (TPF) Program, state highway agencies, and the Nebraska Transportation Center (NTC).

To learn more about Nebraska-funded and in-house research, follow the links below:

- Nebraska DOR State Planning and Research Program: http://www.transportation.nebraska.gov/mat-n-tests/research/researchmain.html
- Nebraska In-house Concrete Research: http://www.transportation.nebraska.gov/mat-n-tests/inhousepcc/inhousepcc.html

Recently Completed In-house Research

Optimized Aggregate Gradation for PCC Mix Designs Evaluation—47BR Concrete



The main purpose of this research was to optimize aggregate blends utilizing locally available materials. With industry collaboration, the NDOR embraced a change that impacts a specification implemented in 1947 for Class 47B concrete. This aggregate optimization embraces today's availability of new blended cements in Nebraska and improves future gradation from a gap-graded to a more densely graded mix design. Combined aggregate gradations were evaluated for mechanical and durability characteristics for paving mix designs. The outcome of these evaluations resulted in the introduction of a new aggregate grading band for the NDOR, which was named 47B Revised (47BR). This new grading band allows the use of more locally available materials currently being produced in the state, therefore making the new mix design more

economical.

The goal for the new 47BR combined aggregate gradation is to have the contractor, with agency oversight, develop a concrete mix design with an optimum combined aggregate gradation and provide the contractor with the responsibility of testing and control to ensure a quality product. This report presents the results of the evaluation and optimization of the 47BR concrete specification. Click here to read the full report.

Investigations into Methods of AASHTO T 260

The NDOR analyzes and determines chloride ion content of concrete cores coming from bridge decks according to AASHTO T 260. This procedure has three methods that can be used when testing by potentiometric titration. The primary benefit of this investigation was to find the best analytical test method that would provide accurate results with more samples but reduce the man hours required in the lab. These test results are used by bridge engineers to categorize bridge inventory needs. Click here to read the research summary.

Nebraska's Aggregate Reactivity Evaluation—Phase I–II

Due to a long history of alkali-silica reactivity (ASR) in Nebraska, the NDOR began an investigation to study the nature of aggregate reactivity from various locations across the state. This research aims to provide NDOR with an overall understanding of the level of aggregate reactivity for each region shown in the map at right. In addition, this study will be used to evaluate the NDOR's current specifications for testing ASR and future potential changes to supplementary cementitious material (SCM) replacement levels.

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Aggregate Reactivity Class	Description of Aggregate Reactivity	ASTM C1293 1-Year Expansion (%)	ASTM C1260 14-Day Expansion (%)
R0	Non-reactive	Exp.<0.04	Exp.≤0.10
R1	Moderate reactive	0.04<Exp.≤0.12	0.10<Exp. ≤0.30
R2	Highly reactive	0.12<Exp.≤0.24	0.30<Exp.≤0.45
R3	Very highly reactive	Exp.>0.24	Exp.>0.45

laboratory investigation was conducted in two phases. In Phase I, nine different aggregates were evaluated using one Type I/II cement in accordance with ASTM C1260 (Standard Test Method for Potential Alkali Reactivity of Aggregates [Mortar-Bar Method]) and ASTM C1293 (Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction). Analysis of the test results was based on the AASHTO PP 65-10 (2010) special provision guide, "Determining the Reactivity of Concrete Aggregate and Selecting Appropriate Measures for Preventing Deleterious Expansion in New Construction." For each aggregate, this guide was used to classify the degree of aggregate reactivity, as summarized in the table above, and ultimately determine the overall level of risk due to ASR, the required level of prevention, and minimum SCM replacement levels.

Phase II of the laboratory investigation serves as a continuation of Phase I. The same aggregate sources analyzed in Phase I were sampled, plus one additional source from the eastern part of the state. These aggregate sources were tested according to ASTM C1293 and ASTM C1567 (Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate [Accelerated Mortar-Bar Method]) using SCM percentages currently specified by the NDOR. Once completed, a correlation between ASTM C1293 and C1567 will be established for future specifications. In addition, this investigation took a look at the NDOR's project field performance with reactive aggregates from the category of moderately reactive to very highly reactive aggregates. The field performance analysis was based on the AASHTO PP 65-10 (2010) special provision guide. Click here to read the research summary.

Measuring & Testing Blended Cements for Evaluating Compliance

The primary objective of this project was to develop a quality assurance method based on the oxide ratios of blended cements. This has served Nebraska well to quantify the quality of the approved blended cements being used in Nebraska's projects. Click here to read the research summary.

Completed Funded Research

Evaluation and Development of a Mechanical Rocker Test Procedure for Ice Melting Capacity for Deicers

In 2009, the development of a set of procedures to evaluate deicers was initiated as a joint effort with the University of Nebraska-Omaha. The project "Performance Rating of De-icing Chemicals for Winter Operations" was completed in 2011. (Click here to read the research summary). The objective of the project was to improve the application rate and selection of deicers for the NDOR by generating a summary of best practices to evaluate performance.

For the project, a collection of accepted deicer test methods was investigated. The project found that the procedure for testing a deicer's melting capacity (SHRP Ice Melting Capacity) had a number of fundamental issues leading to inaccurate results. This prompted the development of a new procedure, the "Shaker Test," which was proposed to be a superior test method for testing deicers' melting capacity. To investigate further, a Phase II project was initiated. The purpose of Phase II, "Development of a Mechanical Rocker Test Procedure for Ice Melting Capacity Evaluation" (click here to read research summary), was to improve the "Shaker Test" by using a mechanical rocker for agitation and to specify the quantitative values of the procedure created in Phase I.

In-House Research In Progress

Evaluation of the Mechanical Rocker Test Procedure for Ice Melting Capacity (Phase III)

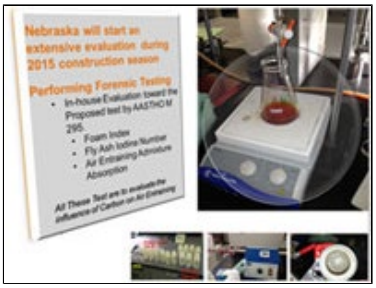
The objective of this research is to verify the validity of the Mechanical Rocker Test Procedure for ice melting capacity developed in Phase II and assess its suitability as a standard procedure. An accurate lab procedure for measuring ice melting capacity would advance progress on two of the eight NDOR performance goals: Safety and Fiscal Responsibility. Click here to read the research summary.

Skid Resistance Evaluation and Performance on Pavement and Bridge Decks

The NDOR has implemented three resurfacing procedures as part of the maintenance application and/or for safety: highfriction surface treatment (HFST), epoxy polymer overlay (EPO), and diamond grinding. The HFST and diamond grinding applications are also used for maintenance of pavements. EPO and HFST can both be used for bridge deck applications. One of the performance verifications of these three applications is measuring skid resistance. Skid resistance testing is performed in accordance with ASTM E 274 using equipment to measure and calculate a skid number (SN). If the skid number for the pavement or bridge deck drops below an accepted value, the structure in question will need to be resurfaced to increase the surface macrotexture. This investigation will evaluate skid resistance performance at multiple locations in NDOR Districts 1 and 2. This evaluation will be conducted over a five-year period to verify that HFST, EPO, and diamond grinding will maintain a safe skid resistance.

Air Evaluations

Forensic Testing: The NDOR is evaluating the Foam Index, Fly Ash Iodine Number, and Air Entraining Admixture Absorption for use as a forensic tool for blended cements and admixtures. These test methods, originally researched by Michigan, are being proposed as revisions to AASTHO M 295.



The RapidAir 457 test is being evaluated as a method for testing the air-void system necessary to provide satisfactory freeze/thaw durability in Nebraska's concrete mixes. Air content is tested in the plastic state with a pressure meter during construction to ensure conformance with

construction specifications.

In Nebraska, the in-place air contents of some paving projects have indicated a large total hardened air void structure, which leads to a large amount of coalescence of air voids at the interface of the aggregates. This test method allows the determination of air content in concrete in far less time than the linear transverse method (the previous test method used in Nebraska). After preparation has been completed, this procedure takes less than half an hour, where the old method could take up to two days.

Ongoing Funded Research

The NDOR is sponsoring the following research project with the University of Nebraska-Lincoln:

Evaluation of Dowel Bar Inserter (DBI) Practices in PCC Pavements with Magnetic Tomography Technology
The primary objective of this research is to analyze the MIT Scan-2 data that NDOR Materials & Research personnel collected from all current and past projects that were using a dowel bar inserter (DBI). The results of this research will help NDOR Materials & Research implement improved dowel bar installation practices for Nebraska's PCC pavements. This investigation of the MIT Scan-2 data will also provide NDOR Materials & Research with practical insights into the potential implementation of the MIT Scan-2 measuring system as a quality control (QC) / quality assurance (QA) tool to assess dowel bar alignment.

About the CP Road Map E-News

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.

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