Reactive Solutions

An FHWA Alkali-Silica Reactivity News Publication

Volume 2, Issue 4

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Delaware Pavement Treated Topically with Lithium Nitrate

Treatment marks first implementation field project under FHWA 's ASR Development and Deployment Program

In late June, the first ASR field trial application under the Federal Highway Administration's (FHWA) Alkali-Silica Reactivity (ASR) Development and Deployment Program was implemented. A section of US 113 in Delaware between Ellendale and Georgetown, which was constructed of jointed plain concrete pavement in the mid-1990's, was treated with a topical application of lithium nitrate.

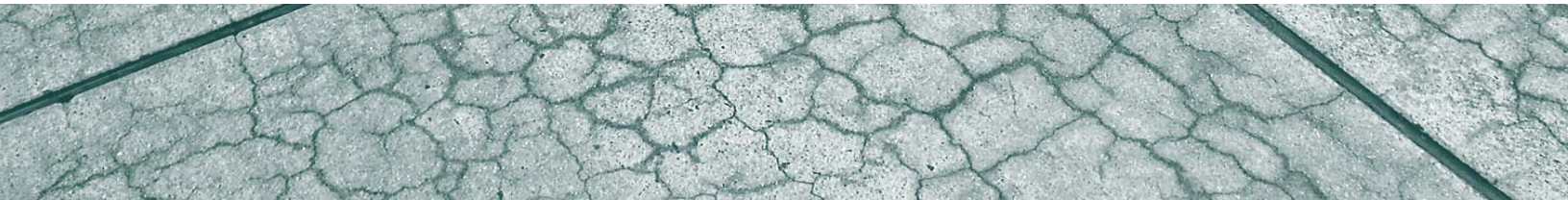
Procession of lithium treatment: Water truck (front) followed by lithium truck. Final water truck (not shown) followed the lithium truck to apply a final coat of water.

Left lane of highway sprayed by lithium truck (application rate set at 1.5 gal/1000 ft²)

After visiting the proposed site in May 2008, the research team and the Delaware DOT (DelDOT) extracted cores from various locations for petrographic analysis. Results of the core analysis confirmed varying levels of ASR in the pavement. The research team and DelDOT determined that a total of 16 lane miles of US 113 would receive a topical application of lithium nitrate to slow the ASR mechanism.

The DelDOT maintenance crew applied two applications of lithium nitrate on US 113. The first topical application occurred on June 23, 2009; due to weather conditions, the second application of lithium nitrate was scheduled two days later and covered the same sections as the first treatment. The topical treatment consisted of an application of water (at a rate of 1 gal/1000 ft²), followed by the application of lithium nitrate at a rate of 1.5 gal/1000 ft²., and ended with a final application of water.

(Continued on page 2)



Editor's Corner

Dr. Michael Thomas, University of New Brunswick

Dear Readers,

ASR hit the headlines in the Houston Chronicle this August with ASR being detected in an estimated 1000 bridges in Texas (2% of the states bridges). This highlights the need for better practices and test methods for detecting reactive aggregates and evaluating effective preventive measures. Current test methods suffer from being either fast but unreliable or too slow. Hopefully, some of the research underway in North America and elsewhere will help to address these deficiencies in time. It is certainly timely that AASHTO is considering a new recommended practice for ASR which could be available as early as next year, and there have been discussions at ASTM regarding the development of improved guidelines for minimizing the risk of ASR in concrete. We will keep you posted on all developments.

Delaware Pavement Treated Topically with Lithium Nitrate (cont.)

Researchers record initial lengths between pins for expansion measurements.

In order to properly monitor the pavement after treatment, selected panels throughout the section were instrumented with stainless steel pin gages for expansion measurements, and also labeled for crack mapping measurements. In addition, several panels were selected as "control" sections, which were not treated. As part of the monitoring process, a series of cores were extracted after the lithium application was complete and sent to the University of Laval and the University of New Brunswick for post-treatment testing, including lithium concentration profile and stiffness damage testing.

Expansion measurements conducted day after first treatment.

The research team, along with DelDOT, will continue to monitor the pavement during the course of the project. The data from future monitoring trips will help determine the efficacy of the overall treatment.

For more information about this field implementation project, please contact Gina Ahlstrom at Gina.Ahlstrom@dot.gov.

ASR Recommended Practice Presented to AASHTO

A recommended practice to address alkali aggregate reaction was presented to the American Association of State Highway and Transportation Officials (AASHTO) Subcommittee on Materials (SOM) at their annual meeting held in August.

The proposed recommended practice was submitted through AASHTO Technical Session 3c—Hardened Concrete Properties. The Technical Session members unanimously agreed to present the proposed recommended practice to the full AASHTO SOM.

The AASHTO SOM membership agreed to place this item on the upcoming ballot and will vote upon the ballot item later this year. If necessary, the AASHTO ASR Task Force will address comments. If the document is approved it will be published in the 2010 edition of the Standard Specification for Transportation Materials and Methods of Sampling and Testing.

Ask The Experts.

Q *D. Stephen Lane of VTRC mentioned in Volume 3 of the newsletter that potassium was the predominant metal in North American hydraulic cements. Why is cement alkalinity presented as a sodium equivalent value using the molecular weights of sodium and potassium to determine this value?*

Submitted by Brian D. Merrill, P.E., Texas Department of Transportation

A When ASR was diagnosed in the early 40's as the cause of expansion in concrete by Thomas Stanton, he established that this expansion was due to the "alkalinity" of the cement combined with a reactive aggregate (opaline in this case). The total alkalinity of the cement was measured by the sum of the percentage of Na_2O and K_2O. When experiments were conducted to establish some limit below which expansion with the aggregate would not occur, a low-alkali cement was used with NaOH added. NaOH was used because it is a strong base commonly used in chemical laboratories to standardize the normality of acids. However, some irregularities were found when the simple sum of Na_2O and K_2O percentage was used to establish a relationship between expansion and the total alkali content. Therefore, the "equivalent alkali" was defined based on Na_2O and K_2O on an equal normality basis. The ratio of the equivalent mass of Na_2O and K_2O is 0.658 (Na_2O/K_2O), which means that K_2O is less alkaline than Na_2O and 1.0% of K_2O has an equivalent alkalinity of 0.658%.

Submit your questions—email us at asrnewsletter@transtec.us

A.sk
S.end
R.eceive

This Issue's Question:

Do you think recycling ASR-affected concrete to use as an aggregate base is a good idea?

Submit your answers to: asrnewsletter@transtec.us

FHWA Seeking More States for ASR Field Application and Demonstration Projects

States Interested in Participating are Encouraged to Contact FHWA

The Federal Highway Administration (FHWA) is still seeking candidate pavement, bridges and other highway structures for alkali-silica reaction (ASR) field application and demonstration projects. Projects will evaluate new and existing technologies to help prevent ASR in new concrete and/or mitigate ASR in existing concrete pavements and structures.

Since the field application and demonstration project was initiated last year, several state DOTs stepped forward and contacted FHWA with potential sites that could be included in the program. In fact, the first implementation project occurred in Georgetown, Delaware in June 2009 (see the full story in Page 1 of this issue). Extensive research that has been conducted in recent years has provided a great deal of knowledge of new and existing ASR technologies, and FHWA needs states to bring these technologies "out of the lab" and into the field.

States that believe they have a concrete pavement or structure that would be suitable for ASR prevention or mitigation techniques and are interested in participating in this endeavor are strongly encouraged to contact FWHA for more information. The FHWA will assist state DOTs in executing ASR field trials by:

- Providing technical guidance (including presentations and training)
- Working together with the state DOT in selecting the appropriate treatment for the pavement or structure in question
- Providing appropriate federal funds for materials
- Instrumenting the structure for data collection
- Designing and implementing monitoring programs
- Evaluating and collecting data from the field site, and
- Analyzing data to determine the efficacy of the technology used.

Interested in participating? Contact Gina Ahlstrom by email at gina.ahlstrom@dot.gov or by phone at (202) 366-4612.

Schedule of Events

November

8-12
ACI Fall Convention
New Orleans, LA
17-19
International Concrete Pavement Symposium
Santiago, Chile
30—December 4
ACPA's 46th Annual Meeting
Orlando, Florida

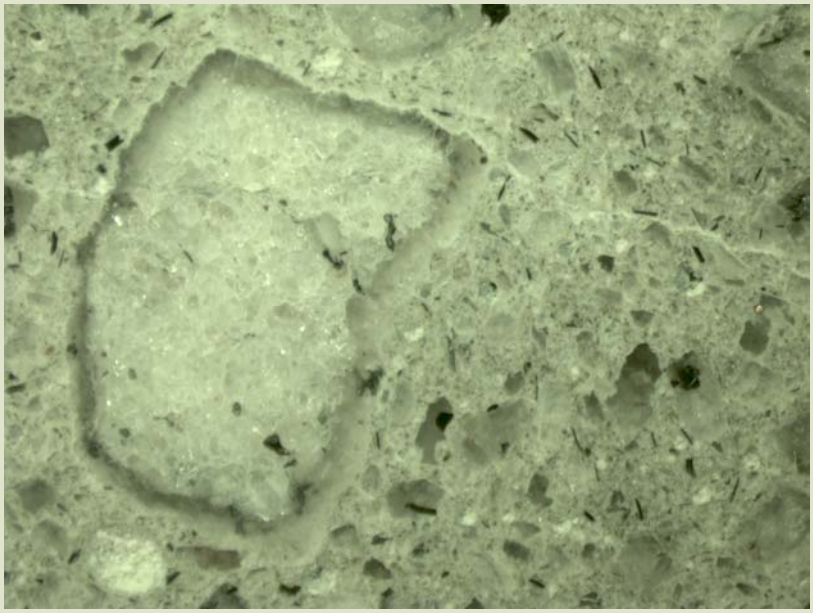
December

2-4
BridgeTech 2009
Shanghai, China
6-9
ASTM Concrete and Concrete Aggregates Committee Meeting
Atlanta, GA

January

10-14
89th Annual TRB Meeting
Washington, D.C.

This Issue's Photo



Reaction Rim in ASR-Affected Aggregate (Submitted by Dr. Prasad Rangaraju)

Have a picture you'd like to send us of an ASR-affected structure in your state? Send us what you like - a bridge, a core, a snapshot of your lab, etc. - our editorial committee will select one picture and post it here for all to see.
Email your pictures to asrnewsletter@transtec.us

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