Winter 2009

Volume 2, Issue 1

Reactive Solutions

An FHWA Alkali-Silica Reactivity News Publication

Inside This Issue:

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FHWA Releases Report on Designing Concrete Mixtures that are Resistant to ASR

FHWA recently released the *Report on Determining the Reactivity of Concrete Aggregates and Selecting Appropriate Measures for Preventing Deleterious Expansion in New Concrete Construction*. The report was developed to improve the decision-making process for preventing Alkali-Silica Reactivity (ASR) in new concrete. Feedback from representatives of state departments of transportation indicated that additional guidance is needed to help engineers and concrete practitioners determine appropriate prevention options.

The report provides a decision tree that can be used to determine the appropriate tests needed to determine aggregate reactivity, one of the three main components required for ASR. Information is provided on using results from field performance evaluations and from petrographic examinations to determine if an aggregate is appropriate for use.

The report also provides a list of suggested guidelines about following American Society for Testing and Materials (ASTM) standards:

- ASTM C1260 - Standard Test Method for Potential Alkali-Aggregate Reactivity of Aggregates (Mortar-Bar Method);
- ASTM C1293 – Standard Test Method for Determination of Length of Change of Concrete Due to Alkali Silica Reaction (Concrete Prism Test Method); and
- ASTM C 1567 – Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregates (Accelerated Mortar-Bar Method).

In general it is suggested that a state consider using ASTM C 1293 (Concrete Prism Method) to assess its aggregate supply; however, a corresponding test should also be run using ASTM C1260.

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FHWA Releases Report on Designing Concrete Mixtures that are Resistant to ASR (cont.)

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Results should be compared every two years unless results from a petrographic assessment or various other screening tests indicate there is a change to the material composition.

Two approaches, the performance approach and the prescriptive approach, to developing a concrete mixture free of ASR are outlined in the report. The performance approach outlines the use of testing the preventative measure (low alkali cement, supplementary cementitious materials, and chemical admixtures, such as lithium) in combination with the aggregate using either ASTM C1293 or ASTM C1260.

The prescriptive approach provides the level of prevention required based on the class, size, and exposure conditions of the structure, degree of aggregate reactivity, and level of alkalis from the portland cement. A series of tables are provided so that the user may follow a step-by-step approach to design a mixture that will significantly reduce the risk of ASR expansion.

Hard copies and electronic versions of the report are available. Contact Gina Ahlstrom at gina.ahlstrom@dot.gov to request a hard copy of the report. The report may also be downloaded free of charge at http://www.fhwa.dot.gov/pavement/concrete/asrprotocols.cfm.

FHWA Field Application and Demonstration Projects Underway!

States Interested in Participating are Encouraged to Contact FHWA

The Federal Highway Administration is initiating field application and demonstration projects to evaluate new and existing technologies to help prevent ASR in new concrete and/or mitigate ASR in existing concrete pavements and structures. A great deal of knowledge has been attained through research of these new and existing ASR technologies, and FHWA's goal is to help bring these technologies "out of the lab" and into the field.

Vacuum impregnation treatment on ASR-affected highway barriers near Leominster, MA

In order to reach this goal FHWA will select candidate sites from state departments of transportation (DOT) that are interested in participating. If a state DOT is interested in participating in this endeavor and it has a pavement or structure that it would like to propose as a candidate, it is encouraged to contact FHWA 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 structure in question
- Providing appropriate federal funds for prevention and mitigation techniques
- 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.

Pavement joint damage on an ASR-affected pavement near Mountain Home, ID

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

Ongoing FHWA ASR Research

In the fall of 2008, FHWA began new research in alkali-silica reactivity (ASR) to develop ASR products and technologies. The research program consists of four research objectives:

Objective 1. Further understand the mechanism of ASR, along with developing a concrete mixture design that prevents ASR;

Objective 2. Develop a rapid ASR laboratory test method to predict field performance;

Objective 3. Develop non-destructive test (NDT) methods for assessing ASR in the field; and

Objective 4. Develop rehabilitation methods to control ASR and extend the life of ASR-affected structures.

Research is occurring at the University of Texas on Objectives 3 and 4 of this program. In August 2008, a total of 64 "bridge deck" specimens, 36 "columns", and 60 "slabs on grade" large size specimens were cast. Half of the specimens were cast with reactive sand, while the other half were cast with reactive gravel. The total alkali content of the concrete mix design was increased to 1.25% in order to initiate and accelerate the ASR deterioration process.

The specimens were instrumented with demec gages, strain gages, and thermocouples. The demec gages were embedded on the concrete surface of the specimens and the reinforcing steel of selected bridge decks and columns were instrumented with strain gages. Initial demec and internal strain measurements were taken after the specimens were cast and are being continuously monitored.

Outdoor Field Site at the University of Texas at Austin. A total of 64 "bridge deck", 36 "column", and 60 "slab" specimens were cast for research under this program.

An NDT team led by Sherbrooke University and Olsen Engineering has already taken baseline NDT measurements of the cast specimens, and NDT evaluations are being performed every few months on key specimens. Initial treatments have already been initiated on selected specimens containing the highly reactive sand (from El Paso, TX), including the application of lithium nitrate (topical, vacuum, and electrochemical methods) and silane-based sealers. The specimens cast with the reactive gravel (from New Mexico) are expected to be treated in the Spring of 2009.

Close-up of bridge decks cast at the Concrete Durability Center at the University of Texas at Austin.

Editor's Corner

Dear Readers,

This has been a busy quarter for ASR. This issue announces FHWA's publication of a report on testing protocols to minimize the risk of damaging ASR in new concrete construction, describes some of the ongoing ASR research under contract by FHWA that commenced last summer, and also includes a solicitation from FHWA to identify candidate structures to serve as field application and demonstration projects. Is there an ASR-affected concrete pavement or structure in your state that needs to be treated? Or is there a new project that requires ASR prevention? State highway officials are encouraged to identify potential projects and submit them to FHWA for evaluation. The first project, a pavement in Delaware, has already been evaluated and selected, and treatment will begin this Spring. So keep your eyes peeled and look out for the tell-tale signs of ASR in your concrete.

Sincerely,

Mike Thomas

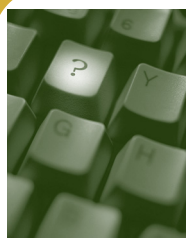
University of New Brunswick

Ask The Experts

Q *I have encountered a government specification for asphalt concrete and aggregate base which excludes the use of potentially reactive aggregates. I am having trouble refuting this condition since reactive aggregates should only be an issue when in contact with portland cement. Can you give me any guidance or information where I can show evidence that potentially reactive aggregates are not a concern for the applications described above?*

Submitted by Ray Costa, P.E. Kleinfelder

A We are not aware of alkali-silica reaction being a problem in asphalt concrete or in an aggregate base. The alkali-silica reaction requires a certain concentration of alkali hydroxides to be present for the reaction to proceed and such a condition does not exist in asphalt concrete and is unlikely to exist in an aggregate base. As such, aggregates should not be rejected for use in this applications solely on the basis of alkali-silica reactivity. However, there are other deleterious reactions that can occur with some aggregates or fill materials (e.g. oxidation of pyrites) but these are beyond the scope of this newsletter.



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This Issue's Question:

Are there any ASR structures that are being treated in your state?

Submit your answers to: asrnewsletter@transtec.us

Schedule of Events

February

23—March 3
International Concrete Exposition
Indianapolis, IN

March

15-18
NRMCA Annual Convention
Orlando, Florida

15-19
ACI 2009 Spring Convention
San Antonio, TX

31-April 2
PCA Concrete Thinking for a Sustainable World
Atlanta, GA

April

14-15
ASR Development and Deployment TWG Meeting
Washington, D.C.

22-24
National Conference on Preservation, Repair and Rehabilitation of Concrete Pavements
St. Louis, Missouri

First ASR Development and Deployment Field Project to Begin Spring 2009

Delaware Pavement Starts off Field Projects Task Order

Since the start of the Field Trials and Demonstration Projects task order last fall, work has been underway at gathering information to determine candidate structures for ASR preventative and mitigative efforts. This task order presents a valuable opportunity to gather certain technologies that may help prevent or mitigate an ASR problem and put them into practice through these field and demonstration projects.

The first structure selected as a field project is an ASR-affected pavement near Georgetown, Delaware. A one-mile section of concrete pavement on U.S. Route 113 was evaluated in November of 2008. A visual inspection was conducted and several cores were extracted from the pavement for petrographic testing. Based on the findings from the petrographic evaluation, this section of pavement was considered a suitable candidate for treatment under this contract. Delaware is interested in the topical application of lithium for their project, in hopes of slowing down the reaction and ultimately extending the service life of the pavement. Treatment of the pavement is undergoing extensive discussion between the contract's research team, Delaware Department of Transportation, and the Federal Highway Administration. It is anticipated that the treatment of the pavement will be underway this spring.

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