Reactive Solutions

An FHWA Technical Update on Alkali-Silica Reactivity

Volume 5, Issue 1 / January 2012

Welcome to the newest edition of *Reactive Solutions*, a Technical Update on Alkali-Silica Reactivity (ASR) issues. This periodical is a communication tool for Federal Highway Administration's ASR Program. The program's goal is to deploy methods that state highway agencies can use to prevent and mitigate ASR. This goal is being achieved through technology transfer, including real-world field trials, demonstration projects, and tools for practitioners to address ASR in their state. This periodical helps achieve the program's goal by providing readers with the tools and information needed to address this complex concrete distress problem.

Features:

Also in This Issue:

Effect of Permeability on ASTM C1260/C1567 Testing

A laboratory study was conducted by the Texas Department of Transportation (TxDOT) to determine the effect of initial permeability on final expansion values when using accelerated mortar bar tests. For this study, specimens were prepared according to ASTM C1260 (Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)) and ASTM C1567 (Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)). Specimens were fabricated with and without fly ash (one Class F and four Class C fly ashes), using two cements with slightly different alkali contents (C1: 0.43%, C2: 0.37%), and a single reactive fine aggregate. One set of specimens underwent standard curing procedures, which specify curing for 24 hours at 23°C followed by 24 hours at 80°C. In order to investigate the effect of permeability, a second set of specimens was cured in a calcium hydroxide solution for 28 days at 38°C. In addition, a set of larger mortar specimens was tested for permeability in accordance with ASTM C1202 (Standard Test Method for Electrical Indication of Concrete's Ability to Resist Chloride Ion Penetration) after curing was completed.

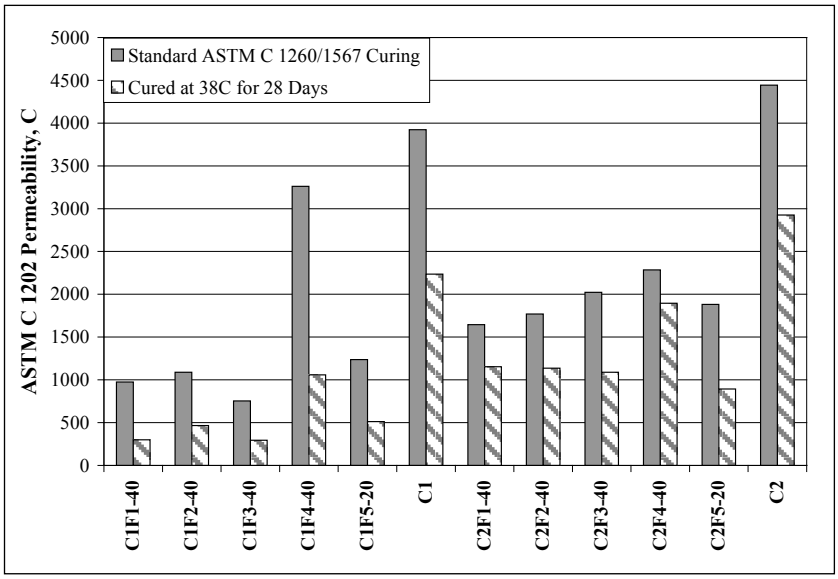

Figure 1. Permeability results for all mortar bar mixes.

Figure 1 shows the permeability results for all of the mortar mixtures. Compared to the control mixtures, specimens containing fly ash and cured according to ASTM C1260/C1567 exhibited substantially reduced permeability. Specimens containing the higher alkali cement (C1) and cured for 28 days had permeability values 43% to 70% lower than the counterpart mixtures subjected to standard curing procedures. Mixtures containing the lower alkali cement (C2) and cured for 28 days had permeability values ranging from 17% to 53% lower than the counterpart mixtures.

Expansion results for all of the mortar mixtures are shown in Figure 2. Higher alkali cement mixtures tended to have slightly lower expansions than the specimens containing lower alkali cement. In most cases, specimens that were cured for 28 days showed slightly higher expansions than specimens cured in accordance with ASTM C1260/C1567.

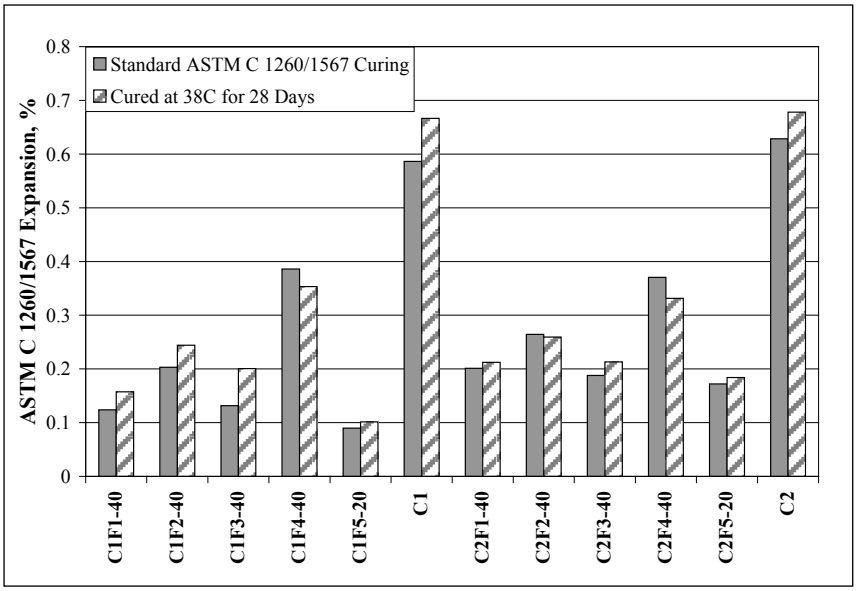

Figure 2. Expansion results for all mortar bar mixes.

The use of fly ash resulted in substantial reductions in initial permeability and final expansion compared to the respective control mixtures. Furthermore, the modified curing method resulted in an even greater reduction in initial permeability compared to standard curing procedures, but had little influence on expansion results. It is also important to note that the higher alkali cement mixtures containing fly ash tended to result in less permeable mortars and lower final expansions than specimens containing lower alkali cement and fly ash, regardless of the curing method.

More detailed information can be found in TxDOT publication DHT-50, September 2011 (http://library.ctr.utexas.edu/digitized/thdresearch/dht_50.pdf). For additional information, please contact Andy Naranjo at Andy.Naranjo@txdot.gov.

Two New ASR Documents Currently Under Review by FHWA

Two new documents that will assist engineers and the alkali-silica reactivity (ASR) community with their ASR-related questions have been developed under FHWA's ASR Development and Deployment Program, and are currently being reviewed by FHWA.

The first document, "Alkali-Silica Reactivity Field Identification Handbook", is a revised version of the Strategic Highway Research Program's "Handbook for the Identification of Alkali-Silica Reactivity in Highway Structures". The revised Handbook includes additional fundamental information about ASR, including requirements necessary for ASR to take place in field structures and pavements. In addition, new images were added to the Handbook to assist readers in the preliminary identification of structures likely suffering from ASR under multiple scenarios, including various environmental conditions and in combination with other concrete-related distresses. The revised Handbook also provides appendices that contain images of ASR-affected structures that are categorized as bridge structures, concrete pavements, and other transportation structures.

The second document, "Alkali-Silica Reactivity Surveying and Tracking Guidelines", was developed to assist State Department of Transportation (DOT) engineers and technicians with surveying and tracking ASR-affected pavements, bridges, and other highway structures. The Guidelines will assist users by providing a framework by which ASR-induced damage can be tracked utilizing existing tools already being used by most, if not all, state highway agency management systems. The document is simple to use, yet detailed enough to help users collect, quantify, and rank typical signs of ASR distress primarily by visual inspection.

To obtain a copy of the Alkali-Silica Reactivity Field Identification Handbook or the Alkali-Silica Reactivity Surveying and Tracking Guidelines, please contact Gina Ahlstrom at Gina.Ahlstrom@dot.gov or visit the FHWA's ASR Development and Deployment Page at http://www.fhwa.dot.gov/pavement/concrete/asr.cfm.

FHWA Updates Online Reference Center Devoted to ASR

The online alkali-silica reactivity (ASR) Reference Center developed under the FHWA ASR Development and Deployment Program has been updated to provide engineers and practitioners with the most current and pertinent information related to ASR in an easily accessible format. There are currently over 300 references posted to the Reference Center, spanning a large variety of subject areas including ASR mechanisms, test methods, laboratory research, and detection and mitigation strategies. The Reference Center also contains a large number of case studies from around the world, including select field trial summaries that document ASR treatment methods, test results, and treatment efficacy. In addition, an extensive collection of State Department of Transportation (DOT) specifications related to ASR has been compiled, and as more states adopt measures to address ASR, the Reference Center will be updated accordingly. Additional specifications, guidance documents, and test methods published by international agencies committed to raising ASR awareness, such as the Canadian Standards Association (CSA) and the

International Union of Laboratories and Experts in Construction Materials, Systems and Structures (RILEM, from the name in French), have been included as well.

In order to access the ASR Reference Center, click on the link shown below. Figure 3 below illustrates the home page of the ASR Reference Center. For more information or if you would like to contribute information to the Reference Center, please contact Jesse Kwilosz at Jesse@TheTranstecGroup.com.

Website: http://www.fhwa.dot.gov/pavement/concrete/asr/reference.cfm

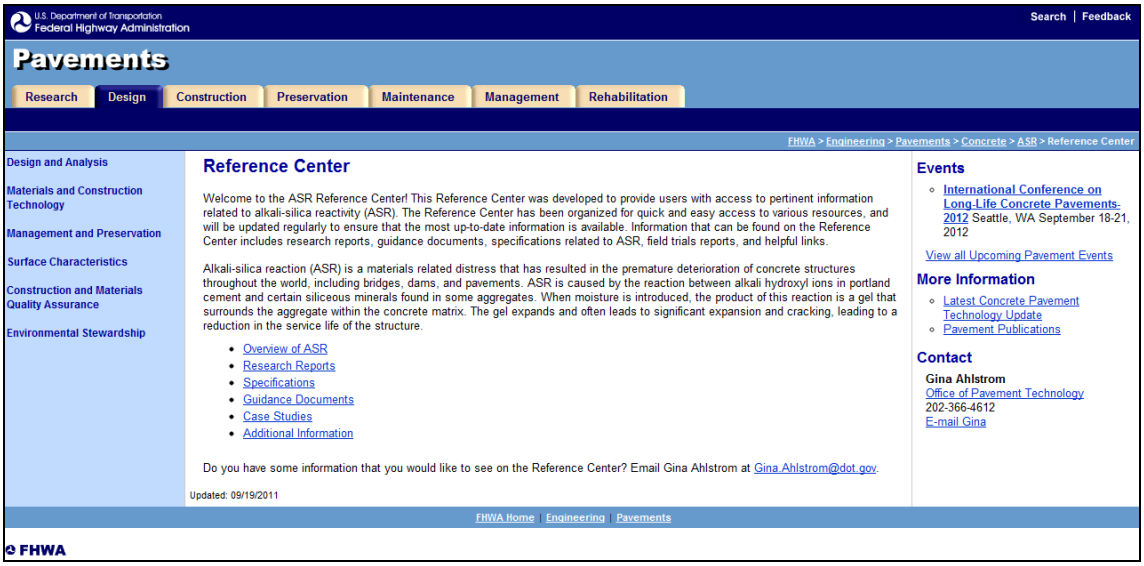

Figure 3. Screenshot of ASR Reference Center on the FHWA website.

14th International Conference on Alkali-Aggregate Reaction (ICAAR) takes place May 20-25 in Austin, TX

For the first time since 1978, the International Conference on Alkali-Aggregate Reaction (ICAAR) is returning to the United States. This conference was first organized in Denmark in 1974 and has grown tremendously, evolving into a quadrennial conference that hosts over 200 attendees from all over the world. Initially focusing on the mere identification of deleterious alkali-aggregate reaction (AAR), ICAAR has broadened to include highly detailed analysis, merging civil and structural engineering with materials characterization, physics, chemistry, applied mineralogy, and computer modeling. Session topics include mechanisms of AAR, prevention/mitigation methods, case studies, and repair and rehabilitation.

For additional information regarding registration, important dates, and lodging, please visit the official website: www.icaar2012.org.

Schedule of Events

January
22-26
Transportation Research Board (TRB) 91st Annual Meeting
Washington, DC

23-27
World of Concrete
Las Vegas, Nevada

February
1-3
Iowa Concrete Paving Association's 48th Annual Concrete Paving Workshop
Des Moines, Iowa

March
14-16
5th International Symposium on Tunnel Safety and Security
New York, New York

18-22
American Concrete Institute (ACI) Spring 2012 Convention
Dallas, Texas

27-29
Spring 2012 Technology Transfer Concrete Consortium (TTCC)/National Concrete Consortium (NCC)
Oklahoma City, Oklahoma

28
Concrete Marine Structures for Renewable Energy
Dallas, Texas

May
20-25
14th International Conference on Alkali-Aggregate Reaction (ICAAR)
Austin, Texas

To view this technical update on the web, please go to
http://www.fhwa.dot.gov/pavement/concrete/reactive/v05issue01.cfm

This material is based upon work supported by the Federal Highway Administration Alkali-Silica Reactivity (ASR) Development and Deployment Program to share information related to ASR.

If you would like to subscribe to future issues, receive more information on the ASR Program, or receive further details on any of the articles in this issue, email us at asrnewsletter@transtec.us.