

What's New with ASR?

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What is ASR?

Alkali-Silica Reactivity

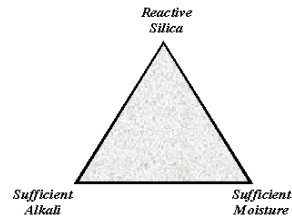
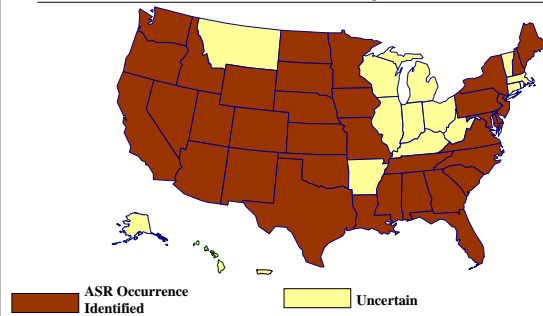


Figure from: FHWA-RD-03-047, Folliard et al., 2003



Occurrences of ASR in the United States

(From 1994 FHWA Showcase Workshop on ASR)



SAFETEA-LU Legislation

- Sec. 5203. (e) Demonstration Projects and Studies
 - (3) **Alkali Silica Reactivity.** Of the funds made available by 5101(a)(1) of this Act, \$2,450,000 shall be made available by the Secretary for each of fiscal years 2006 through 2009 **for further development and deployment of techniques to prevent and mitigate alkali silica reactivity.**

Before FHWA Started a New Program

ASR Benchmarking Workshop

Stakeholders and customers provide input and identify potential program elements toward development of a comprehensive program of development and deployment activities addressing techniques to prevent and mitigate alkali silica reactivity

Main Points from the Workshop

- Develop protocols/framework/decision tree for ASR prevention and mitigation using existing techniques and guide specifications
- Field trials, field trials, and more field trials
- Develop a framework for inventorying and prioritizing structures through existing Pavement Management and Bridge Management systems
- Provide technology transfer through delivery of information and training/education

ASR Program Goals

- Increase durability, performance, and reduce life cycle costs
- More effectively deploy current technologies
- Develop new technologies, develop rapid lab methods, and develop NDE techniques to assess ASR in the field

FHWA's ASR Development and Deployment Program

- (1.) Understanding the ASR Mechanism Process for Prevention
- (2.) Develop Testing and Evaluation Protocols
- (3.) Selection, Implementation, and Maintenance of Field Application and Demonstration Projects

FHWA's ASR Development and Deployment Program

- (4.) Assist States in Inventorying Existing Structures for ASR
- (5.) Deployment and Technology Transfer

Establishment of a Technical Working Group (TWG) to monitor the Program

(1.) Understanding the ASR Mechanism

- Task Goal:
 - Obtain a better understanding of the ASR mechanism
- Applied Research Strategies:
 - Quantify various chemical reactions and rates between constituents
 - Identification of formed products
 - Consideration of environmental effects such as deicers
- Applied Research Products:
 - Development of prescriptive methodology to produce durable concrete mix designs

(2.) Develop Testing and Evaluation Protocols

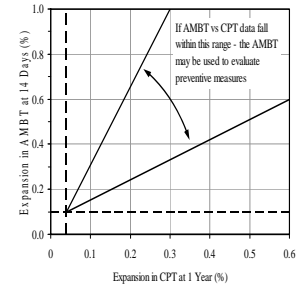
- Task Goal:
 - Develop a reasonable, effective, and clear decision-making process for methods and techniques to prevent and mitigate ASR
- Deployment Strategies:
 - Develop protocols for rapid testing and evaluation for ASR prevention in new construction, ASR mitigation in existing concrete, and determination of future deterioration

(2.) Develop Testing and Evaluation Protocols

- Deployment Products:
 - Guidance on evaluation of aggregates and mixtures appropriate to prevent against ASR
 - Guidance on the determination of existence and extent of ASR
 - Guidance on mitigation measures to reduce the severity of ASR

Determining Aggregate Reactivity and Selecting Measures to Prevent ASR

Guidance on using results from
ASTM C 1293
Concrete Prism Test
 and
ASTM C 1260
Accelerated Mortar Bar Test



Diagnosis and Prognosis of ASR

Guidance on how to use results from of the **Cracking Index and the Petrographic Examination to determine next steps in ASR diagnosis**

Criteria	Comments and Action
"Cracking" > criteria and Low probability of AAR (from petrography)	<ul style="list-style-type: none"> • Significant cracking is affecting the element investigated. On the other hand, there is no conclusive evidence of AAR in the concrete (based on petrography). • Action: initiate further investigations for other mechanisms of deterioration, if required.

Selection of Mitigation Measures

Treat the Cause	Treat the Symptom
Chemical Treatment/Injection <input type="checkbox"/> CO ₂ <input type="checkbox"/> Lithium Compounds	Crack Filling <input type="checkbox"/> Aesthetics <input type="checkbox"/> Protection (e.g. from Chloride ingress)
Drying <input type="checkbox"/> Sealants <input type="checkbox"/> Cladding <input type="checkbox"/> Improved Drainage	Restraint <input type="checkbox"/> Prevent Expansion <input type="checkbox"/> Strengthen/Stabilize
	Relieve Stress <input type="checkbox"/> Sawcutting/Slot Cutting

Guidance on decision factors for considering various mitigation options

(2.) Develop Testing and Evaluation Protocols

- Applied Research Strategies:
 - Identify the most viable rapid test methods to accurately predict field performance of ASR
- Applied Research Products:
 - Modifications to existing test procedures or recommendation for the development of a new test procedure

(3.) Field Trials

- Task Goal:
 - Gather long-term data on the effectiveness and service life of methods and techniques to prevent ASR in new concrete and mitigate ASR in existing concrete
- Deployment Strategies:
 - Implementation of existing techniques to prevent and mitigate ASR
 - Explore new methods and techniques to prevent and mitigate ASR

(3.) Field Trials

- Deployment Products:
 - Implementation and monitoring of field trials
 - Analysis of the best methods and techniques to prevent and mitigate ASR



(3.) Field Trials

- Applied Research Strategies:
 - Controlled laboratory experiments coordinated with field trials
- Applied Research Products:
 - Cost effective methods for ASR mitigation

(4.) Assist States with Inventorying Existing Structures for ASR

- Task Goal:
 - “Assist States in inventorying existing structures for ASR” per SAFETEA-LU legislation
- Deployment Strategies:
 - Provide tools for States to successfully track and monitor ASR affected structures

(4.) Assist States with Inventorying Existing Structures for ASR

- Deployment Products:
 - Track ASR affected structures utilizing States Pavement Management and Bridge Management Systems
 - Development of a severity rating system
 - Training

(4.) Assist States with Inventorying Existing Structures for ASR

- Applied Research Strategies:
 - Distinguish ASR and subsequent damage from other deterioration mechanisms to make decisions regarding mitigation, rehabilitation, and reconstruction
- Applied Research Products:
 - Development of a simple reliable non-destructive field test for the determination of ASR

(5.) Deployment and Technology Transfer

- Task Goals:
 - Provide tools, assistance, and efficient and effective technology transfer to educate and train
- Deployment Strategies:
 - ASR Data Center
 - Technology Transfer

(5.) Deployment and Technology Transfer

- Deployment Products:
 - Data center that serves as a clearing house for information
 - Training (presentations, workshops, etc.)
 - ASR Newsletter – *Reactive Solutions*

A.sk S.end
R.ecieve

Stump The
Experts

Featured Photo

ASR Technical Working Group

States ☆ Academia ☆ Industry ☆ Federal Agencies

- Information Sharing
- Technical Input on the Program
- Monitor Program Implementation

2007	2008	2009	2010	2011	2012
Task 1 – Mechanism of ASR					
Task 2 – Develop Test and Evaluation Protocols					
Task 3 – Field Trials					
Task 4 – Assist States with Inventory for ASR					
Task 5 – Deployment and Technology Transfer					

What's Next

- Looking for ASR field trials
 - Prevention of ASR in new concrete
 - Mitigation of ASR in existing concrete



What's Next

- *Reactive Solutions*
 - Looking for interesting stories, photos, questions, YOUR INVOLVEMENT & INTEREST
- Survey State Structures
 - States to pilot the system developed

For Questions or
Information Regarding
FHWA's ASR Program:

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