Agency Approvals

Since the early 1950s, lithium compounds have been shown to be effective in mitigating ASR in concrete. SHRP Report C-343 details extremely favorable results in controlling ASR in concrete. MasterLife ASR 30 admixture is based on this long-term and extensively tested use of lithium as an effective method for control of ASR in concrete.

Agencies that recognize the benefits of using lithium to control ASR in concrete include:

- Federal Highway Administration (FHWA)
- Federal Aviation Administration (FAA)
- American Association of State Highway Transportation Officials (AASHTO)
- U.S. Army Corps. of Engineers
- NSF International
- State Departments of Transportation and other local agencies

References

Wang, H., Tysl, S., and Gillott, J., E., “Practical Implications of Lithium-Based Chemicals and Admixtures in Controlling Alkali-Aggregate Reactions,” Fourth CANMET/ACI International Conference on Superplasticizers and Chemical Admixtures in Concrete, ACI SP 148, 1994, pp. 353-366.

“Guidelines for the Use of Lithium to Mitigate or Prevent Alkali-Silica Reaction (ASR),” Publication No. FHWA-RD-03-047, Research, Development, and Technology, Turner-Fairbank Highway Research Center, McLean, VA, 2003.

Stark, D., Morgan, B., Okamoto, P., and Diamond, S., “Eliminating or Minimizing Alkali-Silica Reactivity” Strategic Highway Research Program (SHRP), SHRP C 343, National Research Council, Washington D.C., 1993.

More Information

The Master Builders Solutions brand brings expertise to create chemical solutions for new construction, maintenance, repair and renovation of structures. Master Builders Solutions is built on the experience gained from more than a century in the construction industry.

The know-how and experience of a global community of construction experts form the core of Master Builders Solutions. We combine the right elements from our portfolio to solve your specific construction challenges. We collaborate across areas of expertise and regions and draw on the experience gained from countless construction projects worldwide. We leverage global technologies, as well as our in-depth knowledge of local building needs, to develop innovations that help make you more successful and drive sustainable construction.

The comprehensive portfolio under the Master Builders Solutions brand encompasses concrete admixtures, cement additives, chemical solutions for underground construction, fiber reinforcement solutions, waterproofing solutions, sealants, concrete repair and protection solutions, performance grouts, and performance flooring solutions.

Master Builders Solutions Admixtures US, LLC
23700 Chagrin Boulevard
Beachwood, Ohio, 44122-5544
800-628-9990

Master Builders Solutions Canada, Inc.
1800 Clark Boulevard
Brampton, Ontario L6T 4M7
800-387-5862

Visit us at:
www.master-builders-solutions.com/en-us

Email: admixtures@masterbuilders.com

Follow us at:

MASTER® BUILDERS SOLUTIONS

Product in Focus

MasterLife® ASR 30 Admixture

A Solution to Alkali-Silica Reactivity in Concrete

What is Alkali-Silica Reaction?

Alkali-Silica Reaction (ASR) is the reaction between soluble alkalies in portland cement (sodium or potassium) and certain siliceous rocks or minerals that are present in some aggregates. Figure 1 illustrates the environment within concrete that both initiates and supports ASR. A by-product of the reaction is a gel that absorbs water and swells to cause abnormal expansion and cracking of concrete.

Controlling ASR

ASR can be controlled in concrete by limiting alkali content, restricting the use of reactive aggregates, decreasing permeability, using mitigating supplementary cementitious materials, or using a lithium admixture.

The lithium ion works by reacting with dissolved silica to form very insoluble and stable lithium silicates that do not absorb water and are non-expansive. The effect of lithium on controlling expansion caused by ASR is shown in Figure 2.

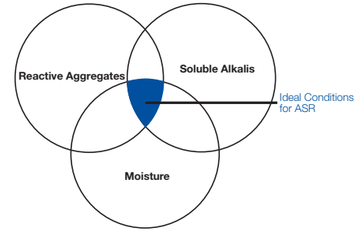
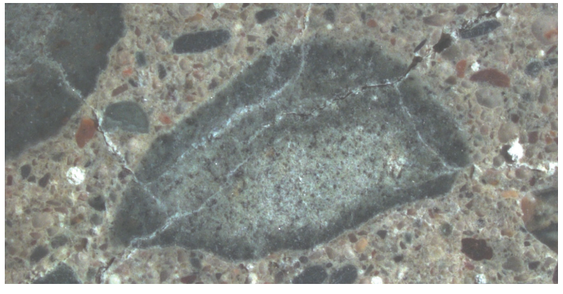
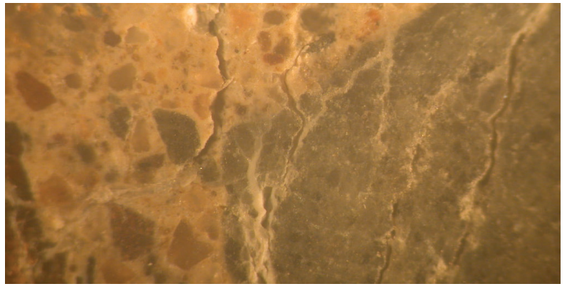


Figure 1. Conditions required for ASR





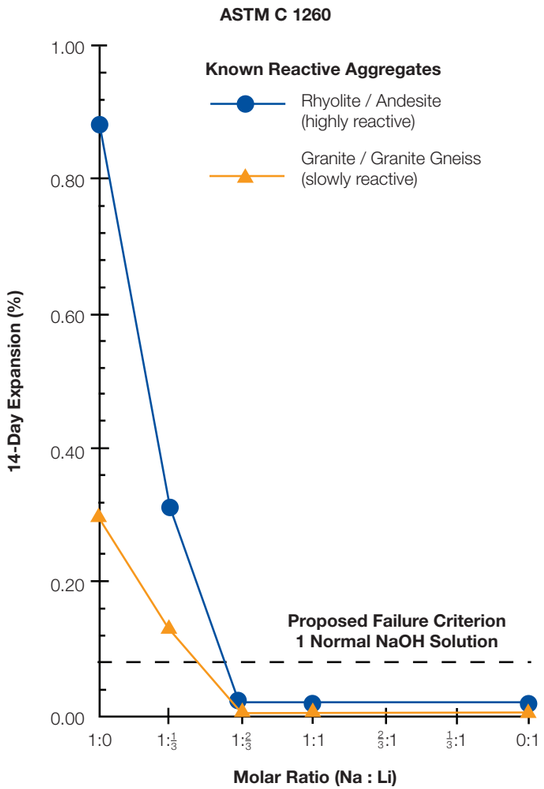


Figure 2. The effect of lithium on controlling expansion caused by ASR (Source: SHRP-C-343, National Research Council, Washington, DC)

Water-Repellent Admixture Technologies Measuring Potential for ASR

The standard test methods that can be used to identify reactive aggregates or measure the potential for ASR include:

- C 227, “Standard Test Method for Potential Alkali Reactivity of Cement-Aggregate Combinations” (Mortar-Bar Method)
- C 295, “Standard Guide for Petrographic Examination of Aggregates for Concrete”
- C 856, “Standard Practice for Petrographic Examination of Hardened Concrete”
- C 1260, “Standard Test Method for Potential Alkali Reactivity of Aggregates” (Mortar-Bar Method)
- C 1293, “Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction”
- C 1567, “Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate” (Accelerated Mortar-Bar Method)
- C 1778, “Standard Guide for Reducing the Risk of Deleterious Alkali-Aggregate Reaction in Concrete”
- CRD-C 662 “Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials, Lithium Nitrate Admixture and Aggregate” (Accelerated Mortar-Bar Method)

MasterLife ASR 30 Admixture Solution

MasterLife ASR 30 lithium-based liquid admixture is formulated for use in concrete containing reactive aggregates to inhibit and control ASR.

Applications

- Highway construction
- Roads, bridges, runways
- Dams, water treatment facilities
- Buildings, stadiums
- Areas with known ASR problems

Features

- Proven chemistry for mitigating ASR
- Ready-to-use liquid admixture
- Compatible with other Master Builders Solutions products
- Does not require low alkali cement
- No adverse effects on concrete properties

Benefits

- Improved durability of concrete
- Extended service life of concrete structures
- Allows use of locally available aggregates

Figure 3. Concrete and mortar prisms used in ASTM C 1293 and ASTM C 1260 tests

Performance Characteristics

The effectiveness of lithium admixtures in mitigating ASR should be evaluated using either the ASTM C 1293 or CRD C 662 test methods. ASTM C 1293 data, shown in Figure 4, indicate that the use of MasterLife ASR 30 admixture significantly reduces the expansion of concrete made with reactive aggregates. The data also show that MasterLife ASR 30 admixture can be used in combination with Class F fly ash to either enhance the performance (further reduce expansion), make the mixture more economical, or both.

Rate of Hardening: The addition of MasterLife ASR 30 admixture can accelerate the initial time of setting of concrete by 5 – 20%.

Dosage: The dosage of MasterLife ASR 30 admixture is based on the alkali content of the cement, but may be adjusted depending on the particular ingredients of the concrete mixture (Note 1).

A) Determine the amount of cement (lb/yd^3 or kg/m^3) in the mixture

B) Determine the alkali content of the cement (%)

C) Determine the preferred dosage multiplier. If you are using gal/yd^3, multiplier is 0.55. If you are using L/m^3, multiplier is 4.6

D) Dosage = $\frac{(A) \times (B) \times (C)}{100}$

Sample Calculation

If the concrete mixture contains 500 lb/yd^3 (297 kg/m^3) of cement with an alkali content of 0.6%, then the MasterLife ASR 30 admixture dosage is:

gal/yd^3: $\frac{500 \times 0.6 \times 0.55}{100} = 1.65$

L/m^3: $\frac{297 \times 0.6 \times 4.6}{100} = 8.15$

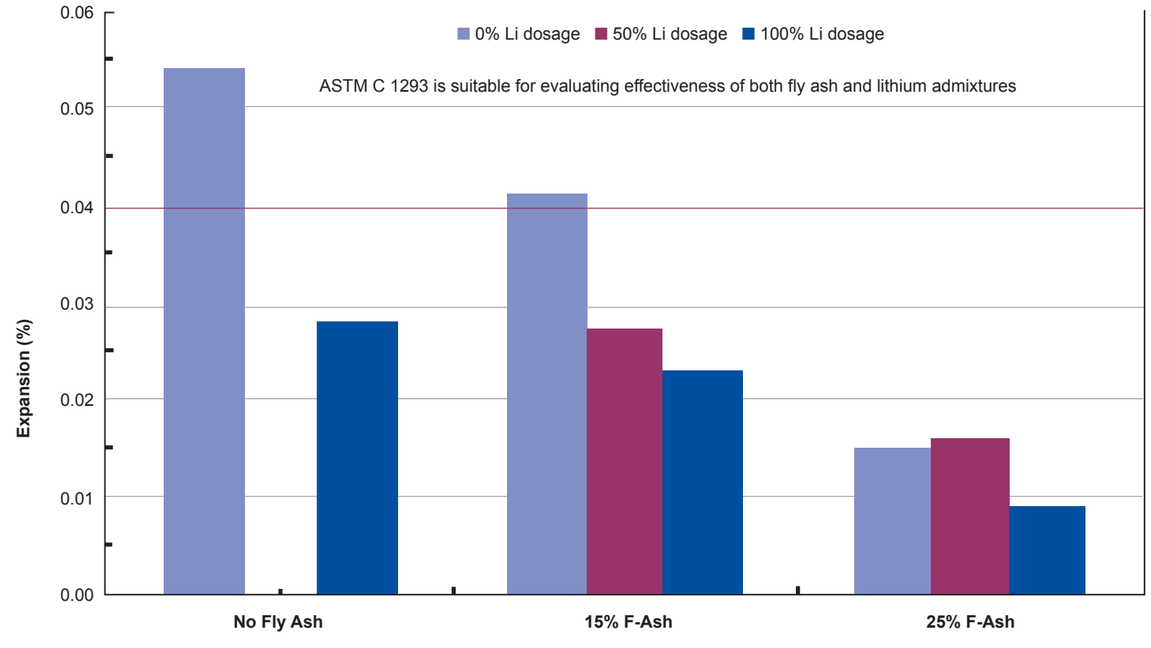


Figure 4. ASTM C 1293 data

Note 1: Some supplementary cementitious materials such as silica fume, metakaolin and some types of fly ash do provide a benefit in mitigating ASR in concrete. Therefore, the dosage of MasterLife ASR 30 admixture in a pozzolan-treated concrete may be reduced if testing is performed (a) to establish the beneficial effect of the pozzolan and (b) to determine the optimum dosage of MasterLife ASR 30 admixture required for the concrete mixture. Testing is particularly recommended if a significant amount of alkalis can be contributed by sodium-bearing admixtures or Class C fly ash that are a part of the concrete mixture. For additional information on testing and dosages of MasterLife ASR 30 admixture in pozzolan-treated or other concrete mixtures, contact your local sales representative.