



# CONCRETE

## Sika<sup>®</sup> Control ASR

ADMIXTURE FOR ALKALI-SILICA REACTION MITIGATION

BUILDING TRUST



# Sika® Control ASR

Admixture to Control Alkali-Silica Reaction in Concrete

**ALKALI-SILICA REACTION (ASR) IN CONCRETE** is widely present in the United States as in many parts of the rest of the world. Most of the states in the U.S. have reported ASR related distress in concrete. ASR has been found to be responsible for the deterioration of various concrete structures including pavements, bridges, dams and other structures. The main reason for the occurrence of ASR is the presence of moderate to highly reactive aggregates and the utilization of high-alkali cements in some regions.

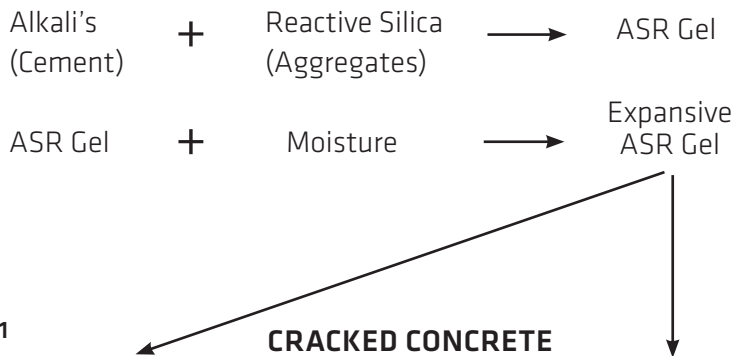


Figure 1

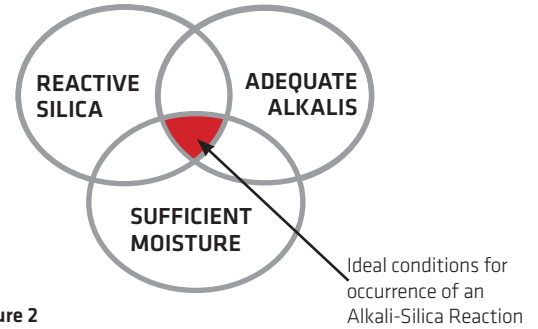


Figure 2

## WHAT IS ALKALI-SILICA REACTION?

Alkali-Silica Reaction (ASR) is a chemical reaction that occurs when alkali ions (Na & K) present in the pore solution of the concrete react with certain forms of reactive silica present in the aggregates to form an alkali silica gel. This gel is harmless, but in the presence of moisture it swells and generates tensile stresses in the concrete, eventually causing the concrete to crack. **(Figure 1)**

Damage due to ASR can lead to significantly reduced service life of the structure or high maintenance cost. As a result, concrete for new construction in regions where ASR has been detected require the use of a mitigation alternative to help prevent ASR. A lithium nitrate admixture is one of most effective mitigation options to prevent ASR. Lithium nitrate based admixtures have been successfully used in many fast track concrete pavement repair projects such as airport runways & taxiways and other commercial projects across the United States.

## SIKA AT WORK

<b>PROJECT:</b>	Detroit Metropolitan Airport (DTW)
<b>COST:</b>	\$48 million Runway Project
<b>LOCATION:</b>	Detroit, Michigan, USA
<b>OWNER:</b>	Wayne County Airport Authority
<b>CONCRETE PRODUCER:</b>	John Carlo Inc.
<b>ARCHITECT:</b>	Gensler Associates Inc.
<b>SIKA ADMIXTURES USED:</b>	Sika® Control ASR, Sika® Air-260, Plastocrete® 10N, Water Reducer



# Sika® Control ASR

How it Works, Dosage and Benefits

**Sika® Control ASR** is a lithium nitrate based liquid admixture that helps prevent the occurrence of ASR in concrete. When Sika® Control ASR is added to concrete, and the lithium ions (from Sika® Control ASR) are present in a sufficient ratio to the alkali ions (Na & K), then lithium will preferentially combine with the available silica present, and form relatively stable, insoluble lithium silicates. The pore solution containing the lithium compound does not have a tendency to form a swellable gel that expands in the presence of moisture; this prevents the concrete from cracking. The ratio of the lithium ion to the sum of the sodium and potassium ions necessary for control depends mainly on the aggregate, but is normally 0.74 on a molar basis (see Figure 4).

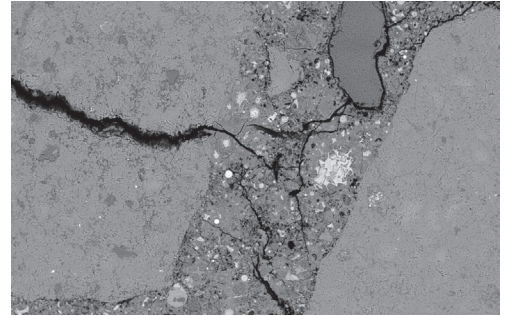


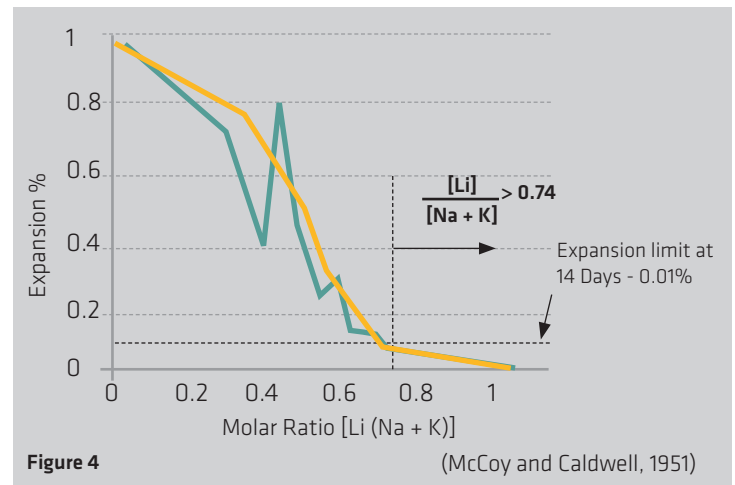
Figure 3: SEM Image of cracking in concrete due to ASR

## DOSAGE OF Sika® Control ASR

The dose of Sika® Control ASR is based on the alkali content of the cement. The “Standard Dose” is 0.55 gallon/ lb. (4.6 kg/m<sup>3</sup>) of sodium equivalent (Na<sub>2</sub>O equi.) supplied by the cement. The “Standard Dose” is also sometimes referred to as the “Normal Dose” or “100% Dose”. To maintain same water to cementitious ratio, subtract 0.85 gallons of water for each gallon (0.85 liter of water for each liter) of Sika® Control ASR added to the concrete mix. The actual dosage of Sika® Control ASR needed to suppress ASR expansions to an acceptable level must be verified by conducting the accelerated mortar bar test like CRD-C 662. Other ASTM tests related to ASR include ASTM C1260, C1567, C441, C227 and C289.

## BENEFITS OF Sika® Control ASR

- Minimizes deleterious expansions in concrete due to ASR
- Increases durability and life span of the concrete structure
- Allows use of locally available aggregate
- Does not promote loss of concrete slump
- Compatible with appropriate pozzolans and other Sika® admixtures
- Easy to use



## PERFORMANCE OF SIKA CONTROL ASR

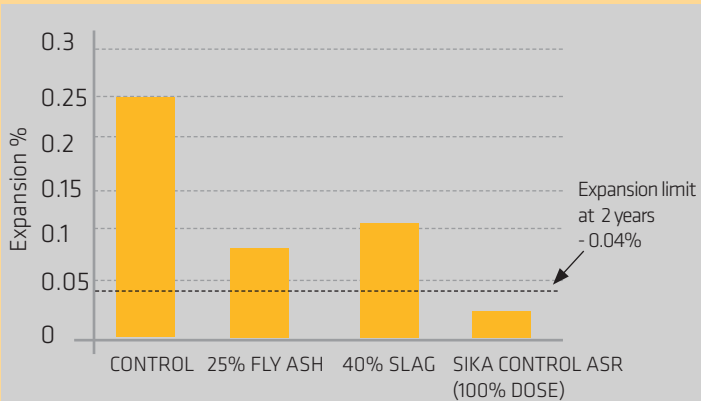


Figure 5: Performance of Sika® Control ASR in ASTM C1293 Test (2 years)

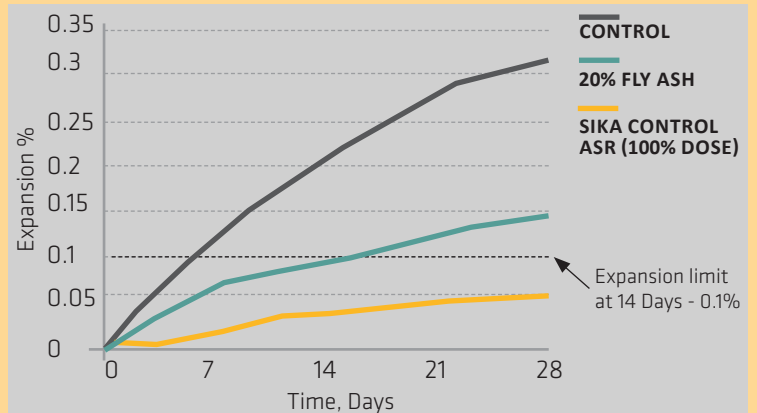


Figure 6: Performance of Sika® Control ASR in CRD-C662 Test (Control & Fly Ash mix as per ASTM C1260 & C1567 Resp.)

# SIKA FULL RANGE SOLUTIONS FOR CONSTRUCTION:



WATERPROOFING



CONCRETE



REFURBISHMENT



SEALING AND BONDING



FLOORING



ROOFING

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