RP 309 – *Alkali-Silica Reaction Mitigation Strategies with Specific Admixtures*

- Project Description:

Concrete is the second most widely used material in construction after water. Besides structural performance, concrete must have good durability which is defined as the ability to withstand damaging effects of the environment without deterioration for a certain period of time. Concrete deterioration is a major challenge in states such as Idaho that experience harsh winters. Every year, ITD spends millions of dollars to repair deteriorated concrete structures around Idaho. One of the leading causes for deterioration of concrete is Alkali-Silica Reaction (ASR), informally known as "Concrete Cancer", a chemical reaction that develops between the reactive silica in the aggregates and the alkalis within the cement paste, causing expansion and cracking to the structure over a number of years. ASR will eventually compromise the durability and structural integrity of structures and pavements.

ITD is currently experiencing problems with secondary cementitious materials (SCMs) test results in terms of consistency and quality of materials. SCMs are critical for concrete durability, longevity, cost, workability, strength, and as a mitigation method to reduce ASR reactions that lead to premature concrete failure. There are various mineral admixtures commercially available in the United States and Idaho. However, the effectiveness of these admixtures in reducing ASR has not been independently verified in Idaho. The goal of this project is to conduct testing, verification and cost analysis of mineral admixtures to identify effective ASR mitigation strategies that will ensure durability of concrete structures in Idaho.

- The objectives of this project are:
  1. To conduct a literature review of all admixtures for reducing ASR, including several mineral and nano-silica admixtures currently available and used in Idaho. The literature review will also examine and summarize relevant test methods to identify the appropriate tests to be performed for this study.
  2. To evaluate the performance of admixtures in reducing ASR potential of ITD concrete mixes containing Idaho reactive aggregates by comparing test data with a benchmark concrete mix without reactive aggregates. Specific admixtures to be evaluated include:
     a. Two ASR reducing mineral admixtures – Diatomaceous Earth and Natural Pozzolans
     b. Three commercially available nano-silica admixtures
  3. To develop recommendations for ITD to implement the use of ASR reducing admixtures in concrete mixes.
- Estimated Completion Date: May 8, 2025
- Budget: $150,000
- Project Manager: Dana Dietz, P.E., Structural Materials Engineer, 208-334-8836, Dana.Dietz@itd.idaho.gov
- Principal Investigator: Emad Kassem, PhD, P.E., Associate Professor University of Idaho Department of Civil and Environmental Engineering, 208-885-1025, ekassem@uidaho.edu
- Co-Principal Investigator: Anol Mukhopadhyay, PhD, Senior Research Scientist, Texas Transportation Institute, 979-317-2298, a-mukhopadhyay@tti.tamu.edu
- TAC Members:
  Chad Clawson, P.E., 208-334-8453, Chad.Clawson@itd.idaho.gov
  Adrienne Woods, 208-886-7841, Adrienne.Woods@itd.idaho.gov
  Ken Hahn, 208-745-5640, Ken.Hahn@itd.idaho.gov
- FHWA Advisor: Kyle Holman, P.E., 208-617-2135, Kyle.Holman@dot.gov