DRISI
Caltrans Division of Research,
Innovation and System Information

Research Results

Results from Visual Inspection and Laboratory Testing for ASR in Existing Concrete cores from Bridges and Pavements in California

Caltrans put in place in 2000 a general specification to reduce ASRs impact on the State of California's highway network.

Pavement

MAY 2019

Project Title:
Results from Visual Inspection and Laboratory Testing for ASR in Existing Concrete cores from Bridges and Pavements in California

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WHAT IS THE NEED?

Caltrans has spent significant resources over several decades attempting to mitigate the impact of ASR on Bridges and Pavement. Alkali-silica reaction (ASR) is a chemical reaction between the alkalis in portland cement and certain types of silica minerals present in some aggregates. The reaction product is a hygroscopic gel, which absorbs moisture and swells. Under certain circumstances, the formation of the gel can cause expansion and, eventually, cracking of the concrete. Factors that affect the rate and severity of ASR include:

- The reactivity of the aggregate (amount and type of reactive silica minerals present).
- The availability of alkalis in the concrete.
- The exposure conditions (moisture availability and temperature).
- The type of concrete element (size and reinforcement details).

In some cases, ASR may cause severe concrete deterioration, leading to a loss in serviceability or rendering the concrete more susceptible to damage by other processes, such as freezing-and-thawing or chloride ingress and corrosion. Therefore Caltrans needed to conduct a study to evaluate the service-life impact of ASR.

WHAT WAS OUR GOAL?

The overall goal was to evaluate the presence of Alkali-silica reaction (ASR) with available Concrete core samples.

The three goals for this project were:

1. To inventory and then use the cores to provide over all high-level assessment of the presence of ASR in the State's pavement and Bridge Decks.
2. To determine Alkaline-Silica reaction and deterioration rates for concrete placed before & after Caltrans changed its ASR-mitigation practice in the 1990s.
3. Create procedure for evaluating ASR that can be used by Caltrans staff.

WHAT DID WE DO?

We used existing concrete cores collected by three earlier Caltrans studies to initiate an ASR survey study on the cores. From these previous studies there were a total of 265 pavement samples and 311 Bridge samples. No new cores were taken for this study. The report summarizes the results of the inventory and testing of the cores.

WHAT WAS THE OUTCOME?

The project produced the following results; the three objectives of the project were completed, but the second objective to evaluate the detection rates of ASR showed no differences because of very low detention rates across all cores tested.

WHAT IS THE BENEFIT?

The reaction of ASR is very difficult to stop once it has begun. The best way to mitigate ASR is to prevent it from happening through the proper use of materials in a concrete mixture. A draft guideline was developed for the visual inspection of concrete cores to identify signs of potential ASR-related distresses. The guideline can be used in the future by Caltrans staff to determine the need for further detailed examinations of pavement. The guideline describes step-by-step inspection procedures and selection criteria, and can be found in Section 3.6 of the report.

LEARN MORE

To view the complete report:
http://www.ucprc.ucdavis.edu/PDF/UCPRC-RR-2015-07.pdf

IMAGES

FIGURE 1: Bridge cores; cores equal to or longer than 3 inches were used for ASR visual inspection

FIGURE 2: Pavement and bridge cores after cutting for visual inspection