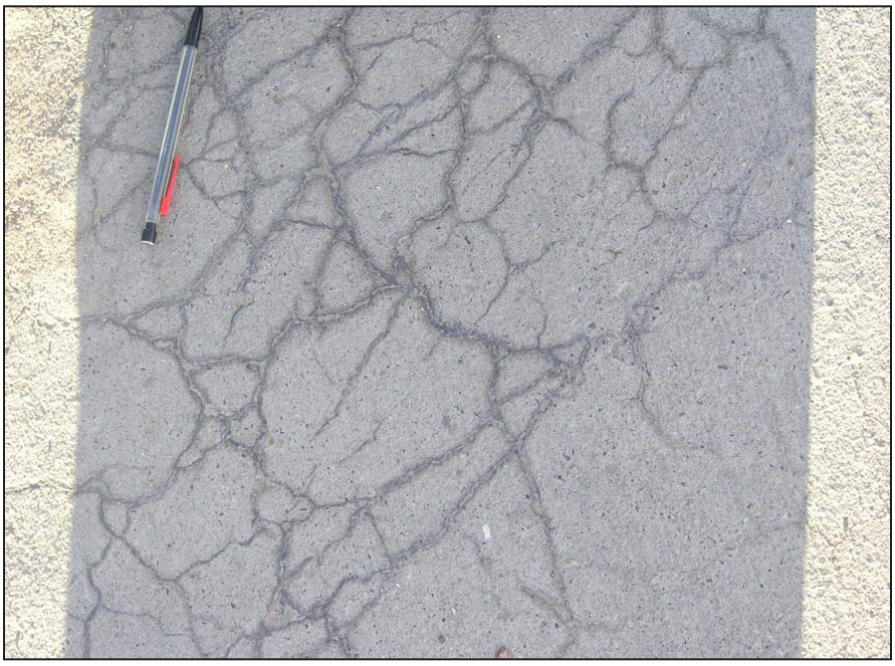
MOUNTAIN-PLAINS CONSORTIUM

RESEARCH BRIEF | MPC 20-425 (project 539) | December 2020

Using an Ultra-accelerated Test Method to Evaluate Aggregate and Cement Combinations to Use Recycled Concrete Aggregate in New Concrete Construction



the ISSUE

The Rocky Mountain Region has experienced considerable difficulty due to the presence of alkali-silica reaction in concrete construction. Several sources of aggregate that have produced poorly performing concrete have been removed from service. For example, runways at Denver International Airport were damaged by alkali-silica reaction with a repair cost of more than $30 million.

As natural aggregate resources become scarce, it is increasingly attractive to use recycled concrete aggregate (RCA) as a raw material in new concrete. Reusing concrete that has been salvaged from demolition work could be a major advancement for concrete structures. A real concern with using RCA as a sustainable building material is its potential for alkali-silica reaction, particularly if the concrete was removed from service due to alkali-silica reaction. As a building material, a full serviceability record is not always available. Hence, effective use of RCA requires the ability to classify whether it is reactive in terms of alkali-silica reaction.

the RESEARCH

This research evaluated the use of RCA in new construction by determining the risk from alkali-silica reaction.

The concrete prism test is a standardized test used to identify reactive aggregates or evaluate preventative measures. A wide range of testing was conducted to evaluate how consistent the concrete prism test is when using recycled concrete aggregate in new construction. The data indicate that introducing recycled concrete did not increase the variability of test results for a single lab or across six different laboratories with experience testing alkali-silica reaction.

MOUNTAIN-PLAINS CONSORTIUM REGION 8

A University Transportation Center sponsored by the U.S. Department of Transportation serving the Mountain-Plains Region. Consortium members:

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Project Title

Ultra-accelerated Method to Evaluate Recycled Concrete Aggregate in New Construction

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the **FINDINGS**

Both of the inter-laboratory and intra-laboratory studies suggested that there was no additional variation with using RCA instead of natural aggregates. Within-laboratory variability for the concrete prism test meets the within-laboratory precision limits. So no recommendation has been proposed to modify existing ASTM within-laboratory precision limits.

Test results show that using previously damaged concrete with alkali-silica reaction often yields innocuous concrete because the reaction has run its course. Consequently, using RCA to replace up to 40% replacement of course aggregates, when combined with natural nonreactive aggregates, can be used in new concrete construction without causing severe alkali-silica reaction damage. In fact, using RCA affected with alkali-silica reaction is less susceptible to alkali-silica reaction than the virgin aggregate when used with a non-reactive aggregate.

the **IMPACT**

The limited variability of results should alleviate alkali-silica reaction concerns for those who wish to use RCA. The Wyoming Department of Transportation has had success in using recycled concrete aggregate on Interstate 80 with limited alkali-silica reaction damage. This performance, coupled with data from this research and a previous study, helps confirm that using RCAs combined with natural aggregates produces durable long-term concrete that will benefit the transportation network in this region. This study provides experimental data that permit RCAs to be used in applications beyond base fill for roads.

For more information on this project, download the entire report at https://www.ugpti.org/resources/reports/details.php?id=1022

For more information or additional copies, visit the Web site at www.mountain-plains.org, call (701) 231-7767 or write to Mountain-Plains Consortium, Upper Great Plains Transportation Institute, North Dakota State University, Dept. 2880, PO Box 6050, Fargo, ND 58108-6050.

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