LOUISIANA TRANSPORTATION RESEARCH CENTER

Technical Summary

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Evaluation of the Miniature Concrete Prism Test (MCPT) for Use in LADOTD

Introduction

Currently, there are two widely used testing methods to evaluate aggregates' alkali-silica reaction (ASR) potential: the concrete prism test (CPT) per ASTM C1293, and the accelerated mortar bar test (AMBT) per ASTM C1260. However, researchers have noticed that the AMBT method could produce false-positive and false-negative results, raising reliability concerns. The CPT method is a more reliable test method, but it takes one year to produce results for reactivity and two years to evaluate the effectiveness of the mitigation measures. This renders the test impractical for the routine assessment of aggregates' reactivity.

In an effort to address the above limitations, the miniature concrete prism test (MCPT) was recently developed. A literature review showed that the MCPT method could produce reliable test results in 56 days in the published cases. In order to explore the suitability and feasibility of implementing the MCPT method for use in Louisiana Department of Transportation and Development (DOTD), this report presents a comparative study of the testing methods for the evaluation of aggregates' alkali-silica reactivity.

Objective

The objectives of this study were to evaluate the suitability of the MCPT method to assess alkali-silica reactivity and to determine the level of implementation and/or continued research required to adopt this test method.

Scope

To fulfill the objectives of this study, aggregates from local sources and DOTD's approved materials list known to be reactive or potentially reactive were used to produce concrete samples. Length change measurements were taken after the removal of molds based on the required testing schedules for the MCPT method and the existing ASR test method, as outlined in ASTM C1293. Finally, the testing results from the MCPT method were compared with those from ASTM C1293 to evaluate the feasibility of the MCPT method.

Methodology

During the pre-screening, aggregates from DOTD's approved materials list that known to be reactive or potentially reactive were selected to represent a wide range of reactivity. The selected aggregates were tested using both the MCPT (AASHTO T380) and CPT methods (ASTM C1293). After testing, the results were compared to evaluate the feasibility and robustness of the MCPT method for assessing ASR potential.

Conclusions

By comparing the test results from the MCPT, CPT, and AMBT methods, it was found that:

- The MCPT and CPT methods were in agreement for 23 out of 24 aggregates, an agreement rate of 95.8% for the evaluation of ASR reactivity. A good linear correlation with an R2 value of 0.83 was established between these two sets of testing results.
- The 56-day MCPT method produced a higher expansion than the one year CPT method for the majority of the reactive aggregates (i.e., expansion value greater than 0.040%).
- The MCPT and AMBT methods were in agreement on the classification of 10 out of 12 coarse aggregates for the evaluation of coarse aggregates' ASR reactivity.
- Of the 33 mixtures evaluated for ASR mitigation, the MCPT and CPT methods were in agreement on 26 specimens, an agreement rate of 79% for the evaluation of ASR mitigation effectiveness.

Principal Investigator
Zhen Liu, Ph.D., P.E.
225-767-9138

LTRC Contact
Samuel Cooper, III, Ph.D., P.E.
225-767-9164

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- The correlation shows that a linear relationship with an R2 value of 0.6697 can be established between the test results from the MCPT and CPT methods for the evaluation of ASR mitigation effectiveness.

Recommendations

The results show that an agreement of 95.8% for the evaluation of ASR reactivity was reached for the MCPT and CPT methods in this study, and a linear correlation with an R2 value of 0.83 was established between these two sets of testing results. However, it is also noted that all of the fine aggregates used in this study were identified as non-reactive by the MCPT and CPT methods. Using the data obtained in this study, it is recommended to adopt the MCPT method to evaluate ASR reactivity for all coarse aggregates, as well as for fine aggregates, provided that the expansions do not exceed 0.30% from the AMBT method.