

TRANSPORTATION POOLED FUND PROGRAM QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT):

 FHWA

INSTRUCTIONS:

Lead Agency contacts should complete a quarterly progress report for each calendar quarter during which the projects are active. Please provide a project schedule status of the research activities tied to each task that is defined in the proposal; a percentage completion of each task; a concise discussion (2 or 3 sentences) of the current status, including accomplishments and problems encountered, if any. List all tasks, even if no work was done during this period.

Transportation Pooled Fund Program Project # TPF5-(521)		Transportation Pooled Fund Program - Report Period: <input checked="" type="checkbox"/> Quarter 1 (January 1 – March 31) <input type="checkbox"/> Quarter 2 (April 1 – June 30) <input type="checkbox"/> Quarter 3 (July 1 – September 30) <input type="checkbox"/> Quarter 4 (October 1 – December 31)	
TPF Study Number and Title: TPF5(521) New Performance Approach to Evaluate ASR in Concrete			
Lead Agency Contact: Jose F Munoz Campos	Lead Agency Phone Number: 202 493 3159	Lead Agency E-Mail Jose.munoz.campos@dot.gov	
Lead Agency Project ID:	Other Project ID (i.e., contract #):	Project Start Date:	
Original Project Start Date: 07/23/2023	Original Project End Date: 12/31/2028	If Extension has been requested, updated project End Date:	

Project schedule status:

- On schedule
 On revised schedule
 Ahead of schedule
 Behind schedule

Overall Project Statistics:

Total Project Budget	Total Funds Expended This Quarter	Percentage of Work Completed to Date
\$315,000	\$93,576	54%

Project Description:

The Turner-Fairbank Highway Research center has developed two new alkali-silica reaction (ASR) tests, the AASHTO TP-144-23 (T-FAST) and the AASHTO T 416-24 (ATT). The T-FAST is sensitive method capable of accurately detecting the presence of alkali-silica reactive phases in any type of aggregate. The ATT is a simple and reliable method to determine the alkali threshold (AT) of any aggregate combination. The AT is defined as the specific alkali level at which the ASR reaction is triggered in an aggregate. Knowing the AT of an aggregate combination is an important piece of

information that provides insight into the field behavior of the aggregates when used in a concrete of specific alkali loading.

A new performance and prescriptive approach have been proposed based on the information provided by the T-FAST and ATT to predict the alkali-silica susceptibility of any concrete mix design. The two newly proposed approaches are based in the widely accepted notion that any given combination of aggregates will develop ASR inside of a specific concrete only when the alkali loading (AL) of the concrete is higher than the AT of the aggregates. The AL of the concrete depends on the mix design proportions, type and content of the cement, and the presence of supplementary cementitious materials. While previous research supports the theory that ASR can be prevented by limiting AL below AT, there is a need to understand the extent of the influence played by available alkalis and aluminum released by SCM in the AL of the concrete and AT of the aggregates, respectively. Lastly, it is also necessary to expand T-FAST capabilities to evaluate ASR mitigation strategies. This is a requirement because it is not always possible to avoid the use of reactive aggregates due to lack of availability or other reasons.

The principal objective of the project is to evaluate a wide selection of concrete mix designs to validate the use of T-FAST and ATT methods in conjunction with mix design data, cement mill reports and SCM properties to determine the likelihood of ASR gel formation in concrete.

Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):

Task 2. Characterization of supplementary cementitious materials (SCM)

The team continued working on the evaluation of SCM, focusing on the compatibility between a particular aggregate combination and SCM. During this quarter, the team developed a new protocol to evaluate the compatibility between the aggregate fraction and SCM in any concrete mixture. The proposed compatibility protocol will be compared against the performance of the project's concrete mix designs to verify whether different aggregate combinations have different affinities for SCM. To evaluate this hypothesis, the team reviewed different chemical protocols to determine the available alkali content of SCM. Specifically, two protocols were identified to evaluate the project's SCMs: ASTM C311 and a chemical protocol developed by Sharbaf and Rajabipour 2024 (Sharbaf, M., & Rajabipour, F. (2024). A New Soluble Alkali Test for Supplementary Cementitious Materials. In RILEM Bookseries (pp. 379-387). (RILEM Bookseries; Vol. 49). Springer Science and Media B.V. https://doi.org/10.1007/978-3-031-59419-9_44.)

The team continued working on the Raman characterization of two SCMs selected for mixing, a Class F fly ash and a slag, and the XRD analysis of the in-house SCMs.

Task 3: Prepare Concrete Samples

Cylinders were prepared for two Goal 1 Mixes (TX Mix C6-708 and TX Mix C16-708). Twenty-four hours after casting, the cylinders were moved into 100% RH and 55 deg C exposure conditions to accelerate ASR. The cylinders prepared using these concrete mixtures will validate the criteria that ASR will not occur when alkali loading is less than the alkali threshold of the aggregate combination.

The team completed planning for two new concrete mixes: CTMix_PCC04460 and SDMix_M1CMD1. This preparation phase included developing batching plans, procuring cements, and measuring the specific gravity and moisture absorption of the aggregates.

Concrete cylinders from AK Mix CA740LA and AK Mix CA835LA were cut to extract 5 and 3 sections, respectively, of 2" x 1" x 0.5" concrete. The cutting was accomplished using a combination of two oil-cooled table saws and a slow-speed precision saw. Samples from the sectioned AK Mix CA740LA core were sent out for epoxy embedding, lapping, and polishing.

The team also completed microstructural analysis and Damage Rating Index (DRI) evaluation on SEM samples from the 12-month mixes (PA Mix GTC15 and PA Mix GTC25).

Anticipated work next quarter:

- Complete XRD analysis of the in house SCMs and Complete Raman analysis of two SCM.
- Batch three concrete mixes (AK Mix CA564LA, CTMix_PCC04460 and SDMix_M1CMD1).
- Cut samples of the 2-year PAMix GTC15 samples, and prepare epoxy embedded specimens.
- Complete DRI and SEM analysis of the AK Mix CA835LA and AK Mix CA740LA samples.

Significant Results:

None

Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).

None

Potential Implementation:

None