Pavement & Materials Partnering Committee
Work Product Scoping Document
New
Performance Based ASR Mitigation
April 1, 2021

Task Group

Concrete Task Group

Problem Process

☒ Annual

☐ Expedited

☐ Emerging Initiative

Title

Performance Based ASR Mitigation

Statement of Effort/Improvement

Caltrans Standard Specifications require cementitious material proportions in concrete to comply with Equations 1 and 2 in Section 90-1.02B(3). These equations establish minimum supplementary cementitious material (SCM) quantities for concrete to mitigate the risk of alkali-silica reaction (ASR) from potentially reactive aggregates, as well as take advantage of improved concrete properties resulting from SCM use. The use of SCMs also helps promote Departmental sustainability goals. To address the ASR susceptibility of aggregates, the factors in Equation 1 are generalized for two categories – "innocuous" and "all other" aggregates. The SCM quantity requirements for the aggregates, however, could be refined by considering the potential reactivity of the specific aggregate, cement and SCM combination that will be used.

This effort will investigate the possibility of developing performance-based specifications that can be used for determining SCM content in a concrete mix to mitigate ASR. In essence, this effort will provide the contractors with an option that may be utilized to refine the X-factor in the Equation 1 for specific combinations of aggregate, cement, and SCM to be used.

Purpose

A performance-based specification would allow contractors to optimize the SCM content for the specific aggregate used and promote more efficient use of aggregates and SCMs. The purpose of this effort is to provide contractors with additional flexibility in the use of SCMs by adopting a performance-based ASR mitigation while still maintaining the Department's durability and sustainability objectives.

Background

The current specifications classify aggregate into two categories: (1) innocuous or non-reactive aggregates, and (2) non-innocuous or all other aggregates. All the non-

innocuous aggregates are regarded as potentially reactive. If there are multiple sources of aggregate in a mix and one source is not categorized as "innocuous", the combined aggregates are also regarded as "non-innocuous." The percentage of SCMs required in a concrete mix varies depending on the type of SCM used and the classification of aggregate. When fly ash is used, for instance, the specifications require a concrete mix to contain either 15% fly ash for innocuous aggregate or 25% fly ash for all other aggregates. For simplicity, the factors in Equation 1 are generalized to make it effective for the entire range of potential reactivity. For some non-innocuous aggregates, however, the ASR potential of these sources may be able to be controlled with less than the amount of SCMs determined from the equations. This work group effort will address this issue and provide a method to optimize the SCM content requirements for specific concrete mix design applications.

Approach

1. Street Ready Assurance

   Upon review of other states' performance-based ASR mitigation specifications, Street Ready specification language will be prepared with input from all stake holders.

2. Performance Tracking/Management

   Tasks will be simple and manageable.

3. Consistently Implemented

   The proposed specification will provide a methodology compatible with all cement and SCM combinations across all strength ranges.

4. Pilot Projects (if anticipated)

   Not anticipated.

5. Research Needs (if necessary)

   Not necessary

Team Members (Indicate CT Chair and Industry Lead)

CT/Industry	Division/Firm Name	Member Name
CT Chair	Office of Concrete Pavement	David Lim
CT	METS	Seyedhamed 'Hamed' Sadati
CT	SP&I	Craig Knapp
CT	Construction	Deborah Yost
Industry Chair	Cemex	Mark Hill
Industry	SWCPA	Bruce Carter
Industry	Calaveras Materials	Nathan Shwiyhat
Industry	CalPortland	Sydney Wilson

Team should not include any more than 4 Caltrans staff and 4 members from Industry. See PMPC Standard Operating Procedures for more information.

Objectives/Deliverables/Due Dates

Description:

The objective of this work product is to investigate the feasibility of using performance-based specifications for ASR mitigation without compromising concrete durability and the Department's sustainability goals. If feasible, this work product will result in updating the current specifications to include the available performance-based measures as an option for the use of SCMs for ASR mitigation.

Details:

Milestones	Name - Responsible Party	Due Date (Start/Complete)
1. Research available performance-based ASR mitigation and sustainability measures and specifications	All	Apr 2021/Jun 2021
2. Summary report of the research	David Lim, Lance Li/ Mark Hill, Sydney Wilson	Jul 2021/Sep 2021
3. Develop specifications - coordinate with Blended SCM WG as needed	Craig Knapp, David Lim/ Bruce Carter, Nathan Shwiyhat	Oct 2021/Feb 2022
4. Develop recommendations for maintaining the Department's durability and sustainability objectives	Craig Knapp, Deborah Yost/ Sydney Wilson, Bruce Carter	Feb 2022/Apr 2022
5. Stakeholder review and concurrence	David Lim/ Mark Hill, Bruce Carter	Apr 2022/Jun 2022
6. Final report including WG recommendations for implementation	David Lim/ Mark Hill, Nathan Shwiyhat	Jul 2022/Sep 2022

Resources To Develop and Implement

	Caltrans Hours	Industry Hours
Research available performance-based ASR mitigation and sustainability measures	100	100
Summary report of the research	100	100
Develop specifications	200	160
Develop recommendations for maintaining the Department's durability and sustainability objectives	100	100
Stakeholder review and concurrence	100	50
Final report	100	100

Benefits

- Ability to optimize available materials.
- Ability to optimize concrete proportions while still maintaining performance and sustainability.

Estimated Impact to Caltrans and Contractor

- Changes to Section 90 of the Standard Specifications.
- Provide contractors with the flexibility in the use of SCMs for ASR mitigation while still maintaining the Department's minimum concrete durability and sustainability goals.
- Provide Caltrans and Industry with the ability to optimize available materials.

Impediments to Completion of Deliverables

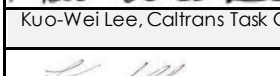
- Lack of communication and delay in agreement within Working Group.
- Delay in approval of proposed specification changes.

Recommendation and Approval

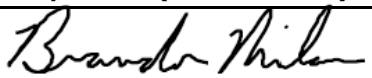
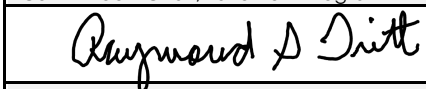
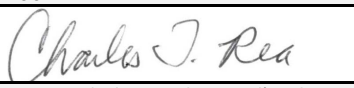
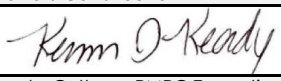
This scoping document for *Performance Based ASR Mitigation* was prepared by *Concrete Task Group* to address a priority issue with statewide significance and is within the Pavement & Materials Partnering Committee mission as described in the Pavement & Materials Partnering Committee Charter. The Subtask Group members have determined the scope, resources required and timeline for delivery of this project to attempt to ensure that the deliverables are achievable. A signature here indicates that each Task Group and PMPC Executive Committee is committed to providing the resources to support this effort within the prescribed timeframes. Furthermore, it is everyone's responsibility to ensure that the final effort/improvement will be:

1) Street-Ready,
2) Monitored and reported for performance,
3) Successfully implemented statewide as appropriate.

Scoping Document Recommendation and Industry Concurrence by (name and date):

Caltrans Name (Recommendation)	Date	Industry Name (Concurrence)	Date
	04/20/2021		04/20/2021
Keith Hoffman, Caltrans Task Group Chair		George Butorovich, Industry Task Group Lead	
	04/22/2021		
Kuo-Wei Lee, Caltrans Task Group Member		~~Mark Hill, Industry Task Group Co-Member~~	
	04/19/2021		
Ken Solak, Caltrans Task Group Member		Chu Wei, FHWA	

Scoping Document Approval and Industry Concurrence by (name and date):

Caltrans Name (Approval)	Date	Industry Name (Concurrence)	Date
	04/30/2021		04/22/2021
Shaila Chowdhury, Caltrans PMPC Executive Committee – Chair, Pavement Program		Brandon Milar, Industry PMPC Executive Committee	
	04/23/2021		04/22/2021
Raymond Tritt, Caltrans PMPC Executive Committee Headquarters Construction		Charley Rea, Industry PMPC Executive Committee	
	04/23/2021		
Kevin Keady, Caltrans PMPC Executive Committee Structures Policy and Innovation			
	04/30/2021		
Tim Greutert, Caltrans PMPC Executive Committee Materials Engineering and Testing Services			

Approval Date: 04/30/2021