

Pavement & Materials Partnering Committee
Work Product Scoping Document
Revised Performance Based ASR Mitigation
Performance Based ASR Mitigation for Non-Innocuous Aggregate
July 21, 2022

Task Group

Materials & Quality Assurance Subtask Group,
Concrete Task Group

Problem Process

- Annual
- Expedited
- Emerging Initiative

Title

Performance Based ASR Mitigation for Non-Innocuous Aggregate

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, may be able to 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 the appropriate SCM content in a concrete mix containing non-innocuous aggregate 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 for non-innocuous aggregate while still maintaining the Department's durability and sustainability objectives. For innocuous aggregate, SCM use will be evaluated as part of a separate scoping document in the future for performance-based concrete specifications.

Background

The current specifications classify aggregate into two categories: (1) innocuous or non-reactive aggregates, and (2) non-innocuous or all other aggregates. Caltrans considers all non-innocuous aggregates to be 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 and Data Collection & Evaluation Plan

Not anticipated.

5. Research Needs

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
Caltrans	METS	Seyedhamed 'Hamed' Sadati
Caltrans	SP&I	Craig Knapp
Caltrans	Construction	Deborah Yost
Industry – Lead	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 to mitigate ASR for concrete mixtures containing non-innocuous aggregates.

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 – Aug 2022
3. Develop specifications – coordinate with Blended SCM WG as needed	Craig Knapp, David Lim / Bruce	Jul 2022 – Oct 2022

Milestones	Name - Responsible Party	Due Date (Start/Complete)
	Carter, Nathan Shwiyhat	
4. Stakeholder review and concurrence	David Lim / Mark Hill, Bruce Carter	Oct 2022 – Feb 2023
5. Final report including WG recommendations for implementation	David Lim / Mark Hill, Nathan Shwiyhat	Oct 2022 – Apr 2023

*Some milestones listed above may not be necessary; final report is mandatory.

Resources To Develop and Implement

Work Scope	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
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 of non-innocuous aggregates 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

Pavement & Materials Partnering Committee

Scoping Document

Concrete Task Group, Materials & Quality Assurance Subtask Group

Performance Based ASR Mitigation for Non-Innocuous Aggregate

07/21/2022

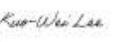
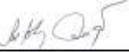
- Lack of communication and delay in agreement within Working Group.
- Delay in approval of proposed specification changes.

Recommendation and Approval

This scoping document for *Performance Based ASR Mitigation for Non-Innocuous Aggregate* was prepared by the *Materials & Quality Assurance Subtask 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 so 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 PMPC TG:

Caltrans Name (Recommendation)		Industry Name (Concurrence)	
 <small>Keith Hoffman (Sep 21, 2022 10:08 PDT)</small>	09/21/2022	 <small>George Butorovich (Sep 14, 2022 10:16 PDT)</small>	09/14/2022
Keith Hoffman Caltrans Task Group Chair Materials Engineering and Testing Services	Date	George Butorovich Industry Task Group Member	Date
 <small>Kuo-Wei Lee</small>	09/14/2022	 <small>Mark Hill (Sep 14, 2022 12:04 PDT)</small>	09/14/2022
Kuo-Wei Lee Caltrans Task Group Member Pavement Program	Date	Mark Hill Industry Task Group Member	Date
 <small>Joseph Dongo</small>	09/15/2022		
Joseph Dongo Caltrans Task Group Member Construction	Date		

Pavement & Materials Partnering Committee
 Scoping Document
Concrete Task Group, Materials & Quality Assurance Subtask Group
Performance Based ASR Mitigation for Non-Innocuous Aggregate
 07/21/2022

Scoping Document Approval and Industry Concurrence by PMPC EC:
Caltrans Name (Recommendation) **Industry Name (Concurrence)**

<u><i>Tom Pyle</i></u>	<u>12/15/2022</u>	<u><i>Brandon Milar</i></u> <small>Brandon Milar (Dec 15, 2022 17:07 PST)</small>	<u>12/15/2022</u>
Tom Pyle Caltrans Executive Committee Chair Pavement Program	Date	Brandon Milar Industry Executive Committee Member	Date
<u><i>Raymond D. Ditt</i></u>	<u>02/27/2023</u>	<u><i>Charles Rea</i></u> <small>Charles Rea (Dec 15, 2022 14:28 PST)</small>	<u>12/15/2022</u>
Raymond Tritt Caltrans Executive Committee Member Construction	Date	Charley Rea Industry Executive Committee Member	Date
<u><i>Mina Pezeshkpoor</i></u>	<u>03/02/2023</u>		
Gudmund Setberg Caltrans Executive Committee Member Structures Design	Date		
<u><i>Timothy Greutert</i></u>	<u>12/15/2022</u>	Approval Date: <u>03/02/2023</u>	
Timothy Greutert Caltrans Executive Committee Member Materials Engineering and Testing Services	Date		