

Pavement & Materials Partnering Committee
Work Product Scoping Document
New
Specification Improvements for Concrete Pavements with Rapid
Strength Concrete
August 31, 2022

Task Group

Concrete Pavement Subtask Group,
Concrete Task Group

Problem Process

- Annual
- Expedited
- Emerging Initiative

Title

Specification Improvements for Concrete Pavements with Rapid Strength Concrete

Statement of Effort/Improvement

The current specification for Jointed Plain Concrete Pavement with Rapid Strength Concrete (JPCP-RSC) is used when traffic constraints require opening new concrete pavement to traffic within a few days. As traffic congestion has grown in California's urban areas, the use of JPCP-RSC has increased significantly.

JPCP-RSC (Section 40-5) provides the requirements for a 40-year life pavement option that is capable of being installed during short nighttime and weekend traffic closures. However, the current JPCP-RSC specification is not configured for use on single panels and short runs of concrete pavement. For those applications, designers commonly specify Individual Slab Replacement (ISR). ISR, under Section 41-9, is a "short-term fix" intended to provide about 5 years of service while a future programmed project replaces the entire stretch of roadway. Inefficiencies arise when there is no such programmed project and the slabs not replaced have a remaining service life of more than 5 years. In this scenario, the ISR is likely to fail before the original existing concrete which then would require another ISR project.

To provide a more optimal solution for designers, this Scoping Document work will expand the JPCP-RSC specification to allow replacement of short pavement sections, including single concrete slabs, which is used for lane replacements designed for 40 years. This will give designers a tool for specifying longer lasting replacement, compared to ISR and would lead to improved strategies for concrete pavement preservation.

There are two types of Concrete Pavement with RSC: Jointed Plain Concrete Pavement (JPCP) and Continuously Reinforced Concrete Pavement (CRCP).

This scoping document focuses on JPCP-RSC.

The Department now has over 20 years of history since the first JPCP-RSC demonstration project was built in 1999 on I-10 in Pomona. Despite this history, there is a current need for specification language that will lead to the use of longer lasting RSC pavement where the increased performance is advantageous. At the same time, improved guidance is needed so the correct type of RSC pavement is used for each project application. This guidance and improved specification will help address questions about durability when applying updated specifications for slab replacements for longer life applications.

The ISR specification does not have shrinkage or innocuous aggregate requirements, nor is the pavement base normally required to be replaced or dowel bars and tie bars included with the slab replacement. To fill these gaps, this scoping document intends to expand the current Section 40-5 for JPCP-RSC to include these requirements, and to align the specification with recent changes to Section 40-1, as explained in detail in the following paragraphs.

As a result, this work will not focus on ISR (Section 41-9), since there is a time and place for short-term fixes, but instead this work will focus on modifying JPCP-RSC (Section 40-5) to include the replacement of short pavement sections, including single slabs, that have failed. Pavement life for these shorter sections can be increased beyond that of ISR by applying the same requirements used for JPCP-RSC (Section 40-5) including the mix requirement for durability like Alkali-Silica Reaction (ASR) mitigation using innocuous aggregate and reducing concrete shrinkage. In addition, pavement life can be improved by requiring base replacement, and dowel bars like done for JPCP-RSC. ISR does not address these issues.

One of the major considerations with short sections of JPCP-RSC is smoothness, as the recent smoothness specifications could only be used if a “blanket” grinding was included in the original contract since it is based on the International Roughness Index (IRI) that is defined for 0.1-mi sections. As a result, smoothness for those short sections with as little as one slab can only be based on straightedge.

The proposed changes would result in replaced slabs lasting at least as long as the adjacent slabs that are not being replaced, which are considered the “weakest link” in the pavement system. JPCP-RSC (Section 40-5) would become

a one-stop-shop offering longer lasting concrete and design features (dowel bar and base replacement), as explained before. This change would serve Contractors and Caltrans, by reducing specification duplication when both JPCP-RSC continuous and short sections are used in the same project.

Slabs located in the inner lanes typically exceed the design life of the outer lane(s) because their pavement structure is the same as outer lanes that carry heavier truck traffic. That is why many times the outermost lane must have JPCP-RSC lane replacement while the inner lanes may have remaining service life with fewer damaged slabs. As projects are developed, broken slabs in the inner lanes will likely be replaced at the same time as the outer lane. For consistency and simplicity, both lanes should use the same specification. In this case, Section 40-5 could be used to replace slabs within the inner lanes depending on their past history of replacements whereas the outer lane(s) with heavy truck traffic would need to be replaced continuously with JPCP-RSC.

In summary, the current version of Section 40-5 on JPCP-RSC can only be used when the entire lane is replaced. This Scoping Document work will expand this specification to short sections where any differences between these two applications would be addressed like smoothness and payment for dowel bars. In addition, Section 40-5 will be modified, if appropriate, to be consistent with recent changes to Section 40-1: like the use of compressive strength for acceptance and the optional use of maturity for opening to traffic.

Purpose

The main purpose of this project is to improve the Non-standard Special Provision (NSSP) for JPCP-RSC by expanding Section 40-5 to include lengths as short as one panel. This would provide engineers with a more durable, longer lasting pavement repair when compared to ISR which has about a 5 year life expectancy. In addition, beneficial Section 40 changes may be incorporated into JPCP-RSC when appropriate, such as referencing latest ASTM C1600 specification for rapid hardening hydraulic cement, use the acceptance of concrete pavements based on compressive strength and the use of maturity for opening to traffic.

Background

Modern advances in hydraulic cement and admixture technology have significantly increased the durability and longevity of Rapid Strength Concrete

(RSC). The Department pioneered the use of RSC for urban highway pavement construction in the US and now this technology has over 20 years of history since the first JPCP-RSC demonstration project built in 1999 on I-10 in Pomona.

The Department's specifications need to be updated as existing specifications like Individual Slab Replacement (ISR) are not being used as originally intended and NSSP 40-5 on JPCP-RSC would be more effective and simpler to use. ISR is predicted to last about 5 years while JPCP-RSC has a life of 40 years if replaced continuously. This scoping document will expand Section 40-5 on JPCP-RSC to include lengths as short sections, which would have a longer life than ISR under 41-9 by using the same specification and recommend design features for a longer lasting life.

Approach

1. Street Ready Assurance

The specification language will be developed by incorporating lessons learned from several RSC projects. Therefore, the combination of JPCP-RSC for continuous and short replacements will improve existing procedures to produce a street-ready specification.

2. Performance Tracking/Management

Tasks and milestones will be simple and manageable.

3. Consistently Implemented

Implementation will take place through the Office of Concrete Pavements. The new specification language will be documented and consistently applied.

4. Pilot Projects

None at this time.

5. Research Needs

None at this time.

Team Members (Indicate CT Chair and Industry Lead)

CT / Industry	Division / Firm Name	Member Name
CT – Chair	HQ Pavement – Division of Maintenance	Dulce Rufino Feldman
Caltrans	HQ Construction Standards	Deborah Yost
Caltrans	HQ Materials Engineering and Testing Services (METS)	Hamed Sadati
Caltrans	District 12 – Maintenance	Ben Nanjappa
Industry – Lead	Euclid	Vince Perez
Industry	CTS Cement	Matt Ross
Industry	Short Load Concrete	Ryan Vanderhook
Industry	Precision Concrete	Matt Murphy

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:

Revise our specification language to combine concrete pavement replacement with JPCP-RSC continuous and slabs that randomly cracked similar to Precast Concrete Pavement (PCP) in a previous PMPC scoping document.

Details:

Milestones	Name - Responsible Party	Due Date (Start/Complete)
1. Develop specification language	Dulce Rufino Feldman, Deborah Yost, and Vince Perez	11/2022 – 09/2023
2. Final Report	Dulce Rufino Feldman, Deborah Yost, and Vince Perez	05/2023 – 11/2023

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

Resources To Develop and Implement

Work Scope	Caltrans Hours	Industry Hours
Develop specification language	180	120

Benefits

- Decrease confusion as this effort would lead to one-stop-shop for JPCP-RSC specifications whether the scope of work is to replace existing concrete pavement with continuous or random JPCP-RSC.
- Restore consistency in the specification of JPCP-RSC (NSSP 40-5) with the general portion of concrete pavement specification (Section 40-1), as many changes have happened in the last 3 years and they have not been incorporated into NSSP 40-5.

Estimated Impact to Caltrans and Contractor

- Changes to the Standard Concrete Pavement Specification Section 40.
- Minimize dubious language and improve communication to specify what is needed to be done for similar work.

Impediments to Completion of Deliverables

- None.

Recommendation and Approval

This scoping document for *Specification Improvement of Concrete Pavements with Rapid Strength Concrete* was prepared by the *Concrete Pavement 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 (Oct 10, 2022 10:16 PDT)</small>	10/10/2022	 <small>George Butorovich (Oct 10, 2022 10:20 PDT)</small>	10/10/2022
Keith Hoffman Caltrans Task Group Chair Materials and Engineering Testing Services	Date	George Butorovich Industry Task Group Member	Date
 <small>Kuo-Wei Lee</small>	10/19/2022	 <small>Mark Hill (Oct 17, 2022 08:10 PDT)</small>	10/17/2022
Kuo-Wei Lee Caltrans Task Group Member Pavement Program	Date	Mark Hill Industry Task Group Member	Date
 <small>Joseph Dongo</small>	10/10/2022		
Joseph Dongo Caltrans Task Group Member Construction	Date		

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

<u><i>Tom Pyle</i></u>	<u>11/09/2022</u>	<u><i>Brandon Milar</i></u>	<u>11/29/2022</u>
Tom Pyle	Date	<small>Brandon Milar (Nov 29, 2022 09:48 PST)</small>	Date
Caltrans Executive Committee Chair Pavement Program		Brandon Milar Industry Executive Committee Member	
<u><i>Raymond A. Tritt</i></u>	<u>12/08/2022</u>	<u><i>Charles Rea</i></u>	<u>11/02/2022</u>
Raymond Tritt	Date	<small>Charles Rea (Nov 2, 2022 09:08 PDT)</small>	Date
Caltrans Executive Committee Member Construction		Charley Rea Industry Executive Committee Member	
<u><i>Gudmund Setberg</i></u>	<u>11/05/2022</u>		
Gudmund Setberg	Date		
Caltrans Executive Committee Member Structure Design			
<u><i>Timothy Greutert</i></u>	<u>12/14/2022</u>	Approval Date: _____	
Timothy Greutert	Date		
Caltrans Executive Committee Member Materials Engineering and Testing Services			