

**Pavement & Materials Partnering Committee**  
**Work Product Scoping Document**  
**Revised**  
**Recycled Crushed Concrete Aggregate for Use in Cast**  
**In-Place Concrete Pavement**  
**November 29, 2018**

**Task Group**

Concrete Task Group

**Title**

Recycled Crushed Concrete Aggregate for use in Cast In-Place Concrete Pavement

**Problem Process**

- Annual
- Expedited
- Emerging Initiative

**Statement of Effort/Improvement**

It is desired to evaluate the potential for using recycled concrete aggregate (RCA) in concrete pavement. For the purpose of this scoping document, RCA refers to aggregate obtained from crushed concrete. Additional utilization of RCA may enhance sustainability, reduce waste, and conserve natural resources when quality and performance of the finished product is equivalent to that constructed from non-recycled materials.

**Purpose**

The purpose of this project is to evaluate the potential for using RCA in new concrete pavements, to complete an analysis to address performance, GHG carbon savings, and reuse resources, and to determine if RCA implementation is feasible.

**Background**

Disposal of existing concrete elements is often a problem faced on many construction projects. Recycling concrete, as an aggregate product, is common practice by several State Departments of Transportation (DOTs), private industry, and many foreign agencies. The Federal Highway Administration (FHWA) Policy Memorandum "Formal Policy on the Use of Recycled Materials," dated February 7, 2002, states that reusing the material used to build the original highway system "... makes sound economic, environmental, and engineering sense." It also emphasizes that recycled materials must be used in an appropriate manner that "... shall not affect the performance, safety or the environment of the highway system." Environmental issues and costs associated with removal and disposal of old concrete must be addressed early in the project development. Concrete contains natural resources including natural aggregates, water, cement, and embodied energy that can be incorporated into new concrete. Underutilization of hardened concrete waste and its components contributes to filling of landfills, increased water usage, depletion of natural resources, increased material transport, and increased greenhouse gas emissions.

This project seeks to evaluate the potential for utilizing RCA in concrete pavement, quantify environmental impacts, and, if the potential for use exists, identify issues that need to be addressed in order to implement.

### **Approach**

1. Street Ready Assurance

The use of recycled hardened concrete aggregate (RCA) in concrete pavement will be made depending on the findings and approval from the Concrete Task Group (CTG) to proceed. If CTG approves, specification and design guide will be developed for implementation of the RCA in Caltrans projects.

2. Performance Tracking/Management

Office of Concrete Pavements with the assistance from Caltrans Districts and information from Pavem, will monitor performance of concrete pavement, and performance information will be utilized for the improvement of the specification.

3. Consistently Implemented

Based on the concluded recommendations, specification and design guide will be developed which will initiate use of recycled hardened concrete aggregates statewide as availability of native aggregates is diminishing, and abundant concrete from the old concrete pavements will be available.

4. Pilot Projects (if anticipated)

If recommended, pilot projects will be considered.

5. Research Needs (if necessary)

Depending on the decision made by the working team, additional research may be warranted, and research work should be performed by Caltrans through contracts.

**Team Members (Indicate CT Chair and Industry Lead)**

<b>CT/Industry</b>	<b>Division/Firm Name</b>	<b>Member Name</b>
CT	Pavement	Deepak Maskey (CT Chair)
CT	Construction	Samir Ead
CT	Pavement	Ron Jones
CT	METS	Will Sommer
Industry	Sully-Miller	Don Vivant (Industry Lead)
Industry	Holiday Rock	Marty Hansberger
Industry	Graniterock	Katha Redmon
Industry	Teichert	Pete Conlin

Team should include no 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 project is to evaluate the potential for using RCA in new concrete pavements, complete a cost benefit analysis and identify issues to address if implementation is feasible. The following deliverables are necessary to meet the objective:

1. Research summary of:
  - 1.1. Cost benefit analysis performed to determine proof of demand that would support a new specification for use of this material in concrete pavements and quantify environmental impacts such as energy savings/greenhouse gas reduction.
  - 1.2. Current concrete recycling companies and their capability of processing plants, availability of materials, and processing costs. Analysis should also include handling, water usage, use and/or disposal of fines generated by the crushing, screening and washing operations. Evaluate the practicality of on-site processing, including identification of potential limitations, where existing paving materials are removed.
  - 1.3. Literature search.
  - 1.4. Successful implementation by other states, including constructability and pavement performance.

Pavement & Materials Partnering Committee  
 Scoping Document  
 Concrete Task Group  
 Recycled Crushed Concrete Aggregate for use in Cast In-Place Concrete Pavement  
 November 29, 2018

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2. Capture lessons learned from existing pilot project if RCA have been used or why they were not used. Review specifications and adjust to address potential future projects.
3. Recommendation regarding the use of RCA in concrete pavement.
4. If recommended to use RCA in concrete pavement, develop specification and design guide.

Details:

<b>Milestones</b>	<b>Name - Responsible Party</b>	<b>Due Date (Start/Complete)</b>
1. Literature Search (Cost-benefit analysis, current practice, lessons learned) and report on findings	Deepak Maskey/Don Vivant	February 2019 / September 2019
If the report recommends to use RCA in concrete pavement and is approved by CTG, then proceed to Milestones 2, 3 and 4.		
2. Draft Specification Proposal	Deepak Maskey/Don Vivant	October 2019 / December 2019
3. Recommendation/Design Guidance on where use is appropriate	Deepak Maskey /Don Vivant	January 2020 / March 2020
4. Research Summary (Final Report of above items)	Deepak Maskey	April 2020 / June 2020

\*Some milestones listed above may not be necessary

**Resources To Develop and Implement**

	Caltrans Hours		Industry Hours	
	FY 18/19	FY 19/20	FY 18/19	FY 19/20
Development	350	850	240	560
Pilot (if used)	-	-	-	-
Other Resources (Districts)	12	28	0	0

**Benefits**

- Explores other opportunity to save energy, natural resources, and landfill space.
- Reduced transportation impacts and costs while maintaining pavement performance and its life-cycle.

**Estimated Impact to Caltrans and Contractor**

- Increased awareness of sustainable materials for transportation construction projects.
- Refined standard specification requirements for recycled concrete materials

**Impediments to Completion of Deliverables**

Delays caused by existing or new higher priority assignments may affect staff availability and therefore project schedule.

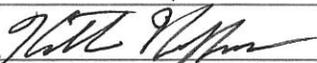
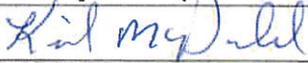
Pavement & Materials Partnering Committee  
 Scoping Document  
 Concrete Task Group  
 Recycled Crushed Concrete Aggregate for use in Cast In-Place Concrete Pavement  
 November 29, 2018

**Recommendation and Approval**

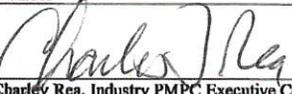
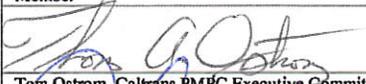
This scoping document for Recycled Crushed Concrete Aggregate for Use in Cast In-Place Concrete Pavement was prepared by the Concrete Task Group to address a priority issue with statewide significance and is within the Pavement & Materials Partnering Committee mission as described in the Pavement & Materials 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
 Keith Hoffman, Caltrans Task Group Chair	11/30/18	 Kirk McDonald, Industry Task Group Lead	11/30/18
 Kuo-Wei Lee, Caltrans Task Group Member	11/30/18	 Mark Hill, Industry Task Group Co-Member	11-30-18
 Blair Anderson, Caltrans Task Group Member	11/30/18		

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

Caltrans Name (Approval)	Date	Industry Name (Concurrence)	Date
 Sergio Aceves, Caltrans PMPC Executive Committee - Chair	12/1/18	Russ Snyder, Industry PMPC Executive Committee - Member	
 Ray Hopkins, Caltrans PMPC Executive Committee - Member	12/6/18	 Charley Rea, Industry PMPC Executive Committee - Member	12/6/18
 Tom Ostrom, Caltrans PMPC Executive Committee - Member	12/6/18		
 Dan Speer, Caltrans PMPC Executive Committee - Member	12/6/18		

Approval Date: \_\_\_\_\_