

Pavement & Materials Partnering Committee
Work Product Scoping Document
New
Use of 4x8 Cylinders for Compressive Strength Testing
November 28, 2018

Task Group

Concrete Task Group

Title

Use of 4x8 Cylinder or Compressive Strength Testing

Problem Process

- Annual
- Expedited
- Emerging Initiative

Statement of Effort/Improvement

There is interest in exploring the use of 4x8 cylinders for determining concrete compressive strengths for acceptance. As an exception to national practice, Caltrans has historically utilized 6x12 cylinders for materials acceptance testing. A coordinated effort is needed to perform a literature review to identify strategies for mitigating variations in test results, determine specific applications where 4x8 cylinders should not be adopted as specified by the ASTM standards, establish correlations of compressive strengths of 4x8 versus 6x12 cylinders, and identify other issues that must be addressed in order to confidently make this transition if it is deemed desirable.

Purpose

This change will reduce the space required to cure concrete test specimens, allows the use of smaller, less expensive testing machines for determining compressive strengths, reduces molding, capping time, and physical strain on technicians incurred due to handling test specimens, and aligns the Department's practices with national and industry standards.

The use of 4x8 specimens would decrease the amount of storage space required for curing purposes, reduce the physical weight and volume of waste material by more than 70%, allows for easier handling during fabrication, transporting, and testing, and also permits the testing of high strength concrete using readily available testing equipment.

Background

To confidently implement the use of 4x8 test specimens, this project intends to identify and evaluate potential issues and/or limitations and provide recommendations on where and how to adopt this practice. Additionally, a cost-benefit analysis should be completed to study the material savings, environmental impacts, equipment costs, etc. The expected outcome is that 4x8 cylinders can replace 6x12 cylinders where possible with minimal impact to confidence in test result outcomes.

Approach

1. Street Ready Assurance

Notify stakeholders (construction, industry, testing labs/technicians, etc.) of upcoming changes. Allow time for review and comments so any concerns can be addressed. Update specifications and manuals to allow option for use of 4x8 cylinders.

2. Performance Tracking/Management

Require laboratories and project field staff to use Data Interchange for Materials Engineering (DIME) for data input and tracking.

3. Consistently Implemented

Update specifications and manuals allowing the option or requiring the use of 4x8 cylinders for acceptance testing. Ensure technicians and laboratories have the proper tools, materials, and certification to fabricate and test 4x8 cylinders.

4. Pilot Projects (if anticipated)

If allowed, utilize five (5) pilot projects that would require the contractor to fabricate and test 4x8 cylinders along with 6x12 cylinders during trial batching of a submitted concrete mix design to determine a correlation. During the life of the project, the contractor would also be required to prepare 4x8 and 6x12 cylinders during QC sampling. The test data from the different cylinder sizes can be plotted on the same chart to monitor the consistency of results. QC and QA data will be logged into DIME

5. Research Needs (if necessary)

Other than the literature review and pilot projects, outside research is not necessary for this work product. However, as part of the literature review, a survey will be conducted to determine other states usage of 4x8 cylinders and their application of a correction factor.

Team Members

CT/Industry	Division/Firm Name	Member Name
CT Chair	METS – Concrete	Patrick Lo
CT	Structures Construction	Tom Collins
CT	METS – Concrete Lab	Larry McCrum
CT	HQ Construction	Samir Ead
Industry Lead	NCE	Tom Van Dam
Industry	PCA	Greg Halsted
Industry	G3 Testing	Marc Robert
Industry	Graniterock	Katha Redmon

Objectives/Deliverables/Due Dates

Description: The objective of this project is to identify and evaluate any potential issues and/or limitations regarding the implementation of 4x8 cylinders for purposes of determining the compressive strength of concrete for acceptance. The following deliverables are necessary to meet the objective:

1. Perform literature review to determine feasibility and identify unknowns of employing the use of 4x8 cylinders and to analyze correlation of compression strengths between 6x12 cylinders and 4x8 cylinders. A survey of other DOT's will be included to determine their standard practice on utilizing 4x8 cylinders for QC/QA purposes and their application of a correction factor, if any.
2. Draft details and requirements for a Non-Standard Special Provision (NSSP) to fabricate 4x8-inch and 6x12-inch concrete cylinders as part of the mix design verification process and during the life of the project. The QC and QA results will be required to be logged into DIME to track and monitor the data. Before implementation, the NSSP will be routed to the STG and CTG for review and comments.

3. Perform Cost-Benefit analysis of any new equipment to be deployed, material savings, environmental impacts, etc.
4. Report to recommend where adoption is appropriate (e.g. aggregate size, pavement, address trial batch requirements)
5. Create an implementation plan that describes the process on how to execute the use of 4x8 cylinders for all statewide construction contracts. Identify procedure to notify all stakeholders and enact new policy, new equipment/tool requirements, recommended changes to manuals, specifications, and California Test Methods, and required training.

It is expected that 4x8 cylinders can replace 6x12 cylinders where feasible for acceptance decisions with minimal impact to confidence in test result outcomes.

Details:

Milestones	Name - Responsible Party	Due Date (Complete)
Literature Review	Tom Van Dam and Patrick Lo	December 2018
NSSP for Pilot Project	Marc Robert and Patrick Lo	February 2019
Cost Benefit Analysis (equipment, material, environmental)	Samir Ead and Greg Halsted	March 2019
Recommendation Report (where to adopt use of 4x8 cylinders)	Tom Collins and Katha Redmon	March 2019
Training and Guidance (implementation plan)	Tom Collins	April 2019
Monitoring Data of Pilot Projects	Larry McCrum	January 2020
Final Report	Patrick Lo	January 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	250	0	220	0
Pilot Project	100	250	50	30
Implementation	100	80	60	40
Long Term Performance	0	50	0	20

Benefits

- Aligns Caltrans practice with national and industry standards
- Reduced physical strain on technicians involved
- Reduces need for curing space
- Reduces the cost of testing equipment
- Reduced material waste

Estimated Impact to Caltrans and Contractor -

At the outcome of this project, when 4x8 cylinders are allowed for use at the construction level, changes to policy and specifications will need to be drafted to reflect the Department’s updated practice. Because testing frequency will not change, there should be minimal impact to construction practices and stakeholders. Also, this will have a negligible impact to project costs, but can reduce costs to testing laboratories for curing space and when purchasing new equipment since smaller testing machines can be utilized.

Impediments to Completion of Deliverables

1. Lack of resources:
 To ensure enough resources are allocated to this project, the chair will maintain communication with the group to determine if more resources are required to achieve project deliverables on time.

2. Lack of coordination and contribution from group members:
 The group chair will hold regular meetings/conference calls and maintain an open line of communication between all members to ensure that everyone receives the necessary support to be successful in completing their tasks

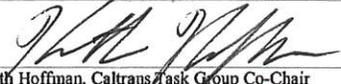
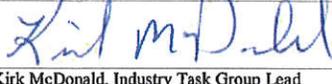
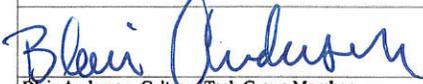
Pavement & Materials Partnering Committee
 Scoping Document
 Concrete Task Group/ Materials and Quality Assurance Sub-Task Group
 Use of 4x8 Cylinders for Compressive Strength Testing
 November 28, 2018

Recommendation and Approval

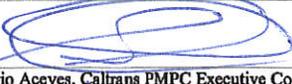
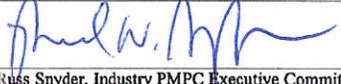
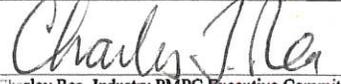
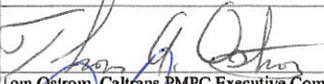
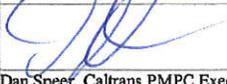
This scoping document for Use of 4x8 Cylinder or Compressive Strength Testing was prepared by the Materials and Quality Assurance Sub-Task Group to address a priority issue with statewide significance and is within the Pavement & Materials Partnering Committee mission as described in the Pavement & Materials 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 Hoffinan, Caltrans Task Group Co-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	12/11/18	 Russ Snyder, Industry PMPC Executive Committee - Member	12/6/18
 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: _____