Pavement & Materials Partnering Committee
Work Product Scoping Document
New
Tracking Concrete Mix Designs in DIME
March 25, 2021

Task Group

Concrete Task Group

Problem Process

☒ Annual

☐ Expedited

☐ Emerging Initiative

Title

Tracking Concrete Mix Designs in DIME

Statement of Effort/Improvement

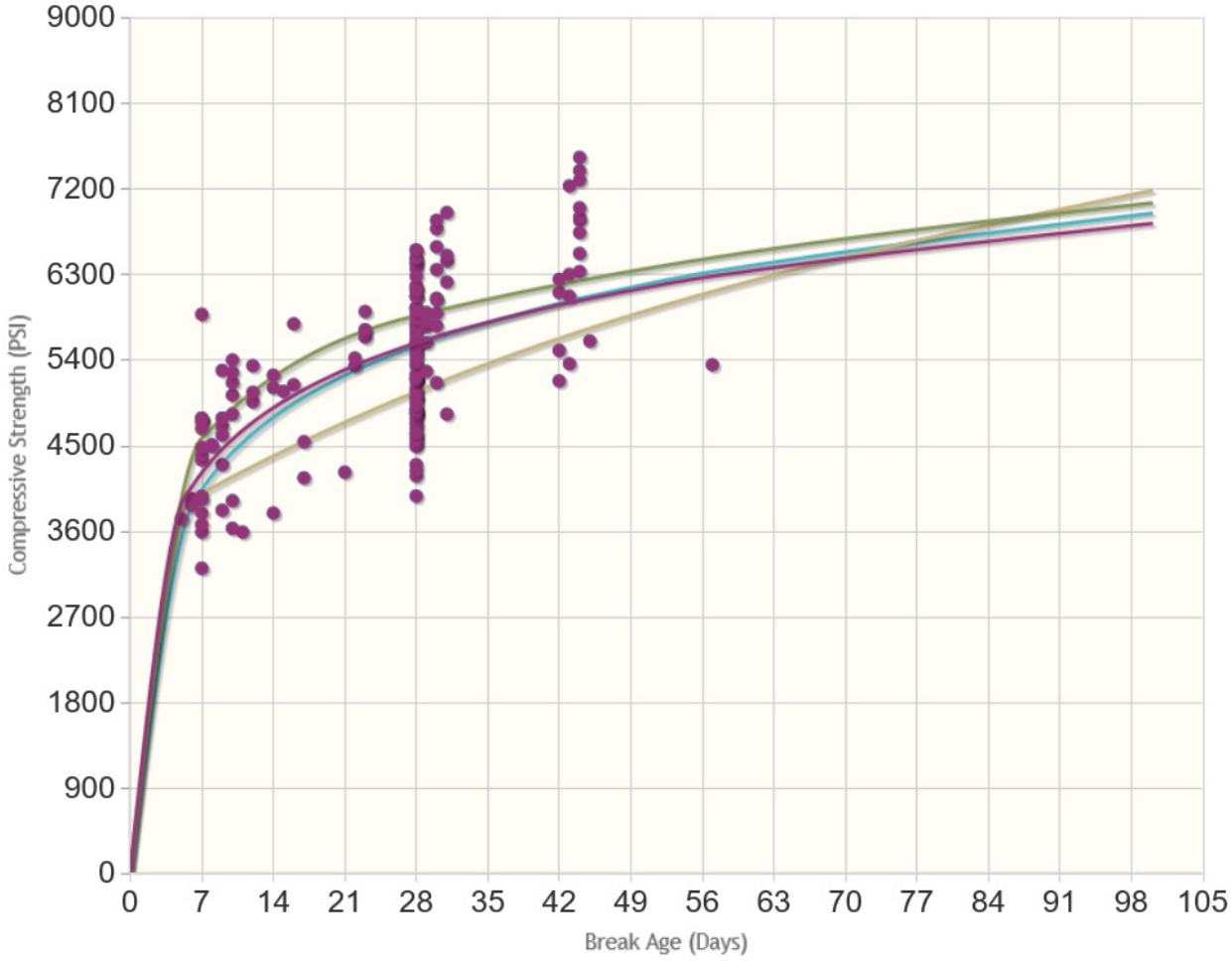
Concrete mix design testing data is required by the specifications. The Department utilizes a database called the Data Interchange for Materials Engineering (DIME) to input and store this data. DIME data requires the mix design identification and currently there is no assurance that a mix design identification represents a unique mix design formula (proportion and source of materials). Historically, there have been different mix formulas labeled with identical mix design identification. A previous working group identified and quantified the factors that required a new mix design identification which allows for efficient tracking of mix design test data. However, the working group came to an impasse when it was stated that changes in raw materials' source (aggregate, cement, supplementary cementitious materials (SCMs), admixtures) require a new mix identification. As an alternative to requiring a new mix identification for each component change of a mix, this revised effort aims to collect material proportion and source information of each component through DIME.

Purpose

Specifications will be developed indicating the additional requirements when submitting certified test data and trial batch test reports for verification of a mix design. Additionally, language specifying the responsibilities of the quality control (QC) manager, as it applies to tracking and documenting changes of an approved mix design, will be included in the specifications. Furthermore, changes to Caltrans' internal quality assurance (QA) manuals and DIME will be implemented to require the input of the batch plant identification, and the sources and proportions of all constituent materials. As an example, modifications to form TL-502 would be considered to reflect the quantities of raw materials obtained from different sources. It is also proposed to include the Bridge number or pavement location, as well as type of element (e.g. deck, column, etc.) cast with the tested concrete as part of DIME input. The additional information required to submit test data on DIME will provide Department staff with the information necessary to track the performance of concrete mix designs based on the constituent materials.

Background

While the DIME graph below is intended to predict performance of a mix, it is not currently recommended because there is no guarantee that each use of the mix identification CONC3600 represents the same mix design formula that was sampled and tested over a span of 3.5 years.



With the requirement to submit individual material information, Department staff can filter and sort concrete mix design testing data based on the individual components of a concrete mix. This allows test results to be directly compared to assess the performance of a unique mix.

Per the Standard Specifications, the contractor is required to submit certified test data or trial batch test reports representing the mix design proposed for use in the work. With this approach, the Engineer is assured that historical test results can be referenced to

submitted test reports with the same mix design components, reducing the time needed for test data searches or new trial batches.

Approach

1. Street Ready Assurance

   Through specification language, additional requirements will be set for submitting test data to ensure that submission will correspond to a unique concrete mixture proportion based on a fixed set of raw materials.

2. Performance Tracking/Management

   It is anticipated that industry will have multiple-project usage linked to a single mix design formula. QC and QA test data input into DIME along with a mix design developed using specification requirements will provide the ability to connect those mix design formulas to DIME to review past mix design performance data. Moreover, having the exact element type and location tied to a specific concrete mixture, enables the tracking of failed elements and correlate the potential performance issues to material properties. DIME test data is currently available publicly. Considering the ongoing efforts for electronic concrete batch ticket submittals, the team will consider synchronization with raw material inputs under this effort should the e-ticketing platform be included in DIME.

3. Consistently Implemented

   The specification will include allowable limits to changes in mix design components and proportions to ensure that if any parameters are not met, industry will be required to create a new mix design in DIME.

4. Pilot Projects (if anticipated)

   N/A

5. Research Needs (if necessary)

   N/A

Team Members (Indicate CT Chair and Industry Lead)

CT/Industry	Division/Firm Name	Member Name
CT Chair	Materials Engineering and Testing Services	Joe Harline
CT	Office of Concrete Pavement	David Lim
CT	Office of Structure Construction	Adrian Cortez
CT	Structure Policy and Innovation, Structural Specifications and Research Development	Paul Fayer, as needed
Industry Lead	California-Nevada Cement Association	Nathan Forrest
Industry	GraniteRock	Katha Redmon
Industry	Cemex	Hernan Jose Perez Rodriguez
Industry	Central	Patrick Frawley

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 project is to make sure that the test data submitted through DIME represents a specific concrete mix design, prepared with a specific set of raw materials for a specific batch plant. This provides further certainty in evaluating the performance of concrete mixtures based on the previously submitted QC/QA data and makes it possible to track the true performance of a specific concrete mixture. The following deliverables are necessary to meet the objective:

1. Specify the additional mix design data that are believed to affect the performance of a concrete mixture. This will include both the mixture proportions and materials types/sources.

2. Language specifying the responsibilities of QC/QA managers as it applies to submitting mix designs, test results, and tracking and documenting changes.

3. Develop and publish the specification updates.

Details:

Milestones	Name - Responsible Party	Due Date (Start/Complete)
Workplan	Joe Harline/Nathan Forrest	02/01/2021 - 03/15/2021
1. Specifying the additional required mix design information and test data	All	03/15/2021 – 07/01/2021
2. Caltrans propose practice for industry acceptance – update DIME for tracking mix designs	John O'Mara (DIME Manager)	07/01/2021 – 03/01/2022
3. Development of specification language and internal QA manuals	All	10/01/2021 – 02/01/2022
4. Routing, publication, and implementation	Joe Harline/Nathan Forrest	02/01/2022 – 10/15/2022

Resources to Develop and Implement

	Caltrans Hours		Industry Hours	
	FY 20/21	FY 21/22	FY 20/21	FY 21/22
Development (work plan, process, specification development)	240	240	60	60
Implementation, training, and guidance	0	200	0	100
Long term performance	0	200	0	100
Other resources	N/A	N/A	N/A	N/A

Benefits

- Enhanced reliability of the mix design data available in DIME to ensure test data represents a unique concrete mixture prepared with uniquely set proportions and materials at a specific batch plant
- Increased reliability of using historical mix design data for use on multiple projects, saving time and mix design verification efforts
- Ensure the ability to track environmental performance of all concrete mixtures, even in the absence of product-specific EPDs

Estimated Impact to Caltrans and Contractor

- Specification change will be necessary
- Additional data entry steps will be required during test data submission by Industry and Caltrans
- Enhanced reliability of decision making based on historical performance records

Impediments to Completion of Deliverables

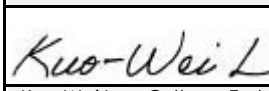
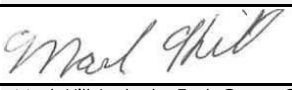
- Caltrans and Industry will need to come to consensus on what data needs to be reported, by whom, when, etc. as well as what the tolerances are, what triggers a different/revised/new submittal, etc.

Recommendation and Approval

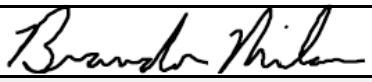
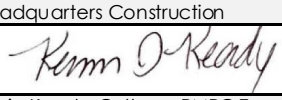
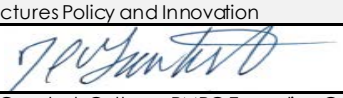
This scoping document for Tracking Concrete Mix Designs in DIME was prepared by the Concrete Task Group (CTG) to address a priority issue with statewide significance and is within the Pavement & Materials Partnering Committee (PMPC) mission as described in the PMPC Charter. The CTG members have determined 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 CTG and PMPC Executive Committee member 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
	03/30/2021		03/30/2021
Keith Hoffman, Caltrans Task Group Chair		George Butorovich, Industry Task Group Lead	
	04/02/2021		03/29/2021
Kuo-Wei Lee, Caltrans Task Group Member		Mark Hill, Industry Task Group Co-Member	
	03/26/2021		
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		04/28/2021
Shaila Chowdhury, Caltrans PMPC Executive Committee – Chair Pavement Program		Brandon Milar, Industry PMPC Executive Committee	
	04/23/2021		04/22/2021
Ray 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			
	05/06/2021		
Tim Greutert, Caltrans PMPC Executive Committee Materials Engineering and Testing Services			

Approval Date: 05/06/2021