



Concrete – Lightweight Concrete

Revision and Approval

Revision	Date	Nature of Changes	Approved By
0	09-30-2022	Original Issue	Richard Foley

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Background

This process establishes Structure Construction (SC) responsibilities and procedures for authorization of submittals, quality assurance, and materials used for furnishing lightweight concrete. Lightweight concrete consists of cementitious materials, lightweight coarse aggregate, fine aggregate, admixtures if used, and water.

Due to the nature of the aggregates, use of lightweight concrete is more technical than portland cement concrete. Proper planning and quality assurance can reduce problems that might otherwise occur during proportioning and placement of lightweight concrete.

After the lightweight concrete is furnished, for preparation, placement, and curing lightweight concrete, refer to the following requirements in the [Contract Specifications](#):

- Section 51-1.03C-D, *Concrete Structures – General – Construction – Preparation and Placing Concrete*
- Section 51-1.03H, *Concrete Structures – General – Construction – Curing Concrete Structures*
- Section 90-1.01D(5), *Concrete – General – Quality Assurance – Compressive Strength*

Prior to reviewing this Bridge Construction Memo (BCM), it is essential to review the *Contract Specifications*, Section 90-6, *Concrete - Lightweight Concrete*, that this BCM is based on as identified in the title block above. The information in the contract specifications typically will not be repeated in the text of this BCM.

Process Inputs

1. Lightweight Concrete submittals, including:
 - a. Lightweight Concrete mix design
 - b. Prequalification data or reports
 - c. Certified copies of the manufacturer's test reports showing the estimated fresh concrete unit weight that results in the selected air-dry unit weight.

Procedure

1. All work associated with this process is charged as [Project Direct – Construction](#).
2. Inspection of field work for this process is:
 - a. [Continuous](#) for lightweight concrete placement and testing activities on the job site.
3. Before construction begins:
 - a. Review the following for background information and tasks unique to lightweight concrete:
 - i. *Construction Manual (CM)*, Chapter 4, *Construction Details*, [Sections 4-9001](#), *Concrete – General*, and 4-9006, *Concrete – Lightweight Concrete*.
 - ii. *Concrete Technology Manual*, [Chapter 7](#), *Caltrans Advancements/High Performance Concrete*, to determine the need for thermal control plan.
 - iii. [BCM 51-1.03C-D](#), *Concrete Structures – General – Construction – Preparation and Placing Concrete*
 - iv. [BCM 51-1.03H](#), *Concrete Structures – General – Construction – Curing Concrete Structures*
 - v. [BCM 90-1](#), *Concrete – General*
 - b. Review the following contract requirements for lightweight concrete with the contractor at the preconstruction conference:
 - i. The lightweight concrete mix design submittal must include:
 1. Verification that the Engineer has access to the lightweight aggregate supply for up to 500 pounds of lightweight aggregate for quality testing.
 2. Penetration test results.
 - ii. Air-dry unit weight test and unit weight test results are to be included with the lightweight concrete mix prequalification submittal.

- iii. Production unit weight test results are to be reviewed during lightweight concrete placement and submitted to the Engineer.
 - c. Review and authorize or reject for resubmittal the lightweight concrete mix design and prequalification reports. Notify the contractor in writing.
 - d. Review and accept certificates of compliance for cementitious materials.
 - e. Review Materials Engineering and Testing Services (METS) test reports for lightweight aggregates compliance with the following test methods required by the *Contract Specifications*:
 - i. ASTM C330/C330M, *Standard Specification for Lightweight Aggregates for Structural Concrete*
 - ii. [California Test 214](#), *Method of Test for the Soundness of Aggregates by Use of Sodium Sulfate*
 - iii. [California Test 537](#), *Method of Test for the Drying Shrinkage of Lightweight Concrete*
 - f. For quality assurance during trial batch, verify the following are completed per test methods required in the *Contract Specifications*:
 - i. Sample lightweight concrete per [California Test 539](#), *Method of Test for Sampling Freshly Mixed Concrete*.
 - ii. Unit Weight per [California Test 518](#), *Method of Test for Density (Unit Weight) of Fresh Concrete*
 - iii. Penetration per [California Test 533](#), *Method of Test for Ball Penetration in Fresh Portland Cement Concrete*
 - iv. Air Content per ASTM C173/C173M
 - v. Fabricate lightweight concrete cylinders per [California Test 540](#), *Method of Test for Making and Curing Concrete Test Specimens in the Field*.
 - g. Arrange for a lightweight concrete batch plant inspection for trial batches.
 - h. Verify quality assurance and quality control prequalification compressive strength test results prior to authorization.
4. During Construction:
- a. Verify that the delivered lightweight concrete is the authorized mix design, and
 - i. Confirm that the total cementitious material content of delivered concrete is within the allowable limits specified in the contract.
 - ii. Confirm the absolute volume of the coarse aggregate does not exceed allowable limits.

- b. Sample and test lightweight concrete at the frequency outlined in the *CM*, Chapter 6, *Sampling and Testing*, Section 6-107, *Materials Acceptance Sampling and Testing*, and in accordance with:
 - i. The *CM*, Chapter 4, *Construction Details*, Sections 4-9001, *General* and 4-9006 *Lightweight Concrete*:
 - 1. Sample (California Test 539) and prepare concrete specimen(s) (California Test 540) for the compressive strength test per the *Contract Specifications*, Section 90-1.01D(5).
 - 2. Tests include penetration per California Test 533, air content per ASTM C173/C173M, and unit weight per California Test 518.
 - i. Verify that the unit weight of fresh concrete is within 4 pcf of the unit weight shown in the test report.
 - c. Document all inspection, construction, and quality assurance activities in the Daily Reports per [BCM C-7](#), *Daily and Weekly Reports*.
5. Following construction:
- a. Verify QA lightweight concrete compressive strength with design strength. Consult with the Bridge Design Structure Project Engineer if concrete strengths are lower than anticipated. Calculate and enforce appropriate payment deductions as outlined in the *Contract Specifications*, Section 90-1.01D(5)(a), *Concrete – General – Quality Assurance – Compressive Strength- General*.
6. File all project documentation (correspondence, materials acceptance documentation, Daily Reports, etc.) in the appropriate category in the project records as specified in the *CM*, [Section 5-102](#), *Organization of Project Documents*.

Process Outputs

- 1. Lightweight Concrete prequalification submittal review and authorization
- 2. Lightweight concrete mix design submittal review and authorization
- 3. Quality Assurance Field Testing (California Test results for acceptance, rejection, or payment)

Attachments

None