



**REQUEST FOR PROPOSAL
TESTS IN CONCRETE NEW MIXTURES (LOW CARBON CONCRETE)**

BACKGROUND

The concrete industry has stopped using only Portland cement and begun using blended cements for use in concrete mixtures to address concerns of energy use during cement production. Cement suppliers no longer provide cement meeting ASTM C150 – *Standard Specification for Portland Cement* and are now producing cement meeting ASTM C595 – *Standard Specification for Blended Cements*. It has been reported that ASTM C150 Type I/II cement is no longer being produced. ASTM C595 specification pertains to blended hydraulic cements for both general and special applications, using slag, pozzolan, limestone, or some combination of these, with Portland cement or Portland cement clinker or slag with lime. Cements meeting ASTM C595 have been referred to as Type 1L indicating the cement contains a percentage of Portland limestone cement. The Portland limestone cement percentage varies from the total cement content within the cement supplier industry. For example, a concrete supplier in Minnesota uses a C595 blended cement with 4%-5% Portland limestone cement. A concrete supplier in Illinois uses 8%-13% C595 blended cement.

OBJECTIVE

The post-installed anchor industry is interested in learning if there are anchor performance differences when anchors are installed in concrete made with C150 Type I/II cement and C595 blended cement. The objective is an independent test of bonded anchors in these base materials with the focus on concrete cone failure.

SCOPE

The contractor shall perform the following tasks, which include performance of the material and tension tests, review of the test data, statistical evaluation, preparation of a test report, and a summary presentation.

Tests to be performed:

- **Unconfined tests** according to ACI 355.4-Table 3.2, line 11a and 11b.

<i>Service-condition tests</i>									
11a	8.4	Tension in low-strength concrete	Tension, unconfined, single anchor away from edges	—	—	10.4.2 10.4.4 10.4.5	low	min max	Five*
11b	8.4	Tension in high-strength concrete [‡]	Tension, unconfined, single anchor away from edges	—	—	10.4.2 10.4.4 10.4.5	high	min	Five*

5 tests each concrete mix



- One test series (5 anchor tests) in ASTM C150 Type I/II concrete and one test series (5 anchor tests) in C595 blended cement concrete with 20% limestone cement content, in low strength and high strength concrete (see section 4.3.4 of ACI 355.4).
- Anchorage depth is to be 4 inch, using ¾ inch threaded rod, with steel strength adequate to avoid steel failure. Steel with an ultimate tensile strength of 150 ksi (1035 MPa) is suggested.
- Epoxy adhesive with enough bond strength to avoid bond failure. 1,700 psi (12MPa) would be recommended as minimum characteristic bond strength ($\tau_{Rk,ucr}$) in uncracked, dry concrete at normal ambient temperature for the selected epoxy adhesive.

Test members:

- Cast the concrete mixes at the same time, aiming for comparable compressive strength levels after 28 days.
- A slump of 4 (+/-1) inches is required.
- Cast cylinders and prisms for performing material tests: Compressive strength and bending strength according to ASTM C78 – *Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)*.
- Perform the bending and compression tests concurrently with the anchor tension tests.

Test procedure (according to ACI 355.4):

- Drill and clean the hole according to the Manufacturer's Published Installation Instructions (MPII) of the product.
- Install the anchors in standard concrete and the low carbon concrete mix. Permit all anchors to fully cure in accordance with curing time noted in the MPII before testing anchors.
- Perform a tension test unconfined with concrete cone failure not influenced by supports.
- Perform tests within the concrete age interval of 28 to 56 days.
 - Note: Tests conducted in each concrete mix must be conducted on the same day.

Test report:

- Record the test data and the test setup with equipment used in the test report.
- Record the test protocols and the results of the material tests and the concrete mix in the annex.

Statistical Evaluation:

Compare the test results of the reference tests in the standard concrete mix and the low carbon concrete mix, and on a normalized level with the calculated mean concrete cone capacity.

Perform a TOST (two one-sided *t*-test) test for statistical equivalence of the test results if they are on the same level. Prepare a presentation and a summary for CAMA.



DELIVERABLES

A test report, in Word and PDF format, summarizing the tests. In addition, a presentation of the findings to the CAMA Board.

QUALIFICATIONS

At a minimum, the contractor should be able to demonstrate:

- Experience with testing and assessing tests according to ACI 355.4 and material testing of concrete.
- Opportunity to cast the concrete or have the concrete supplied by an experienced supplier.
- Knowledge and experience to cast the C595 blended cement concrete mix, in this case including 20% limestone cement.

QUOTE SUBMITTALS

The proposal, with a schedule to perform the work and the cost to perform the work, shall be emailed no later than December 9, 2024 to the following address:

Tony Bouquot
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Concrete and Masonry Anchor Manufacturers Association
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