SECTION 03 30 05
CONCRETE TESTING

PART 1 GENERAL

1.1 SECTION INCLUDES
A. Concrete sampling and testing requirements.

1.2 REFERENCES
A. ACI 318: Building Code Requirements for Reinforced Concrete.
B. ASTM C 31: Standard Practice for Making and Curing Concrete Test Specimens in the Field.
C. ASTM C 39: Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
D. ASTM C 42: Standard Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
E. ASTM C 78: Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading).
F. ASTM C 136: Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
G. ASTM C 138: Standard Test Method for Unit Weight, Yield, and Air Content (Gravimetric) of Concrete.
H. ASTM C 143: Standard Test Method for Slump of Portland Cement Concrete.
I. ASTM C 172: Standard Method of Sampling Freshly Mixed Concrete.
J. ASTM C 173: Standard Test Method for Air Content of Freshly Mixed Concrete by Volumetric Method.
K. ASTM C 231: Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
L. ASTM C 567: Standard Test Method for Unit Weight of Structural Lightweight Concrete.
M. ASTM C 1064: Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete.
N. ASTM D 1077: Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.

1.3 SUBMITTALS
A. Concrete Supplier: If requested, submit reports and material certificates verifying concrete quality control.
B. Laboratory: Promptly submit test data results for 7 and 28 day breaks to Supplier, CONTRACTOR and ENGINEER**.**

1.4 QUALITY ASSURANCE
A. Provide an ASTM D 1077 compliant and ACI certified laboratory.
B. Provide level I ACI certified field sampling technicians.

1.5 **SITE CONDITIONS**

A. Assist ENGINEER: Furnish labor to assist ENGINEER in obtaining and handling acceptance samples at site or sources.

B. Store and Cure Test Specimens: Safely store and cure concrete test specimens and acceptance test specimens for first 24 hours.

1. Follow ASTM C 31 in making and curing cylinders or beams at site. Do not move the cylinders or beams for the initial 16 hour cure period. Provide initial cure temperature as follows.
   a. 60 to 80 deg. F. for Class 4,000 or less.
   b. 68 to 78 deg. F. for Class 5,000 or greater.
2. Equip storage device with an automatic 24 hour temperature recorder with an accuracy of plus or minus 2 deg. F.
3. Use water containing hydrated lime if water is to be in contact with cylinders or beams.
4. Ensure the device(s) can accommodate the required number of test cylinders or beams. Lack of capacity will cause the placement of concrete to cease.
5. Have the storage devices available at the point of placement at least 24 hours before placement.
6. A 24 hour test run may be required.

1.6 **ACCEPTANCE**

A. At the Site:

1. Sampling: ASTM C 172. Reject non-complying batches until 2 consecutive batches are compliant then proceed in random batch testing for acceptance.
2. Temperature, ASTM C 1064.
3. Air content, ASTM C 231 or ASTM C 173 if lightweight aggregate is used.
4. Slump, ASTM C 143. 200

B. At the Laboratory:

1. Compressive strength, ASTM C 31.
2. Flexure strength, ASTM C 78.

PART 2 PRODUCTS Not Used

PART 3 EXECUTION

3.1 **PRECAST PRODUCTS**

A. Obtain composite Samples from different portions of the batch.

B. Make and cure concrete test specimens for acceptance, ASTM C 31.

C. Cure all precast products with water vapor or water.

D. Do not damage precast products by stripping forms or handling before the concrete reaches its specified strength.

3.2 **CAST-IN-PLACE PRODUCTS**

A. Obtaining Samples:

1. Batch samples, ASTM C 172.

2. Core samples, ASTM C 42.

B. Identify location of tests on test reports.

C. Compressive strength, ASTM C 39.
1. Mold 4 test specimens, ASTM C 31.
2. For each strength test perform slump, air, unit weight, and temperature test.
3. Break 1 cylinder at 7 days and 3 cylinders at 28 days. The average strength of 3 cylinder breaks shall be considered the test result.
4. If anyone cylinder in a 28 day test shows definite evidence of improper sampling, molding, handling, curing, or testing, discard the cylinder. The average strength of the remaining cylinders shall be considered the test result.

D. Tensile (flexural) strength, ASTM C 78.
1. Mold 4 test specimens, ASTM C 31.
2. For strength test perform slump, air, unit weight, and temperature test.
3. Break 1 beam at 7 days and 3 beams at 28 days. The average strength of the 3 beam breaks shall be considered the test result.
4. If anyone beam in a 28 day test shows definite evidence of improper sampling, molding, handling, curing, or testing, discard the beam. The average strength of the remaining beams shall be considered the test result.

E. Aggregate, ASTM C 136 for fine and coarse aggregate.

F. Slump test, ASTM C 143.

G. Air Test:
1. Normal weight concrete, ASTM C 231.
2. Light weight concrete, ASTM C 173.

H. Unit Weight:
1. Normal weight concrete, ASTM C 138.
2. Light weight concrete, ASTM C 567.

I. When requested, test in-place concrete by impact hammer, sonoscope, or other non-destructive device:
1. To determine relative strengths in various locations in Work.
2. To aid in evaluating concrete strength.
3. To select areas to be cored.
4. To verify quality control in the absence of control testing.

3.3 RETESTING DEFECTIVE CONCRETE

A. If CONTRACTOR desires to do a retest, a request to ENGINEER for retesting must be made within 35 days from time of concrete placement.
No coring or retesting shall be done after 40 days have elapsed from the time of placement.
1. Choose 3 random test locations and verify choice with ENGINEER. Obtain retest samples per ASTM C 42 and test compressive strength per ASTM C 39 or flexure strength per ASTM C 78.
2. Establish a chain of custody for all test samples.

3. If concrete placed in the Work will be dry under service condition, air dry cores for 7 days before tests. Unless otherwise specified, use air temperature 60 to 80 deg. F. and relative humidity less than 60 percent.
4. If concrete placed in the Work will be more than superficially wet under service conditions, test cores after moisture conditioning (liquid or vapor water cure).
5. If more than 1 core shows evidence of having been damaged before testing provide replacement cores, otherwise evaluation will be done on 2 or more core samples.
6. Evaluate cores in accordance with ACI 318 requirements.
7. If core tests are inconclusive, or impractical to obtain, or if structural analysis does not confirm the safety of the Work, load test may be used and evaluated in accordance with ACI 318 requirements.

B. Coat sides of core hole with concrete epoxy resin adhesive. Fill core holes with non-shrink concrete mortar. Match color and texture of surrounding concrete.

C. Within 40 days from time of placement publish the chain of custody record and the results of retesting.

END OF SECTION