

## SECTION 01450 - QUALITY CONTROL - CONSTRUCTION MANAGER EDITION

### PART 1 - GENERAL

#### 1.1 Summary:

- A Independent testing, inspection and quality control services for evaluation of material, methods and workmanship for concrete work, steel work, compaction and backfilling, and bituminous concrete. At Contractor's option, one or more agencies may be used for quality control services with the exception of Geotechnical firm that provided Subsurface Exploration Data must be used for Earthwork Inspection and Testing.
- B. Contractor shall retain services of acceptable independent agencies for testing required by specifications and pay costs related thereto.
- C. Contractor shall designate one typical classroom in the building as a mock-up for approval of finishes.

#### 1.2 Related Sections:

- A Drawings and general provisions of Contract, including General Conditions and other Division-1 Specification sections, apply to work of this section.

#### 1.3 Concrete Quality Control Testing During Construction:

- A Concrete Testing Laboratory: Contractor shall employ testing laboratories to conduct tests and inspections, interpret results and evaluate for compliance with Contract Documents and report findings to Construction Manager, Architect, Owner, Contractor and Structural Engineer.
- B. Sampling and testing for quality control during placement of concrete shall include the following, as directed by Construction Manager and Architect.
  - 1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
    - a. Slump: ASTM C 143; one test for each concrete load at point of discharge; and one test for each set of compressive strength test specimens.
    - b. Air Content: ASTM C 143, volumetric method for lightweight or normal weight concrete; ASTM C 231 pressure for normal weight concrete; one for each set of compressive strength test specimens.
    - c. Concrete Temperature: Test hourly when air temperature is 40° Fahrenheit and below, and when 80° Fahrenheit and above; and each time a set of compression test specimens are made.
    - d. Compression Test Specimen: ASTM C 31; one set of 4 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens. Secure samples in accordance with ASTM C 172.
    - e. Compressive Strength Tests: ASTM C 39; one set for each day's pour, or for each 100 cu. yds. or fraction thereof, of each concrete class placed in any

one day or for each 5,000 sq. ft. of surface area placed; 2 specimens tested at 7 days; 2 specimens tested at 28 days.

- f. When frequency of testing will provide less than 5 strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.
  - g. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi.
- 2. Test results shall be reported in writing to Architect (2 copies); and Construction Manager, Contractor, Owner, and Structural Engineer (1 copy each). Reports of compressive strength tests shall contain the project identification, name of Contractor, name of concrete supplier, truck number and batch number, date of concrete placement, name of concrete testing service and certifying Engineer, concrete type and class, ambient and concrete temperatures, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials; slump and air test results, compressive breaking strength and type of break for both 7-day tests and 28-day tests.
  - 3. Test Evaluation: Concrete cylinder tests shall be evaluated by Architect in accordance with ACI 318 and ACI 214.
  - 4. Additional Tests: Testing service shall make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in structure, as directed by Construction Manager and Architect. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 142, or by other methods as directed. Contractor shall pay for tests conducted, and additional testing as may be required, when unacceptable concrete is verified.
  - 5. In event that additional coring tests do not show strength required or as determined by load tests made in accordance with ACI 318, and if tests indicate necessity, defective parts shall be removed and replaced, or shall be reinforced as directed by Construction Manager and Architect at Contractor's expense, including expense of tests. If tests indicate structure adequately meets requirements of Contract Documents, test results of defective cylinders shall be waived.
- C. Contractor's Responsibility: Contractor shall observe daily work of testing laboratory in field and laboratory and shall report all known deviations to approved standards to Construction Manager and Architect within 24 hours. Failure to so notify Construction Manager and Architect in event of deviations shall not waive the Contractor's approval of subsequent test results.
  - D. Curing Box: Contractor shall construct an insulated curing box to cure concrete cylinders and maintain required temperatures. Construct each box large enough to store a minimum of 18 cylinders.
- 1.4 Structural Steel and Steel Joist Quality control During Construction:
- A. Inspection Agency: Contractor shall employ an independent testing and inspection agency having a registered Professional Engineer licensed in State of Maryland on its staff to inspect high strength bolted connections, welded connections, to perform tests and prepare test reports. This firm shall provide a qualified project inspector who shall work under direct supervision of registered Professional Engineer and who shall be approved in advance by Owner, Local Building Department and be acceptable to Construction Manager and Architect.

1. Testing agency shall conduct and interpret tests and state in each report whether test specimens comply with requirements, and specifically state deviations there from.
  2. Testing agency may inspect structural steel and steel joist at plant before shipment; however, Construction Manager and Architect reserve right, at any time before final acceptance, to reject material not complying with specified requirements.
- B. Testing agency shall have access to places where structural steel Work and steel joist Work is being fabricated or produced so that required inspection and testing can be accomplished.
- C. Contractor shall correct deficiencies in structural steel and steel joist Work which inspections and laboratory test reports indicate not to be in compliance with requirements.
- D. Testing agency shall perform additional tests, at Contractor's expense, as may be necessary to reconfirm any non-compliance of original Work, and as may be necessary to show compliance of corrected Work.
- E. Minimum Testing Requirements:
1. Shop Bolted Connections: Inspect or test in accordance with AISC specifications for structural steel.
  2. Shop Welding: Inspect and test during fabrication of structural steel and steel joist assemblies as follows:
    - a. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in Work. Record work required and performed to correct deficiencies.
    - b. Perform visual inspection of all welds.
    - c. Perform tests of suspected defective welds as follows: Inspection procedures listed are to be used at testing agency's option.
      - (1) Liquid Penetrant Inspection: ASTM E 165.
      - (2) Magnetic Particle Inspection: ASTM E 109; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration not acceptable.
      - (3) Radiographic Inspection: ASTM E 94 and ASTM E 142: minimum quality level "2-2T".
      - (4) Ultrasonic Inspection: ASTM E 164.
- F. Field Bolted Connections: Inspect in accordance with AISC and SJI specifications.
- G. Field Welding: Inspect and test during erection of structural steel, steel joist and metal decking as follows:
1. Certify welders and conduct inspections and tests as required. Record types and locations of defects found in Work. Record Work required and performed to correct deficiencies.
  2. Perform visual inspection of all welds.

3. Perform tests of suspected defective welds and of all moment connection welds as follows: Inspection procedures listed are to be used at testing agency's option.
  - a. Liquid Penetrant Inspection: ASTM E 165.
  - b. Magnetic Particle Inspection: ASTM 109; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration not acceptable.
  - c. Radiographic Inspection: ASTM E 94 and ASTM E 142; minimum quality level "2-2T".
  - d. Ultrasonic Inspection: ASTM E 164.

1.5 Backfilling and Compaction Quality Control During Construction:

- A. Contractor will employ an independent testing and inspection agency to conduct tests and inspections, interpret them, evaluate results for compliance with specifications and report findings to Construction Manager, Architect, Owner, Contractor, Civil Engineer and Structural Engineer as their interests may appear.
- B. Quality Control Testing During Construction: Testing agency shall inspect and approve subgrades and fill layers before further Work is performed.
  1. Perform field density tests in accordance with ASTM D 1556 (sand cone method) or ASTM D 2922 (nuclear method-shallow depth), as applicable.
  2. Footing Subgrade: For each stratum of soil on which footings will be placed, conduct at least one test to verify required design bearing pressure. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested strata, when acceptable to Construction Manager and Architect.
  3. Paved Areas and Building Slab Subgrade: Make at least one field density test of subgrade for every 1500 sq. ft. of paved area or building slab, but in no case less than three (3) tests. In each compacted layer of embankment fill, make one field density test for every 1000 sq. ft. of overlying building slab or paved area, but in no case less than three (3) tests. Augment field density test with observation of fill stability using Proofroll by loaded 20-wheel truck.
- C. If in opinion of Construction Manager and Architect, based on testing service reports and inspection, subgrade or fills which have been placed are below specified density, provide additional reworking, compaction and testing at no additional expense.

1.6 Concrete and Bituminous Concrete Paving Quality Control During Construction:

- A. Contractor will employ an independent testing and inspection agency to conduct tests and inspections, interpret them, evaluate results for compliance with specifications and report findings to Construction Manager, Architect, Owner, Contractor and Civil Engineer as their interests may appear.
- B. General: Test in-place concrete and asphalt concrete paving courses for compliance with requirements for thickness and surface smoothness.
- C. Thickness: In-place compacted thickness of asphalt concrete paving will not be acceptable if exceeding following allowable variation from required thickness:

Base Course: 1/2", plus or minus.  
Surface Course: 1/4", plus or minus.

- D. Surface Smoothness: Test finished surface of each asphalt concrete course for smoothness, using 10' straightedge applied parallel with, and at right angles to centerline of paved area. Surfaces will not be acceptable if exceeding the following tolerances for smoothness:

Base Course Surface: 1/4".  
Wearing Course Surface: 3/16".

- E. Check surface areas at intervals as directed by Construction Manager and Architect.
- F. Contractor shall repair or remove and replace unacceptable paving as directed by Construction Manager and Architect.

1.7 Masonry Mortar and Grout Quality Control During Construction:

- A. Masonry Mortar: The designated testing agency shall sample and test mortars in accordance with property specifications of ASTM C 270 and evaluate in accordance with ASTM C780. At least one test for each 5000 square feet of wall area or portion thereof.
- B. Masonry Grout: Designated testing agency shall sample and test masonry grout in accordance with ASTM C 1019 for each 5,000 square feet of masonry wall surface.

1.8 Typical Classroom Mock-up for Approval of Finishes:

- A. Contractor shall designate one classroom to establish a standard for finishes for the balance of the project. Finishes in this classroom must be approved by the Owner and Architect prior to the commencement of finishes in the balance of the building for the following items:
1. Block fill – 1<sup>st</sup> and 2<sup>nd</sup> coat
  2. Floor tile/cove base
  3. Painting – 1<sup>st</sup> and 2<sup>nd</sup> coat
  4. Casework
  5. Ceilings/lighting
  6. White/Tack boards
  7. Window treatments
  8. Ductwork hung and insulated
  9. Sprinkler System
  10. Floor waxing
  11. Fire alarm
  12. Switches and plugs with cover plates

**PART 2 - PRODUCTS**

2.1 Acceptable Inspection and Testing Agencies:

- A. Hillis-Carnes Engineering Associates
- B. Engineering Consulting Services, Ltd.
- C. Geotech Engineers, Inc.
- D. Kim Engineering, Inc.
- E. PSI

- F. KCI
- G. CTI Consultants, Inc.
- H. Giles Engineering Associates, Inc.
- I. Specialized Engineering

**PART 3 - EXECUTION**

3.1 Inspection and Testing Reports

- A. Copies of inspection and testing reports shall be submitted to Architect (2 copies), Construction Manager, Contractor, Owner, Structural Engineer and Civil Engineer (1 copy each).
- B. Reports shall be clearly and neatly typed (handwritten reports will not be accepted) and shall contain pertinent project information for each type of test. Submit samples of each report form for approval.

**END OF SECTION**