# SECTION 01 45 29

# TESTING LABORATORY SERVICES

## PART 1 - GENERAL

### 1.1 DESCRIPTION:

A. This section specifies materials testing activities and inspection services required during project construction to be provided by a Testing Laboratory retained by the General Contractor and working in behalf of and reporting directly to the Department of Veterans Affairs for VAMC Upgrade Parking Garage – Project N0. 642-09-121.

### 1.2 APPLICABLE PUBLICATIONS:

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

B. American Association of State Highway and Transportation Officials (AASHTO):

T27-06.....Sieve Analysis of Fine and Coarse Aggregates
T96-02 (R2006).....Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
T99-01 (R2004).....The Moisture-Density Relations of Soils Using a 2.5 Kg (5.5 lb.) Rammer and a 305 mm (12 in.) Drop
T104-99 (R2003).....Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate
T180-01 (R2004).....Moisture-Density Relations of Soils using a 4.54 kg (10 lb.) Rammer and a 457 mm (18 in.) Drop
T191-02(R2006).....Density of Soil In-Place by the Sand-Cone Method

C. American Concrete Institute (ACI):

506.4R-94 (R2004).....Guide for the Evaluation of Shotcrete

D. American Society for Testing and Materials (ASTM):

A325-06.....Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
A370-07.....Definitions for Mechanical Testing of Steel Products
A416/A416M-06.....Steel Strand, Uncoated Seven-Wire for Prestressed Concrete
A490-06.....Heat Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength
C31/C31M-06.....Making and Curing Concrete Test Specimens in the Field
C33-03.....Concrete Aggregates
C39/C39M-05.....Compressive Strength of Cylindrical Concrete Specimens
C109/C109M-05.....Compressive Strength of Hydraulic Cement Mortars
C138-07.....Unit Weight, Yield, and Air Content (Gravimetric) of Concrete
C140-07.....Sampling and Testing Concrete Masonry Units and Related Units
C143/C143M-05.....Slump of Hydraulic Cement Concrete
C172-07.....Sampling Freshly Mixed Concrete
C173-07.....Air Content of freshly Mixed Concrete by the Volumetric Method
C780-07.....Pre-construction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
C1019-08.....Sampling and Testing Grout
C1064/C1064M-05.....Freshly Mixed Portland Cement Concrete
C1077-06.....Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
C1314-07.....Compressive Strength of Masonry Prisms
D698-07.....Laboratory Compaction Characteristics of Soil Using Standard Effort
D1143-07.....Piles Under Static Axial Compressive Load
D1188-07.....Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens

D1556-07.....Density and Unit Weight of Soil in Place by the Sand-Cone Method

D1557-07.....Laboratory Compaction Characteristics of Soil Using Modified Effort

D2166-06.....Unconfined Compressive Strength of Cohesive Soil

D2167-94(R2001).....Density and Unit Weight of Soil in Place by the Rubber Balloon Method

D2216-05.....Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

D2922-05.....Density of soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

D2974-07.....Moisture, Ash, and Organic Matter of Peat and Other Organic Soils

D3666-(2002).....Minimum Requirements for Agencies Testing and Inspection Bituminous Paving Materials

D3740-07.....Minimum Requirements for Agencies Engaged in the Testing and Inspecting Road and Paving Material

E94-04.....Radiographic Testing

E164-03.....Ultrasonic Contact Examination of Weldments

E329-07.....Agencies Engaged in Construction Inspection and/or Testing

E543-06.....Agencies Performing Non-Destructive Testing

E605-93(R2006).....Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members

E709-(2001).....Guide for Magnetic Particle Examination

E1155-96(R2008).....Determining FF Floor Flatness and FL Floor Levelness Numbers

E. American Welding Society (AWS):

D1.1-07.....Structural Welding Code-Steel

**1.3 REQUIREMENTS:**

A. Accreditation Requirements: Testing Laboratory retained by the Contractor and acting on behalf of and reporting directly to the Department of Veterans Affairs, must be accredited by one or more of the National Voluntary Laboratory Accreditation Program (NVLAP) programs acceptable in the geographic region for the project. Furnish to the Contracting Officer a copy of the Certificate of Accreditation and Scope

of Accreditation. For testing laboratories that have not yet obtained accreditation by a NVLAP program, submit an acknowledgement letter from one of the laboratory accreditation authorities indicating that the application for accreditation has been received and the accreditation process has started, and submit to the Contracting Officer for approval, certified statements, signed by an official of the testing laboratory attesting that the proposed laboratory, meets or conforms to the ASTM standards listed below as appropriate to the testing field.

1. Laboratories engaged in testing of construction materials shall meet the requirements of ASTM E329.
2. Laboratories engaged in testing of concrete and concrete aggregates shall meet the requirements of ASTM C1077.
3. Laboratories engaged in testing of bituminous paving materials shall meet the requirements of ASTM D3666.
4. Laboratories engaged in inspection and testing of steel, stainless steel, and related alloys will be evaluated according to ASTM A880.
5. Laboratories engaged in non-destructive testing (NDT) shall meet the requirements of ASTM E543.

B. Inspection and Testing: Testing laboratory shall inspect materials and workmanship and perform tests described herein and additional tests requested by Resident Engineer. When it appears materials furnished, or work performed by Contractor fails to meet construction contract requirements, Testing Laboratory shall direct attention of Resident Engineer to such failure.

C. Written Reports: Testing laboratory shall submit test reports to Resident Engineer, Contractor, and Local Building Authority within 24 hours after each test is completed unless other arrangements are agreed to in writing by the Resident Engineer. Submit reports of tests that fail to meet construction contract requirements on colored paper.

D. Verbal Reports: Give verbal notification to Resident Engineer immediately of any irregularity.

E. Test Standards: The Testing Laboratory shall include a lump sum allowance of $500 for furnishing published standards (ASTM, AASHTO, ACI, ANSI, AWS, ASHRAE, UL, etc.) referred to or specifically referenced which are pertinent to any Sections of these specifications. Furnish one

set of standards in single copies or bound volumes to the Resident Engineer within 30 days. Photocopies are not acceptable. Billings for the standards furnished shall be at the net cost to Testing Laboratory. A preliminary list of test standards, with the estimated costs, shall be submitted to the Resident Engineer for review before any publications of reference standards are ordered.

F. Availability: The Testing laboratory shall provide pick-up and timely reporting for all inspection and testing requirements listed herein.

**PART 2 - PRODUCTS (NOT USED)**

**PART 3 - EXECUTION**

**3.1 LANDSCAPING:**

A. Test topsoil for organic materials, pH, phosphate, potash content, and gradation of particles.

1. Test for organic material by using ASTM D2974.
2. Determine percent of silt, sand, clay, and foreign materials such as rock, roots, and vegetation.

B. Submit laboratory test report of topsoil to Resident Engineer.

**3.2 CONCRETE:**

A. Test concrete including materials for concrete as required in Article CONCRETE of this section.

B. Batch Plant Inspection and Materials Testing:

1. Perform continuous batch plant inspection until concrete quality is established to satisfaction of Resident Engineer with concurrence of Contracting Officer and perform periodic inspections thereafter as determined by Resident Engineer.
2. Periodically inspect and test batch proportioning equipment for accuracy as directed by and report deficiencies to Resident Engineer.
3. Sample and test mix ingredients as necessary to insure compliance with specifications.
4. Sample and test aggregates as necessary for moisture content. Test the dry rodded weight of the coarse aggregate whenever a sieve

analysis is made, and when it appears there has been a change in the aggregate.

5. Certify, in duplicate, ingredients and proportions and amounts of ingredients in concrete conform to approved trial mixes. When concrete is batched or mixed off immediate building site, certify (by signing, initialing or stamping thereon) on delivery slips (duplicate) that ingredients in truck-load mixes conform to proportions of aggregate weight, cement factor, and water-cement ratio of approved trial mixes.

C. Field Inspection and Materials Testing:

1. Provide a technician at site of placement at all times to perform concrete sampling and testing.
2. Review the delivery tickets of the ready-mix concrete trucks arriving on-site. Notify the Contractor if the concrete cannot be placed within the specified time limits or if the type of concrete delivered is incorrect. Reject any loads that do not comply with the Specification requirements. Rejected loads are to be removed from the site at the Contractor’s expense. Any rejected concrete that is placed will be subject to removal.
3. Take concrete samples at point of placement in accordance with ASTM C172. Mold and cure compression test cylinders in accordance with ASTM C31. Make at least four cylinders for each 50 cubic yards or less of each concrete type, and at least four cylinders for any one day's pour for each concrete type. After good concrete quality control has been established and maintained as determined by Resident Engineer, make three cylinders for each 100 cubic yards or less of each concrete type, and at least three cylinders from any one day's pour for each concrete type. Label each cylinder with an identification number. Resident Engineer may require additional cylinders to be molded and cured under job conditions.
4. Perform slump tests in accordance with ASTM C143. Test every truck each day, and every time test cylinders are made. Test pumped concrete at the hopper and at the discharge end of the hose at the beginning of each day’s pumping operations to determine change in slump.
5. Determine the air content of concrete per ASTM C173. For concrete required to be air-entrained, test every truck each day. For concrete

not required to be air-entrained, test every 100 cubic yards at random. For pumped concrete, initially test concrete at both the hopper and the discharge end of the hose to determine change in air content.

6. If slump or air content fall outside specified limits, make another test immediately from another portion of same batch.
7. Perform unit weight tests in compliance with ASTM C138 for normal weight concrete. Test the first truck and each time cylinders are made.
8. Notify laboratory technician at batch plant of mix irregularities and request materials and proportioning check.
9. Verify that specified mixing has been accomplished.
10. Environmental Conditions: Determine the temperature per ASTM C1064 for each truckload of concrete during hot weather and cold weather concreting operations:

    a. When ambient air temperature falls below 40 degrees F, record maximum and minimum air temperatures in each 24 hour period; record air temperature inside protective enclosure; record minimum temperature of surface of hardened concrete.
    b. When ambient air temperature rises above 85 degrees F, record maximum and minimum air temperature in each 24 hour period; record minimum relative humidity; record maximum wind velocity; record maximum temperature of surface of hardened concrete.

11. Inspect the reinforcing steel placement, including bar size, bar spacing, top and bottom concrete cover, proper tie into the chairs, and grade of steel prior to concrete placement. Submit detailed report of observations.
12. Observe conveying, placement, and consolidation of concrete for conformance to specifications.
13. Observe condition of formed surfaces upon removal of formwork prior to repair of surface defects and observe repair of surface defects.
14. Observe curing procedures for conformance with specifications, record dates of concrete placement, start of preliminary curing, start of final curing, end of curing period.
15. Observe preparations for placement of concrete:

    a. Inspect handling, conveying, and placing equipment, inspect vibrating and compaction equipment.

b. Inspect preparation of construction, expansion, and isolation joints.

16. Observe preparations for protection from hot weather, cold weather, sun, and rain, and preparations for curing.
17. Observe concrete mixing:

    a. Monitor and record amount of water added at project site.
    b. Observe minimum and maximum mixing times.

18. Other inspections:

    a. Grouting anchor bolts and reinforcing steel in hardened concrete.

C. Laboratory Tests of Field Samples:

1. Test compression test cylinders for strength in accordance with ASTM C39. For each test series, test one cylinder at 7 days and one cylinder at 28 days. Use remaining cylinders as spares tested as directed by Resident Engineer. Compile laboratory test reports as follows: Compressive strength test shall be result of one cylinder, except when one cylinder shows evidence of improper sampling, molding or testing, in which case it shall be discarded and strength of spare cylinder shall be used.
2. Furnish certified compression test reports (duplicate) to Resident Engineer. In test report, indicate the following information:

    a. Cylinder identification number and date cast.
    b. Specific location at which test samples were taken.
    c. Type of concrete, slump, and percent air.
    d. Compressive strength of concrete in psi.
    e. Weight of concrete in pounds per cubic feet.
    f. Weather conditions during placing.
    g. Temperature of concrete in each test cylinder when test cylinder was molded.
    h. Maximum and minimum ambient temperature during placing.
    i. Ambient temperature when concrete sample in test cylinder was taken.
    j. Date delivered to laboratory and date tested.

**3.3 REINFORCEMENT:**

A. Review mill test reports furnished by Contractor.

B. Make one tensile and one bend test in accordance with ASTM A370 from each pair of samples obtained.

C. Written report shall include, in addition to test results, heat number, manufacturer, type and grade of steel, and bar size.

D. Perform tension tests of mechanical and welded splices in accordance with ASTM A370.

**3.4 UNIT MASONRY:**

A. Perform inspections and prepare reports. Place grout only after inspectors have verified compliance of grout spaces and grades, sizes, and locations of reinforcement.

1. Retesting of materials failing to comply with specified requirements shall be done at Contractor's expense.

B. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

C. Concrete Masonry Unit Test: For each type of unit provided, per ASTM C140.

D. Mortar Test (Property Specification): For each mix provided, per ASTM C780. Test mortar for compressive strength.

E. Grout Test (Compressive Strength): For each mix provided, per ASTM C1019.

**3.5 GARAGE WATERPROOFING SYSTEMS:**

A. Traffic Deck Coating Membrane Inspection: At Architect’s option, select and install a test section prior to general deck coating membrane application to verify installation procedures, compatibility with substrates, application rates, adhesion, and acceptability of finished surface.

1. Establish procedures, verify compatibility and adhesion, and inspect appearance from the test section to confirm membrane effectiveness and profile acceptability in accordance with ICRI 03732. This test area will serve as the “base area.”
2. Inspect areas to receive deck coating membrane application for comparison with the “base area.”

B. Field Adhesion Testing: Test elastomeric joints as follows:

1. Perform 10 tests for first 1000 lineal ft of joint for each type of sealant and substrate.
2. Perform one test for each additional 1000 lineal ft or 1 test per floor thereafter.
3. Refer to Section 07 90 20 for specific testing method to use.

**3.6 DESCRIPTION OF WORK:**

A. In preparation for the start of the project, Facilities Management Services (FMS), determined that construction period testing services were required for the existing parking garage upgrades. The construction period testing services are to include but are not limited to landscaping, cast-in-place concrete repairs, concrete masonry, garage waterproofing and all special inspections. FMS is requesting a price for the construction period testing services listed in the following section.

**3.7 TYPE OF TEST:** (ALLOWANCE FOR NUMBER OF TESTS REQUIRED)

A. Landscaping:

1. Topsoil Test 2

B. Cast-n-Place Concrete:

1. Making and Curing Concrete Test Cylinders (ASTM C31) 50
2. Compressive Strength, Test Cylinders (ASTM C39) 50
3. Concrete Slump Test (ASTM C143) 20
4. Concrete Air Content Test (ASTM C173) 20
5. Concrete Unit Weight (ASTM C138) 20
6. Grout Testing (ASTM C109) 10

C. Unit Masonry:

1. Concrete masonry Unit Test (ASTM C140) 1
2. Mortar Compressive Strength (ASTM C780) 2
3. Grout Compressive Strength (ASTM C1019) 2

D. Garage Waterproofing Systems:

1. Deck Coating Membrane Effectiveness Inspection 5
2. Joint Sealant Field Adhesion Testing 20

E. Technical Personnel:

1. Technicians to perform tests and inspection listed above. Laboratory will be equipped with concrete cylinder storage facilities, compression machine, cube molds, proctor molds, balances, scales, moisture ovens, slump cones, air meter, and all necessary equipment for compaction control.
2. Type of Personnel Man Days

   a. Soils Technician 2
   b. Concrete Technician 5
   c. Waterproofing Technician 5

F. FMS is requesting unit prices for all tests and testing personnel listed above. Vendors are reminded that all tests and services are on an as use basis.

END OF SECTION 01 45 29