

SECTION 01 45 29
TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This section is being provided to the General Contractor for information purposes only. The General Contractor will not be responsible for providing or paying for any of the testing discussed within.
- B. This section specifies materials testing activities and inspection services required during project construction to be provided by a Special Inspector and a Testing Laboratory retained by Department of Veterans Affairs.
- C. Special inspections are required for this Project. Refer to Chapter 17 of the IBC for general requirements of special inspections. In addition, see Appendix 4G of UFC 4-023-3 for 2003 International Building Code modifications for construction of building to resist progressive collapse. The Special Inspector shall furnish weekly reports of tests and inspections to the Resident Engineer, Engineer and Architect of Record. The Special Inspector shall also submit a final signed report that all items requiring special inspection and testing were fulfilled and reported and, to the best of his/her knowledge, in conformance with the approved design drawings, specifications, and approved Change Orders. Items not in conformance, unresolved items or any discrepancies in inspection coverage shall be specifically itemized on in an Addendum to this final Report.

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
- C330-05.....Lightweight Aggregates for Structural Concrete
- C567-05.....Density Structural Lightweight Concrete
- 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
- F. International Code Council (ICC):
- IBC (2006).....International Building Code

1.3 REQUIREMENTS:

- A. Accreditation Requirements: Testing Laboratory retained by 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 **and** Resident Engineer 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 testing of soil and rock, as used in engineering design and construction, shall meet the requirements of ASTM D3740.
 5. Laboratories engaged in inspection and testing of steel, stainless steel, and related alloys will be evaluated according to ASTM A880.
 6. Laboratories engaged in non-destructive testing (NDT) shall meet the requirements of ASTM E543.
 7. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA.
- 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 fail 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. The Special Inspector or Inspection Agency shall furnish weekly and final reports of tests and inspections to the Resident Engineer and the Engineer and Architect of Record.
- 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 \$5000 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 60 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.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EARTHWORK:

- A. General: The Testing Laboratory shall provide qualified personnel, materials, equipment, and transportation as required to perform the services identified/required herein, and/or IBC Table 1704.7 required verification and inspection of soils, within the agreed to schedule and/or time frame. The work to be performed shall be as identified herein and shall include but not be limited to the following:
1. Observe fill and subgrades during proof-rolling to evaluate suitability of surface material to receive fill or base course. Provide recommendations to the Resident Engineer regarding suitability or unsuitability of areas where proof-rolling was observed. Where unsuitable results are observed, witness excavation of unsuitable material and recommend to Resident Engineer extent of removal and replacement of unsuitable materials and observe proof-rolling of replaced areas until satisfactory results are obtained.
 2. Provide full time observation of fill placement and compaction and field density testing in building areas and provide full time observation of fill placement and compaction and field density testing in pavement areas to verify that earthwork compaction obtained is in accordance with contract documents.
 3. Provide supervised geotechnical technician to inspect excavation, subsurface preparation, and backfill for structural fill.
 4. Provide supervised technician with equipment to monitor existing building and foundation for any potential vertical and lateral movements as well as any cracks near major excavations. Submit monitor reports to the Resident Engineer.
- B. Testing Compaction:

1. Determine maximum density and optimum moisture content for each type of fill, backfill and subgrade material used, in compliance with AASHTO T99/T180, Method A and ASTM D1557.
2. Make field density tests in accordance with the primary testing method following ASTM D2922 and AASHTO T238 wherever possible. Field density tests utilizing ASTM D1556, AASHTO T191, or ASTM D2167 shall be utilized on a case by case basis only if there are problems with the validity of the results from the primary method due to specific site field conditions. Should the testing laboratory propose these alternative methods, they should provide satisfactory explanation to the Resident Engineer before the tests are conducted.
 - a. Building Slab Subgrade: At least one test of subgrade for every 185 m² (2000 square feet) of building slab, but in no case fewer than three tests. In each compacted fill layer, perform one test for every 185 m² (2000 square feet) of overlaying building slab, but in no case fewer than three tests.
 - b. Foundation Wall Backfill: One test per 30 m (100 feet) of each layer of compacted fill but in no case fewer than two tests.
 - c. Pavement Subgrade: One test for each 335 m² (400 square yards), but in no case fewer than two tests.
 - d. Curb, Gutter, and Sidewalk: One test for each 90 m (300 feet), but in no case fewer than two tests.
 - e. Trenches: One test at maximum 30 m (100 foot) intervals per 1200 mm (4 foot) of vertical lift and at changes in required density, but in no case fewer than two tests.
 - f. Footing Subgrade: At least one test for each layer of soil on which footings will be placed. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested subgrade when acceptable to Resident Engineer. In each compacted fill layer below wall footings, perform one field density test for every 30 m (100 feet) of wall. Verify subgrade is level, all loose or disturbed soils have been removed, and correlate actual soil conditions observed with those indicated by test borings.
- C. Testing for Footing Bearing Capacity: Evaluate if suitable bearing capacity material is encountered in footing subgrade.
- D. Testing Materials: Test suitability of on-site and off-site borrow as directed by Resident Engineer.

3.2 FOUNDATION PILES: Special Inspections shall be performed during installation and testing of pile foundations as required by IBC, Table 1740.8 and/or the following:

- A. Witness load test procedure for conformance with ASTM D1143 and interpret test data to verify geotechnical recommendations for pile capacity. Submit load test report in accordance with ASTM D1143.
- B. Review Contractor's equipment, methods, and procedures prior to starting any work on site. Provide continuous inspection of pile installation. Maintain a record of all pertinent phases of operation for submittal to Resident Engineer.
- C. Drilled Micropiles: Take and test samples of grout in accordance with ASTM C109 for conformance with specified strength requirements. Not less than six cubes shall be made for each day of casting. Test three cubes at 7 days and three at 28 days.

3.3 FOUNDATION CAISSONS: Special Inspection shall be performed during installation and testing of pier foundations as required by IBS, Table 1704.9 and/or the following:

- A. Concrete Testing: Test concrete including materials for concrete as required in Article, CONCRETE of this section, except make two test cylinders for each day's placement of concrete.
- B. Maintain a record of concrete used in each caisson. Compare records with calculated volumes.
- C. Inspect percussion hole in bottom of each caisson to determine that material is capable of supporting design load.
- D. Inspect sides and bottom of each caisson for compliance with contract documents.
- E. Submit a certified "Caisson Field Record" for each caisson, recording actual elevation at bottom of shaft; final center line location of top; variation of shaft from plumb; results of all tests performed; actual allowable bearing capacity of bottom; depth of socket into rock; levelness of bottom; seepage of water; still water level (if allowed to flood); variation of shaft (from dimensions shown); location and size of reinforcement, and evidence of seams, voids, or channels below the bottom. Verify the actual bearing capacity of the rock strata by the use of a calibrated penetrometer or other acceptable method.
- F. Caissons Bearing on Hardpan: Take undisturbed samples, suitable for tests required, from caisson bottom. Make auger probe to a depth of 2.5 meters (8 feet) below bottom and visually inspect and classify soil. Verify continuity of strata and thickness.

1. Conduct the following test on each sample, and report results and evaluations to the Resident Engineer:
 - a. Unconfined Compression Test (ASTM D2166).
 - b. Moisture Content (ASTM D2216).
 - c. Density.

3.4 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.

3.5 ASPHALT CONCRETE PAVING:

- A. Aggregate Base Course:
 1. Determine maximum density and optimum moisture content for aggregate base material in accordance with AASHTO T180, Method D, and ASTM D1557, Method D.
 2. Make a minimum of three field density tests on each day's final compaction on each aggregate course in accordance with AASHTO T191 and ASTM D1556.
 3. Sample and test aggregate as necessary to insure compliance with specification requirements for gradation, wear, and soundness as specified in the applicable state highway standards and specifications.
- B. Asphalt Concrete:
 1. Aggregate: Sample and test aggregates in stock pile and hot-bins as necessary to insure compliance with specification requirements for gradation (AASHTO T27), wear (AASHTO T96), and soundness (AASHTO T104).
 2. Temperature: Check temperature of each load of asphalt concrete at mixing plant and at site of paving operation.
 3. Density: Make a minimum of two field density tests in accordance with ASTM D1188 of asphalt base and surface course for each day's paving operation.

3.6 SITE WORK CONCRETE:

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

3.8 CONCRETE: Special Inspections and verifications for concrete construction shall be as required by IBC–Section 1704.4 and Table 1704 and/or the following:

A. 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 and report deficiencies to Resident Engineer.
3. Sample and test mix ingredients as necessary to insure compliance with specifications.
4. Sample and test aggregates daily and 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.

B. 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 (4) cylinders for each 40 m³ (50 cubic yards) or less of each concrete type, and at least four (4) 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 four (4) cylinders for each 80 m³ (100 cubic yards) or less of each concrete type, and at least make four (4) 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 the first 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 the first truck and every 20 m³ (25 cubic yards) thereafter each day. For concrete not required to be air-entrained, test every 80 m³ (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 and ASTM C567 for lightweight 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 4.4 degrees C (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 29.4 degrees C (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. Measure concrete flatwork for levelness and flatness as follows:
 - a. Perform Floor Tolerance Measurements F_F and F_L in accordance with ASTM E1155. Calculate the actual overall F- numbers using the inferior/superior area method.
 - b. Perform all floor tolerance measurements within 48 hours after slab installation and prior to removal of shoring and formwork.
 - c. Provide the Contractor and the Resident Engineer with the results of all profile tests, including a running tabulation of the overall F_F and F_L values for all slabs installed to date, within 72 hours after each slab installation.
 19. Other inspections:
 - a. Grouting under base plates.
 - b. 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 (1) cylinder at 7 days and two (2) cylinders at 28 days. Use remaining cylinder as a spare tested as directed by Resident Engineer. Compile laboratory test reports as follows: Compressive strength test shall be result of two (2) cylinder.
 2. Make weight tests of hardened lightweight structural concrete in accordance with ASTM C567.

3. 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 MPa (psi).
 - e. Weight of lightweight structural concrete in kg/m³ (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.

3.9 REINFORCEMENT:

- A. Review mill test reports furnished by Contractor.
- B. Perform tension tests of mechanical and welded splices in accordance with ASTM A370.

3.10 SHOTCRETE:

- A. Inspection and Material Testing:
 1. Provide field inspection and testing service as required by Resident Engineer to certify that shotcrete has been applied in accordance with contract documents.
 2. Periodically inspect and test proportioning equipment for accuracy and report deficiencies to Resident Engineer.
 3. Sample and test mix ingredients as necessary to insure compliance with specifications.
 4. Sample and test aggregates daily and as necessary for moisture content. Report instances of excessive moisture to Resident Engineer.
 5. Certify, in duplicate, that ingredients and proportions and amounts of ingredients in shotcrete conform to approved trial mixes.
 6. Provide field inspection of the proper size and placement of the reinforcement in the shotcrete.
- B. Shotcrete Sampling:
 1. Provide a technician at site of placement to perform shotcrete sampling.
 2. Take cores in accordance with ACI 506.

3. Insure maintenance of water-cement ratio established by approved trial mix.
4. Verify specified mixing has been accomplished.

C. Laboratory Tests of Field Sample Panels:

1. Compression test core for strength in accordance with ACI 506. For each test series of four (4) cores, test one core at 7 days and two (2) core at 28 days. Use remaining core as a spare to be tested as directed by the Resident Engineer. Compile laboratory test reports as follows: Compressive strength test shall be result of one core, except when one core shows evidence of improper sampling or testing, in which case it shall be discarded and strength of spare core shall be used.
2. Submit certified compression test reports (duplicate) to Resident Engineer. On test report, indicate following information:
 - a. Core identification number and date cast.
 - b. Specific location at which test samples were taken.
 - c. Compressive strength of shotcrete in MPa (psi).
 - d. Weather conditions during placing.
 - e. Temperature of shotcrete in each test core when test core was taken.
 - f. Maximum and minimum ambient temperature during placing.
 - g. Ambient temperature when shotcrete sample was taken.
 - h. Date delivered to laboratory and date tested.

- D. Submit inspection reports certification and instances of noncompliance to Resident Engineer.

3.12 ARCHITECTURAL PRECAST CONCRETE:

- A. Inspection at Plant: Forms, placement of reinforcing steel, concrete cover, and placement and finishing of concrete.
- B. Concrete Testing: Test concrete including materials for concrete as required in Article CONCRETE of this section, except make two test cylinders for each day's production of each strength of concrete produced.
- C. Inspect members to insure specification requirements for curing and finishes have been met.

3.13 MASONRY Comply with IBC Table 1704.5-1, Level 1 Special Inspection and/or the following:

- A. Mortar Tests:
 1. Laboratory compressive strength test:
 - a. Comply with ASTM C780.

- b. Obtain samples during or immediately after discharge from batch mixer.
- c. Furnish molds with 50 mm (2 inch), 3 compartment gang cube.
- d. Test one sample at 7 days and 2 samples at 28 days.
- 2. Two tests during first week of operation; one test per week after initial test until masonry completion.
- B. Grout Tests:
 - 1. Laboratory compressive strength test:
 - a. Comply with ASTM C1019.
 - b. Test one sample at 7 days and 2 samples at 28 days.
 - c. Perform test for each 230 m² (2500 square feet) of masonry.
- C. Masonry Unit Tests:
 - 1. Laboratory Compressive Strength Test:
 - a. Comply with ASTM C140.
 - b. Test 3 samples for each 460 m² (5000 square feet) of wall area.
- D. Prism Tests: For each type of wall construction indicated, test masonry prisms per ASTM C1314 for each 460 m² (5000 square feet) of wall area. Prepare one set of prisms for testing at 7 days and one set for testing at 28 days.

3.14 STRUCTURAL STEEL:

- A. General: Provide shop and field inspection and testing services to certify structural steel work is done in accordance with contract documents. Welding shall conform to AWS D1.1 Structural Welding Code. The Special Inspections for steel elements of buildings and structures shall be as required by the IBC, Section 1704.3, Table 1704.3
- B. Prefabrication Inspection:
 - 1. Review design and shop detail drawings for size, length, type and location of all welds to be made.
 - 2. Approve welding procedure qualifications either by pre-qualification or by witnessing qualifications tests.
 - 3. Approve welder qualifications by certification or retesting.
 - 4. Approve procedure for control of distortion and shrinkage stresses.
 - 5. Approve procedures for welding in accordance with applicable sections of AWS D1.1.
- C. Fabrication and Erection:
 - 1. Weld Inspection:
 - a. Inspect welding equipment for capacity, maintenance and working condition.
 - b. Verify specified electrodes and handling and storage of electrodes in accordance with AWS D1.1.

- c. Inspect preparation and assembly of materials to be welded for conformance with AWS D1.1.
 - d. Inspect preheating and interpass temperatures for conformance with AWS D1.1.
 - e. Measure 25 percent of fillet welds.
 - f. Welding Magnetic Particle Testing: Test in accordance with ASTM E709 for a minimum of:
 - 1) 20 percent of all shear plate fillet welds at random, final pass only.
 - 2) 20 percent of all continuity plate and bracing gusset plate fillet welds, at random, final pass only.
 - 3) 100 percent of tension member fillet welds (i.e., hanger connection plates and other similar connections) for root and final passes.
 - 4) 20 percent of length of built-up column member partial penetration and fillet welds at random for root and final passes.
 - 5) 100 percent of length of built-up girder member partial penetration and fillet welds for root and final passes.
 - g. Welding Ultrasonic Testing: Test in accordance with ASTM E164 and AWS D1.1 for 100 percent of all full penetration welds, braced and moment frame column splices, and a minimum of 20 percent of all other partial penetration column splices, at random.
 - h. Welding Radiographic Testing: Test in accordance with ASTM E94, and AWS D1.1 for 5 percent of all full penetration welds at random.
 - i. Verify that corrections of rejected welds are made in accordance with AWS D1.1.
 - j. Testing and inspection do not relieve the Contractor of the responsibility for providing materials and fabrication procedures in compliance with the specified requirements.
2. Bolt Inspection:
- a. Inspect high-strength bolted connections in accordance AISC Specifications for Structural Joints Using ASTM A325 or A490 Bolts.
 - b. Slip-Critical Connections: Inspect 10 percent of bolts, but not less than 2 bolts, selected at random in each connection in accordance with AISC Specifications for Structural Joints Using ASTM A325 or A490 Bolts. Inspect all bolts in connection when one or more are rejected.

- c. Fully Pre-tensioned Connections: Inspect 10 percent of bolts, but not less than 2 bolts, selected at random in 25 percent of connections in accordance with AISC Specification for Structural Joints Using ASTM A325 or A490 Bolts. Inspect all bolts in connection when one or more are rejected.
 - d. Bolts installed by turn-of-nut tightening may be inspected with calibrated wrench when visual inspection was not performed during tightening.
 - e. Snug Tight Connections: Inspect 10 percent of connections verifying that plies of connected elements have been brought into snug contact.
 - f. Inspect field erected assemblies; verify locations of structural steel for plumbness, level, and alignment.
- D. Submit inspection reports, record of welders and their certification, and identification, and instances of noncompliance to Resident Engineer.

3.15 STEEL DECKING:

- A. Provide field inspection of welds of metal deck to the supporting steel, and testing services to insure steel decking has been installed in accordance with contract documents and manufacturer's requirements.
- B. Qualification of Field Welding: Qualify welding processes and welding operators in accordance with "Welder Qualification" procedures of AWS D1.1. Refer to the "Plug Weld Qualification Procedure" in Part 3 "Field Quality Control."
- C. Submit inspection reports, certification, and instances of noncompliance to Resident Engineer.

3.16 SHEAR CONNECTOR STUDS:

- A. Provide field inspection and testing services required by AWS D.1 to insure shear connector studs have been installed in accordance with contract documents.
- B. Tests: Test 20 percent of headed studs for fastening strength in accordance with AWS D1.1.
- C. Submit inspection reports, certification, and instances of noncompliance to Resident Engineer.

3.17 SPRAYED-ON FIREPROOFING:

- A. Provide field inspection and testing services to certify sprayed-on fireproofing has been applied in accordance with contract documents.
- B. Obtain a copy of approved submittals from Resident Engineer.
- C. Use approved installation in test areas as criteria for inspection of work.

- D. Test sprayed-on fireproofing for thickness and density in accordance with ASTM E605.
 - 1. Thickness gauge specified in ASTM E605 may be modified for pole extension so that overhead sprayed material can be reached from floor.
- E. Location of test areas for field tests as follows:
 - 1. Thickness: Select one bay per floor, or one bay for each 930 m² (10,000 square feet) of floor area, whichever provides for greater number of tests. Take thickness determinations from each of following locations: Metal deck, beam, and column.
 - 2. Density: Take density determinations from each floor, or one test from each 930 m² (10,000 square feet) of floor area, whichever provides for greater number of tests, from each of the following areas: Underside of metal deck, beam flanges, and beam web.
- F. Submit inspection reports, certification, and instances of noncompliance to Resident Engineer.

3.18 TYPE OF TEST:

| | Approximate Number of Tests Required |
|--|---|
| A. Earthwork: | |
| Laboratory Compaction Test, Soils: | |
| (AASHTO T180), (AASHTO T99) and (ASTM D1557) | <u>5</u> |
| Field Density, Soils (AASHTO T191, T205, or T238) | <u>100</u> |
| Penetration Test, Soils | <u>NOT REQUIRED</u> |
| Test Holes, Caissons | <u>40</u> |
| Testing or Bearing Spread Footings | <u>75</u> |
| Testing for Bearing, Spread Footings | <u>25</u> |
| Sacrificial Verification Test Piles | <u>2</u> |
| Proof Load Test Piles | <u>5</u> |
| B. Landscaping: | |
| Topsoil Test | <u>NOT REQUIRED</u> |
| C. Aggregate Base: | |
| Laboratory Compaction, (AASHTO T180)and (ASTM D1557) | <u>3</u> |
| Field Density,(AASHTO T191) and (ASTM D1556) | |
| Aggregate, Base Course | <u>100</u> |
| Gradation (AASHTO T27) | <u>2</u> |
| Wear (AASHTO T96) | <u>NOT REQUIRED</u> |
| Soundness (AASHTO T104) | <u>NOT REQUIRED</u> |
| D. Asphalt Concrete: | |
| Field Density, (AASHTO T230) AND (ASTM D1188) | |
| Aggregate, Asphalt Concrete | <u>15</u> |
| Gradation (AASHTO T27) | <u>NOT REQUIRED</u> |
| Wear (AASHTO T96) | <u>NOT REQUIRED</u> |
| Soundness (AASHTO T104) | <u>NOT REQUIRED</u> |
| E. Concrete: | |
| Making and Curing Concrete Test Cylinders (ASTM C31) | <u>500</u> |
| Compressive Strength, Test Cylinders (ASTM C39) | <u>400</u> |
| Concrete Slump Test (ASTM C143) | <u>130</u> |
| Concrete Air Content Test (ASTM C173) | <u>130</u> |

| | |
|---|----------------------------|
| Unit Weight, Lightweight Concrete (ASTM C567) | <u>50</u> |
| Aggregate, Normal Weight: | |
| Gradation (ASTM C33) | <u>3</u> |
| Deleterious Substances (ASTM C33) | <u>3</u> |
| Soundness (ASTM C33) | <u>3</u> |
| Abrasion (ASTM C33) | |
| Aggregate, Lightweight | <u>NOT REQUIRED</u> |
| Gradation (ASTM C330) | <u>3</u> |
| Deleterious Substances (ASTM C330) | <u>3</u> |
| Unit Weight (ASTM C330) | <u>3</u> |
| Flatness and Levelness Readings (ASTM E1155) (number of days) | <u>5</u> |
| F. Reinforcing Steel: | |
| Tensile Test (ASTM A370) | <u>NOT REQUIRED</u> |
| Bend Test (ASTM A370) | <u>NOT REQUIRED</u> |
| Mechanical Splice (ASTM A370) | <u>4</u> |
| Welded Splice Test (ASTM A370) | <u>NOT REQUIRED</u> |
| G. Shotcrete: | |
| Taking and Curing Test Cores (ACI 506) | <u>5</u> |
| Compressive Strength, Test Cores (ACI 506) | <u>5</u> |
| H. Prestressed Concrete: | |
| Testing Strands (ASTM A416) | <u>NOT REQUIRED</u> |
| I. Masonry: | |
| Making and Curing Test Cubes (ASTM C109) | <u>50</u> |
| Compressive Strength, Test Cubes (ASTM C109) | <u>50</u> |
| Sampling and Testing Mortar, Comp. Strength (ASTM C780) | <u>20</u> |
| Sampling and Testing Grout, Comp. Strength (ASTM C1019) | <u>20</u> |
| Masonry Unit, Compressive Strength (ASTM C140) | <u>4</u> |
| Prism Tests (ASTM C1314) | <u>4</u> |
| J. Structural Steel: | |
| Ultrasonic Testing of Welds (ASTM E164) | <u>285</u> |
| Magnetic Particle Testing of Welds (ASTM E709) | <u>285</u> |
| Radiographic Testing of Welds (ASTM E94) | <u>95</u> |
| K. Sprayed-On Fireproofing: | |
| Thickness and Density Tests (ASTM E605) | <u>5</u> |

L. Technical Personnel (man-hours): 3500

This line item refers to on-site Technician(s) required for Project periods where observation, inspection, sampling, and testing, as listed above and described in parts 1 and 3 of this specification, are required. Rates shall include all costs, including but not limited to travel time to site, reports and reviews, home and field office, clerical support, office supplies, supervision, materials and equipment required to perform testing and inspections under this specification. The Laboratory utilized for all testing 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 earthwork, compaction control, concrete, reinforcement, and structural steel testing required. Laboratory shall be located within 50 miles of the construction site. The time required on site will be as requested by the VA Resident Engineer and will vary during the performance period from 0 hours on any given day to a maximum of 40 hours (except as noted below) in any weekly period. Technician(s) shall be on site within 24 hours of any request by the VA Resident Engineer. Services shall be provided during periods of construction contracts and will require a minimum of 300 days on site.

| | |
|---|----------|
| <u>Half-day Rate</u> (between 1 and 3 hours on site) | \$ _____ |
| <u>Daily rate</u> (between 4 and 8 hours on site). | \$ _____ |
| <u>Weekly Rate</u> (more than 36 hours on site in a given weekly period). Hours over 40 will be paid at 1.5 times the hourly rate (calculated by dividing the daily rate by 8). | \$ _____ |

M. Special Inspection: (Man-hours) 270

This item refers to on-site Registered Professional Geotechnical Engineer services required for project construction periods where observation and inspection as listed above and described in parts 1 and 3 of this specification are required. Rates shall include all costs, including but not limited to travel time to site, reports and reviews, home and field office, clerical support, office supplies and supervision required to perform special onsite geotechnical analysis. The time required on site will be as requested by the VA Resident Engineer. Between 25 and 35 days of service are anticipated during performance of the construction contracts. Services of the Registered Professional Engineer (registered in the state of Arkansas) shall include geotechnical analysis and recommendations conducted in general accordance with current standards of care exercised by geotechnical

Testing Services for
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consultants performing similar tasks in the project area. Engineer shall be on site within 24 hours of any request by the VA Resident Engineer.

Registered Professional Engineer (Work-days), Daily rate
(between 4 and 8 hours on site) \$ _____

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