

## SECTION 01450

### TESTING AND PROCESS CONTROL

#### PART 1 GENERAL

##### 1.01 SECTION INCLUDES

- A. This section defines the responsibility of the Developer or Contractor to adequately test native materials and construction materials, and to furnish the City with manufacturer's certifications of material quality.

##### 1.02 QUALITY ASSURANCE

- A. The developer or Contractor shall be responsible for all sampling, delivery of samples to a qualified testing agency, testing, and delivery of test results or materials certifications to City at no charge to the City. Testing and certifications reports shall be approved by the City as to conformance to City construction specifications prior to final inspection and/or acceptance by the City of any materials or workmanship.

##### 1.03 SUBMITTALS

- A. Field Test Report: When possible submit original reports immediately to Engineer or inspector, but in no case later than end of following day.
- B. Laboratory Test Report: Submit original report to Engineer within 48 hours after test results are determined.

#### PART 2 EXECUTION

##### 2.01 SAMPLING

- A. Sampling of materials shall be as specified in each test.
- B. The City Engineer or City Inspector may require that sampling be performed in their presence, in which case the Developer or Contractor shall be notified of this requirement in writing at the time the building permit is issued, or at the preconstruction meeting, or when construction drawings are released by the City for construction, as applicable.
- C. The presence of a City Inspector shall not relieve the Developer/Contractor of any requirement in this Section.
- D. Each sample or test shall be accompanied by the following written data, which shall be reported to the City with test results:
  - 1. Name of Project.
  - 2. Name of Developer/Contractor.
  - 3. Project Street Address.
  - 4. Appropriate Test Name.

5. Date of Sampling.
6. Sample Number (if more than one sample per day).
7. Name of technician who performed the testing.
8. Location of sample.

#### 2.02 TESTING AGENCY

- A. All materials testing, whether in a laboratory or in the field, shall be conducted by a testing agency approved by the City.

#### 2.03 SOIL CLASSIFICATION TEST

- A. The soil classification test shall be conducted to determine the suitability of native soils for road subbase and building foundations.
- B. The soil classification test shall conform to AASHTO M-146 of latest revision.
- C. The soil shall be classified according to AASHTO soil classifications.
- D. One soil classification test shall be required for each test area. A test area shall be limited to one parcel of one soil type, a maximum 1,000 feet long and maximum 5 acres.
- E. In test areas of less than 2 acres, the City Engineer may waive this requirement.
- F. The soil sample shall be taken from a test area at a minimum depth of 24 inches below the future design grades, of native soil, and shall be free from foreign material, asphalt, concrete, ice or manmade materials.
- G. Where deep footings or pile foundations are proposed, soil classification tests at several depths may be required in each test area.
- H. The results of all determinations shall be reported in writing to City Engineer.

#### 2.04 COMPACTION TEST OF SOIL AND UNTREATED BASE COURSE

- A. Laboratory tests to establish maximum laboratory density shall be determined in accordance with AASHTO T-180, Method D for A-1 classification soils and AASHTO T-99, Method D for all other soils.
- B. Samples to determine laboratory density shall be taken from the stockpiled backfill or from the uncompacted base course in place.
- C. The acceptance of soil and base course with respect to compaction shall be based upon the average density of all density tests made in a lot.

#### ROADS

1. Field density tests shall be as specified by AASHTO T-191 or by use of a portable nuclear density testing device. Field density tests shall be taken at a depth equal to  $\frac{1}{2}$  the maximum depth of the lift tested.

2. A lot shall equal the amount of soil or untreated base course compacted in each production day.
3. A test lot shall be divided into sublots and one density test shall be taken within each subplot.
4. The location of sampling sites within the subplot shall be chosen on a random basis by use of a suitable random number table.
5. Each test lot shall have a minimum of two (2) sublots. A subplot shall be no larger than 1,000 cubic yards for embankment, no larger than 200 cubic yards for backfill over pipe or against structures and no larger 1,000 tons for untreated road base.

#### UTILITY PIPE

1. Compaction test results shall be provided every 100 LF of sidewalk length, with a minimum of one test within length of 100 LF. If two sequential tests fail, the frequency of the tests may be increased at the City Engineer's discretion.
- D. The test results of all samples tested shall be reported to the City Engineer. A test lot shall be accepted when the average of the density determinations is not less than the density required for that improvement in these specifications and when no one density determination is less than 95% of the density required by these specifications.
- E. Compaction tests not conforming to required specifications may be rejected and recompaction or related construction efforts to obtain compaction shall be at the Developer's expense.

#### 2.05 TEST ROLL OF ROADWAY SUBGRADE

- A. Roll Test shall be performed when required by City Engineer to determine the structural integrity of the subgrade and street section.
- B. The Roll Test shall be performed as follows:
1. The contractor shall provide a loaded 10 wheel dump truck or water truck to drive over the subgrade material within the roadway.
  2. The loaded truck shall be driven slowly over the subgrade to locate soft spots in the subgrade surface.
  3. Soft spots in the subgrade shall be identified and marked by the City Engineer.
  4. It shall be the developer's responsibility to remove the rejected subgrade material to depth determined by City Engineer. The rejected material shall be replaced with A-1 granular backfill approved by City Engineer.

#### 2.06 GRADATION TEST OF UNTREATED BASE COURSE

- A. The gradation of untreated base course shall be determined in accordance with AASHTO T-27.
- B. The total amount of material passing the No. 200 sieve shall be determined by washing in water in accordance with AASHTO T-11.
- C. The acceptance of road base with respect to gradation shall be based upon the average of all determinations in a lot. A lot shall be limited to one source of borrow and limited to one subdivision

plat or one development. One sample shall be required for each 1,000 tons of untreated base course in a test lot. When the test lot is less than 100 tons, the requirement for the gradation test may be waived by the City Engineer.

- D. The location of sampling sites within a test lot shall be chosen on a random basis by a suitable random number table.
- E. All material not conforming to the specified gradations may be rejected at the Developer's expense.

#### 2.07 EXTRACTION - GRADATION TESTING OF BITUMINOUS SURFACE COURSE

- A. Samples of the bituminous surface course or asphalt concrete shall be tested with respect to gradation and bitumen content in accordance with Utah Department of Highways Test Procedure 8-946 and 8-947 if required by the City Engineer.
- B. Mix design shall be submitted to the City Engineer for approval 5 working days before work is to begin.
- C. Acceptance of bituminous surface course with respect to gradation and bitumen content shall be based upon the average of the determinations made in a lot.
  - 1. A lot shall equal the amount of bituminous surface course placed in each production day.
  - 2. When a lot exceeds 1,000 tons, a minimum of three (3) samples shall be taken in each lot.
  - 3. When a lot is 1,000 tons or less, a minimum of two (2) samples shall be taken.
  - 4. Samples shall be taken at the time of lay-down of bituminous surface course and before compaction. Samples shall be taken from the mat behind the lay-down machine.
  - 5. Sampling shall be timed to represent the entire production day. The time of day, date of sample, station and offset location shall be clearly marked with the sample.
  - 6. If the average asphalt is less than 2.5% of optimal content, the Contractor may be required to lay an additional lift or slurry seal, based on the City Engineer's recommendation.

#### 2.08 COMPACTION TESTING OF BITUMINOUS SURFACE COURSE

- A. Laboratory tests to establish the maximum laboratory density of bituminous surface course shall be determined by the "Marshall Test" in accordance to ASTM D-1559.
- B. Samples to determine maximum laboratory density shall be taken at the time of lay-down of bituminous surface course and before compaction.
- C. Acceptance of bituminous surface course with respect to compaction shall be based upon the average determination of field density tests made in a lot.
  - 1. Field density tests shall be by a portable nuclear density testing device or by laboratory density analysis of core samples.
  - 2. A test lot shall be the quantity of surface course placed and compacted in each construction day.
  - 3. The test lot shall be subdivided into subplot(s) of approximately equal size and no larger than 1,600 square yards in area.

4. One field density test shall be taken in each subplot, randomly located in the test lot by use of a suitable random number table.
- D. The test lot shall be accepted with respect to density when the average of all density determinations is not less than the density required by Section 02504.
- E. Core Tests
1. Acceptance of the completed bituminous surface course with respect to thickness shall be based on the average thickness of a test lot.
    - a. A test lot shall equal approximately 4,000 square yards of completed roadway.
    - b. A lot shall be divided into sublots of approximately 2,000 square yards.
  2. One thickness test, randomly selected by use of a random number table, shall be taken within each subplot. A minimum of three core tests will be taken.
  3. A lot shall be accepted when the average thickness of all sublots is not less than 3/8 inch the total designated bituminous surface course thickness and when no individual subplot shows a deficient thickness of more than 1/2 inch.
  4. Lots or sublots that are not acceptable because of deficient thickness shall be brought into compliance by placing additional surface course as directed by the Engineer.
  5. The removed core will be replaced with low strength concrete.

#### 2.09 COMPRESSIVE STRENGTH TESTING OF CONCRETE CYLINDERS

- A. Samples of concrete shall be taken at the construction site, molded in standard cylinder shapes, allowed to cure, and tested with respect to comprehensive strength when required by the City Engineer.
- B. All samples of concrete shall be taken in conformance to AASHTO T-141 of the latest revision.
- C. Acceptance of concrete with respect to compressive strength shall be based upon the average determination of all "strength tests" made in a lot.
  1. A test lot shall be the quantity of concrete placed at one job in a construction day.
  2. For each 50 cubic yards of concrete in a test lot, three (3) compressive "strength tests" shall be run, except that for lots of less than 5 cubic yards, the number of "strength tests" per lot shall be the average strength of three standard cylinders.
  3. The making, curing and compressive strength testing of concrete cylinders shall conform to AASHTO T-22 and AASHTO T-23.
- D. Concrete may be rejected if desired strengths are not obtained at the Developer's expense.

#### 2.10 ADDITIONAL CONCRETE TESTING

- A. Slump Test: Determine slump in accordance with AASHTO T-152. One slump test is required for every 50 yards with a minimum of one test per day.
- B. Air Test: Determine normal weight concrete air content; AASHTO T-152 and light weight concrete air content; AASHTO T-196.

- C. When requested by Engineer, test concrete in place by impact hammer, sonoscope, or other nondestructive 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.

2.11 CERTIFICATIONS FOR WATER SYSTEM VALVES

- A. In certain water system equipment, steel items and pipe listed below, a manufacturer's certificate shall be furnished with each unit of equipment, certifying conformance to the applicable requirements of City Standard Specifications:
1. Gate Valves.
  2. Butterfly Valves.
  3. Steel Reinforcing Bars.
  4. Structural Steel.
  5. Corrugated Metal Pipe.
  6. Polyvinyl Chloride Pipe.
  7. ABS Composite (Truss) and Solid Wall Pipe.

2.12 SUMMARY TABLE OF TESTS AND CERTIFICATIONS

- A. The following is a summary of the tests, number of samples per test and certificates that are required for construction work and developments in City. This summary is provided as a reference guide. For details governing each item, refer to the appropriate test specification herein.

TEST SUBJECT	SPECIFIC TEST	NUMBER OF TESTS
Soil Classification	AASHTO M-145	1 test per test area of uniform soil type and 5 acres maximum.
Compaction of Soil & Base Course	Lab Density- AASHTO T-99 Method D or AASHTO T-180 Method D Embankment & Base Course Field Density- Portable Nuclear Equipment or AASHTO T-191 Backfill Field Density- Portable Nuclear Equipment or AASHTO T-191	As needed to establish laboratory density  1 test plus minimum one test per 1,000 cu.yds.  1 test plus minimum one test per 200 cu.yds.
Base Course Gradation	Sieve Analysis- AASHTO T-27 Passing No. 200 Sieve- AASHTO T-11 Utility Pipe	1 test per 1,000 tons  Every 200 linear feet of trench at each lift.
Extraction-Gradation Test of Bituminous Surface Course	UDOT Test Procedure 8-946 & 8-947	3 tests per pavement construction day
Compaction of Bituminous	Lab Density- Marshall Test, ASTM	1 test per pavement construction

TEST SUBJECT	SPECIFIC TEST	NUMBER OF TESTS
Surface Course	D-1559 Field Density- Portable Nuclear Equipment	day 1 test per 1600 square yards subplot
Core Tests	4" Core Sample	1 thickness test per 2,000 square yards or 3 test minimum
Concrete Test Cylinders Air & Slump Test	AASHTO T-23	3 cylinders per 50 cubic yards or minimum of 3 cylinders on placements less than 50 cubic yards
Pressure Reducing & Regulating Valves	Manufacturer's Certificate	1 for each valve
Gate Valves	Manufacturer's Certificate	1 for each valve over 12" diameter
Back Flow Reduced Pressure Valves (RP)	Field Test Certificate by licensed technician	
Butterfly Valves	Manufacturer's Certificate	1 for each valve
Steel Re-Bar	Manufacturer's Certificate	1 for each 1,000 pounds of one grade
Structural Steel	Manufacturer's Certificate	1 for each lot of one shape, one grade
Corrugated Metal Pipe	Manufacturer's Certificate	1 for each 500 lineal feet of one size, one class
Polyvinyl Chloride Pipe	Manufacturer's Certificate	1 for each 500 lineal feet of one size, one class
A.B.S. Pipe	Manufacturer's Certificate	1 for each 500 lineal feet of one size, one class

END OF SECTION