
Test Procedure for**CEMENT TREATED MATERIALS**TxDOT Designation: **Tex-120-E****Effective Date: April 2022**

1. SCOPE

- 1.1 This test method consists of two parts for the laboratory compaction of cement treated materials. Cement treated materials may include subgrade (soils), reclaimed roadway (existing materials), existing materials blended with flexible base, or flexible base only.
- 1.2 Part I is used to determine the optimum moisture content and maximum dry density (M-D) curve in accordance with [Tex-113-E](#) for cement treated materials prepared in the laboratory or sampled from the roadway after mixing. This part may also be used to verify a M-D curve with material sampled from the roadway after mixing.
- 1.2.1 Specimens are compacted using an automatic tamper (compaction) device equipped with a Soil Compactor Analyzer (SCA). All specimens are 6 in. in diameter and 8 ± 0.250 in. in height.
- 1.3 Part II is a mixture design procedure used to determine a target cement content from materials prepared in the laboratory based on the unconfined compressive strength (UCS). This part may also be used to verify the UCS of material sampled from the roadway after mixing.
- 1.3.1 The target cement content is determined from the UCS of compacted specimens after seven days of curing in an environment with a minimum humidity of 95%. The humidity may be measured using a handheld hygrometer.
- 1.3.2 Part II includes an optional moisture conditioning procedure that includes submerging compacted specimens completely in water for 24 hr. after seven days of curing.
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2. APPARATUS

- 2.1 As outlined in test methods:
- [Tex-100-E](#);
 - [Tex-101-E](#);
 - [Tex-113-E](#);
 - [Tex-117-E](#); and
 - [Tex-400-A](#).
- 2.2 *Container*, adequate height and volume to completely submerge compacted specimens.
- 2.3 *Handheld hygrometer*.

2.4 Load cell, minimum 10K (for use with automated load frame).

3. REPORTING

3.1 Report all data and pertinent information pertinent using SiteManager form '[Tx120-21.xlsm](#)'.

3.2 This form is available from the Materials & Tests Division/Soils & Aggregates Section and online at the following link <https://www.txdot.gov/inside-txdot/forms-publications/consultants-contractors/forms/site-manager.html>.

4. MATERIAL SAMPLING AND PREPARATION

4.1 *This test procedure does not claim to address the safety concerns associated with its use. It is the responsibility of the user of this test procedure to establish the appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations before use.*

4.2 Obtain a minimum of 1 gal. of cement in a sealed container from a fresh supply of an approved source from the Department's Material Producer List unless otherwise directed.

4.3 When testing materials for Part I, sample a minimum of 100 lb. in accordance with [Tex-100-E](#) for soils or [Tex-400-A](#) for flexible base and prepare in accordance with [Tex-101-E](#), Part II.

4.4 When testing materials for Part II, sample a minimum of 300 lb. in accordance with [Tex-100-E](#) for soils or [Tex-400-A](#) for flexible base and prepare in accordance with [Tex-101-E](#), Part II.

4.5 When reclaimed asphalt pavement (RAP) is included and greater than 1-3/4 in., resize the RAP to pass the 1-3/4 in. sieve.

Note 1 Heating the RAP to a maximum temperature of 140°F can assist in resizing the RAP.

4.6 When testing material from the roadway after reclamation and mixing, sample the treated material before the start of compaction.

4.6.1 Screen the cement treated material using a 7/8 in. sieve and a 1/4 in. sieve at the field moisture content, without drying.

4.6.2 Separate the material retained on the sieve from the material passing the sieve.

4.6.3 Cover the materials to retain field moisture.

PART I—MOISTURE-DENSITY CURVE

5. PROCEDURE

5.1 *This test procedure does not claim to address the safety concerns associated with its use. It is the responsibility of the user of this test procedure to establish the appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations before use.*

5.2 Select a percentage of cement.

- 5.3 Determine the optimum moisture content and maximum dry density (M-D) curve for the material prepared from Article 4., "Material Sampling and Preparation," in accordance with the applicable Sections of [Tex-113-E](#).
- 5.3.1 Prior to compaction of [Tex-113-E](#), add the cement uniformly to ensure even distribution of the cement throughout the sample. The amount of cement added is a percentage based on the dry mass of the material to be treated.
- 5.4 *Using Roadway Mixed and Treated Material.*
- 5.4.1 Recombine the material from Article 4., "Material Sampling and Preparation," to produce samples for laboratory compaction.
- 5.4.2 Determine the M-D curve for this material in accordance with the applicable Sections of [Tex-113-E](#). Alternatively, compact samples to only verify a M-D curve that was produced from laboratory prepared materials in Section 5.3.
- 5.4.2.1 Estimate the field moisture content. Place material in a pan and weigh to the nearest 0.001 lb.
- 5.4.2.2 Adjust the moisture content of material by adding or removing moisture as needed. When removing moisture, do not oven dry the material. Stir frequently and as needed to achieve the necessary mass of material.
- 5.4.2.3 Determine the mass of material needed to achieve the desired moisture content.
- 5.4.2.4 Weigh material to the nearest 0.001 lb.

6. TEST REPORT

- 6.1 Cement Content, 0.1%;
- 6.2 Optimum Moisture Content, 0.1%; and
- 6.3 Maximum Dry Density, 0.1 pcf.

PART II—MIXTURE DESIGN TO DETERMINE THE TARGET CEMENT CONENT

7. PROCEDURE

- 7.1 *This test procedure does not claim to address the safety concerns associated with its use. It is the responsibility of the user of this test procedure to establish the appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations before use.*
- 7.2 Determine the optimum moisture content and maximum dry density (M-D) curve using 5% cement for the material prepared from Article 4., "Material Sampling and Preparation," in accordance with the applicable Sections of [Tex-113-E](#).
- 7.2.1 Before compaction of [Tex-113-E](#), add the cement uniformly to ensure even distribution of the cement throughout the sample. The amount of cement added is a percentage based on the dry mass of the material to be treated.

- 7.3 Recombine the material prepared from Article 4., "Material Sampling and Preparation," and mold three samples at 3, 5, and 7% cement in accordance with the applicable Sections of [Tex-113-E](#) to determine the unconfined compressive strength (UCS) at each percentage. Samples may be molded at fewer, more, or different percentages of cement as deemed necessary.
- 7.3.1 Calculate the moisture content for each cement content using equation from Section 8.1 of this test procedure.
- 7.3.2 Before compaction of [Tex-113-E](#), add the cement uniformly to ensure even distribution of the cement throughout the sample. The amount of cement added is a percentage based on the dry mass of the material to be treated.
- 7.3.3 Place a card on each specimen labeling the laboratory identification number and the percent of cement.
- 7.3.4 Proceed to Section 7.5 for curing the specimens.
- 7.4 *Using Roadway Mixed and Treated Material to Verify UCS.*
- 7.4.1 Recombine the material from Article 4., "Material Sampling and Preparation," and mold three samples in accordance with the applicable Sections of [Tex-113-E](#).
- 7.4.1.1 Estimate the field moisture content. Place material in a pan and weigh to the nearest 0.001 lb.
- 7.4.1.2 Adjust the moisture content of material by adding or removing moisture as needed. When removing moisture, do not oven dry the material. Stir frequently and as needed to achieve the necessary mass of material.
- 7.4.1.3 Determine the mass of material needed to achieve the desired moisture content.
- 7.4.1.4 Weigh material to the nearest 0.001 lb.
- 7.5 *Curing.*
- 7.5.1 Store the compacted specimens the same day as molded with the top and bottom porous stones in an environment with a minimum humidity of 95% for seven days. Do not use a triaxial cell.
- 7.5.2 When the humidity is unknown, use a handheld hygrometer to measure the humidity to ensure it is a minimum of 95%.
- 7.5.3 When necessary, place a pan on top of the top porous stone to protect the specimen from any dripping water.
- 7.6 After seven days of curing, remove the test specimens from the environmental room and use a cloth to remove any free water on the surface of the specimens.
- 7.7 Weigh the specimens to the nearest 0.001 lb. and measure the sample height with the micrometer dial assembly to the nearest 0.001 in.
- 7.8 Measure the UCS in accordance with the applicable Sections of [Tex-117-E](#), Part II.
- 7.9 Determine the target cement content using the template from Article 3., "Reporting," with the UCS test results from Section 7.8.
- 7.10 *Optional Moisture Conditioning by 24-hr. Water Submersion.*

- 7.10.1 Use the M-D curve with the calculated moisture content from Sections 7.2, 7.3, or 7.4 from this procedure.
- 7.10.2 Recombine the material prepared from Article 4., "Material Sampling and Preparation," and mold three samples in accordance with the applicable Sections of Tex-113-E.
- 7.10.2.1 Prior to compaction of [Tex-113-E](#), add the cement uniformly to ensure even distribution of the cement throughout the sample. The amount of cement added is a percentage based on the dry mass of the material to be treated.
- 7.10.3 Cure the compacted specimens in accordance with Section 7.5.
- 7.10.4 Place the specimens with the bottom porous stone only, into the container identified in Section 2.2.
- 7.10.5 Fill the container to approximately 1/2 to 1 in. above the top of the specimens with tap water in a manner that does not disturb and contact the specimens.
- 7.10.6 Soak each specimen in the container for 24 hr. ± 1 hr.
- 7.10.7 Remove each specimen from the container and use an absorptive cloth or paper towel to remove free water on the surface of the specimen.
- 7.10.8 Measure the UCS in accordance with the applicable Sections of [Tex-117-E](#), Part II.

8. CALCULATIONS

- 8.1 Use the following equation to determine the percent moisture content at different cement percentages.

$$\% \text{ Moisture Content} = \% \text{ Optimum Moisture} + (0.25 \times \% \text{ Cement Difference})$$

Where:

$\% \text{ Moisture Content}$ = Moisture content of samples prepared for laboratory compaction;

$\% \text{ Optimum Moisture}$ = Optimum moisture content from the Moisture-Density curve; and

$\% \text{ Cement Difference}$ = Difference in cement content between the cement content used for the Moisture-Density curve and the chosen molding cement content.

9. TEST REPORT

- 9.1 Target Cement Content, 0.1%;
- 9.2 Optimum Moisture Content, 0.1%;
- 9.3 Maximum Dry Density, 0.1 pcf; and
- 9.4 Unconfined Compressive Strength, nearest whole psi.