FLORIDA DEPARTMENT OF TRANSPORTATION
State Materials Office
5007 NE 39th Avenue
Gainesville, Florida 32609
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Florida Method Of Test
For
Laboratory Design Of Soil-Cement Mixtures

Designation FM 5 - 520

1. PURPOSE

1.1 The purpose of this procedure is to establish the laboratory guidelines for design of soil-cement mixtures. It is intended that this procedure will be updated as more knowledge is gained in the field of soil-cement.

2. SCOPE

2.1 This design procedure is prescribed for establishing the minimum quantity of portland cement to be incorporated with any given soil to obtain an acceptable soil-cement mixture for use in subbase or base courses. Minimum design strength requirements for hardened soil-cement (unconfined compressive strength) specimens is 2068 kPa (300 pounds per square inch).

2.2 A 0.000943 ± 0.000008 m^3; (1/30 cu.ft.) 101.6 mm (4 inch diameter) mold and a 2.495 kg (5.5 lb.) rammer dropped from a height of 304.8 mm (12 inches) are used and two methods, depending on soil gradation are covered as follows:

2.2.1 Method A - Using soil material passing the 4.75 mm (No. 4) sieve. This method shall be used when 100 percent of the soil sample passes the 4.75 mm sieve. (Section 4)

2.2.2 Method B - Using soil sample passing the 19.0 mm (3/4 in.) sieve. This method shall be used when part of the soil sample is retained on the 4.75 mm sieve. (Section 6)

3. APPARATUS

3.1 The apparatus for preparing and testing molded specimens shall consist of items described in Section 3.1.1 through 3.1.11 along with dimensional tolerances for each item.

3.1.1 Compaction Mold - The metal mold shall have a diameter of 101.6 ±0.41 mm (4.00 ± 0.016 inches and a height of 116.43 ± 0.13 mm

(4.584 ± 0.005 inches) giving a nominal volume of 0.000943m; (1/30 cu.ft.), to permit molding of compacted specimens of soil-cement mixtures of this size. The mold shall be provided with a detachable collar assembly approximately 60.3 mm (2 3/8 inches) in height. Molds may be of the "split" type, consisting of two half round sections, (a section of pipe split along one element), which can be securely locked in place to form a cylinder, or a cylindrical section of pipe. The mold and collar assembly shall be so constructed that it can be fastened firmly to a detachable base plate.

3.1.2 Rammer

3.1.2.1 Manually Operated - Metal rammer having a flat circular face of 50.8 ± 0.013 mm (2.000 ± 0.005 inch) diameter and weighing 2.495 ± 0.009 kg (5.50 ± 0.02 lbs). The rammer shall be equipped with a suitable guide sleeve to control the height of drop to a free fall of 304.8 " 1.6 mm (12.00 ± 0.06 (or 1/16) inches) above the elevation of the soil-cement. The guide sleeve shall have at least 4 vent holes, no smaller than 9.53 mm (3/8 inch) diameter, spaced approximately 90 degrees apart and approximately 19 mm (3/4 inch) from the end; and shall provide sufficient clearance so the free fall of the rammer shaft and head is unrestricted.

Note 1: The mechanical rammer shall be periodically calibrated using the manually operated rammer as a standard. A variation in maximum density not in excess of ± 2 percent shall be considered satisfactory agreement between the two methods.

3.1.2.2 Mechanically Operated - A metal rammer which is equipped with a device to control the height of drop to a free fall of 304.8 ± 1.6 mm (12.00 ± 0.06 (or 1/16) inches) above the elevation of the soil-cement, and uniformly distributes such drops to the soil-cement surface. The rammer shall have a flat circular face 50.8 ± 0.13 mm (2.000 ± 0.005 inches) in diameter and shall weigh 2.495 ± 0.009 kg (5.50 ± 0.02 lbs). (See Note 1)

3.1.2.3 Rammer Faces - A flat sector face may be substituted with mechanical rammers. The sector face shall be a sector of a 101.6 ± 0.41 mm (4.000 ± 0.016 inch) diameter circle, and have a contact area equal to that of the circular rammer face.

3.1.3 Sample Extruder - A jack, lever frame, or other suitable device adapted for the purpose of extruding compacted specimens (intact) from the mold. The extruder is not required when a split type mold is used.

3.1.4 Balances and Scales - A balance or scale of at least 11.3 kg (25 lb.) capacity sensitive to 5g (0.01 lb.); and a balance of at least 1000 g capacity sensitive to 0.1 g.

3.1.5 Drying Oven - A thermostatically controlled drying oven capable of maintaining a temperature of 110 ± 5°C (230 ± 9°F) for drying moisture samples.

3.1.6 Straightedge - A hardened steel straightedge at least 254 mm (10 inches) in length. It shall have one beveled edge and at least one longitudinal surface (used for final trimming) shall be plane with 0.01 inches per 10 inches of length within the portion used for trimming the soil-cement. (See Note 2)

3.1.7 Sieves - Sieves shall be 75 mm (3 in.), 19.0 mm (3/4 in.) and 4.75 mm (No. 4) mm sieves conforming to the requirements of AASHTO M92 Specifications for Sieves for Testing Purposes.

3.1.8 Mixing Tools - Miscellaneous tools such as mixing pan, spoon, trowel and spatula, or a suitable mechanical device for thoroughly mixing the sample of soil with cement and with increments of water.

3.1.9 Containers - a round or rectangular flat pan suitable for moisture absorption by soil-cement mixtures, about 51 mm (2 inches) deep.

3.1.10 Moisture Cans - Containers for moisture content samples, made of metal and suitable for containing moisture samples.

Note 2: The beveled edge may be used for final trimming if the edge is true within a tolerance of 0.01 in. per 10 in. of length; however, with continued use the cutting edge may become excessively worn and not suitable for trimming the soil-cement to the level of the mold. The straightedge should not be so flexible that trimming the soil-cement surface with the cutting edge will cause a concave or convex soil-cement surface.

3.1.11 Butcher Knife (Optional) - A butcher knife approximately 254 mm (10 inches) long for trimming the top of the specimens.

4. METHOD A. USING SOIL MATERIAL PASSING A 4.75 mm (No. 4) SIEVE

4.1 Sample

4.1.1 Prepare the sample by breaking up the soil aggregations to pass the 4.75 mm (No. 4) sieve in such a manner as to avoid reducing the natural size of the individual particles. When necessary, first dry the sample until it is friable under a trowel. Drying may be accomplished by air drying or by use of a drying apparatus such that the temperature of the sample does not exceed 60°C (140°F).

4.1.2 Select a representative sample weighing approximately 13.6 kg (30 lb.) or more of the soil prepared as described in Section 4.1.1.

4.1.3 Select three or more cement contents to mix the soil such that the seven day unconfined compressive strengths of the different mixtures will bracket the minimum requirement of 2068 kPa (300 psi) after the strength correction specified in Section 9.2.4. At least one of the mixtures shall have a seven day maximum unconfined compressive strength less than 2068 kPa (300 psi) and at least one of the mixtures shall have a seven day maximum unconfined compressive strength greater than 2068 kPa (300 psi).

5. ALTERNATIVE METHODS

5.1 Procedure

5.1.1 Add to the soil the required amount of cement for any one cement content selected above. For proper proportioning use a 11.3 kg (25 lb.) (dry weight) sample of soil and the required amount of cement to achieve the cement content desired. All cement contents are to be calculated on the basis of the dry weight of the soil. Mix the cement and soil thoroughly to a uniform color. When the soil and cement have been intimately blended, separate the soil-cement material into five approximately equal portions about 2.3 kg (5 lbs.) each. Each of the samples shall be representative of the total mixture. Each of the separate portions shall be thoroughly mixed with amounts of water sufficient to cause each of the moisture contents of the samples to vary by one or two percentage points with the lowest moisture content being approximately four percentage points below the optimum moisture content. The moisture contents selected shall bracket the optimum moisture content, thus providing samples which, when compacted, will increase in weight to the maximum density and then decrease in weight. The samples of soil-cement and water shall be compacted within 60 minutes after it is mixed.

5.1.2 As an alternate to Section 5.1.1 above, individual 2.3 kg (5 lb.) samples of soil (dry weight) may be selected from the material prepared as described in Section 4.1.2 and the required amount of cement added to each of the individual samples. As each sample is mixed with cement, the desired moisture content may be obtained by adding water sufficient to cause each of the moisture contents of the samples to vary by one or two percentage points with the lowest moisture content being approximately four percentage points below the optimum moisture content. The moisture contents selected shall bracket the optimum moisture content, thus providing samples which, when compacted, will increase in weight to the maximum density and then decrease in weight. The samples of soil-cement and water shall be compacted within 60 minutes of the time it is mixed. This alternate method offers the advantage of having only one sample at a time mixed and requiring immediate attention.

5.2 Immediately prior to compacting the material (prepared as described above), it shall be remixed and a representative sample shall be taken for moisture content determination. The sample shall be weighed immediately and then dried in an oven at 110° ± 5°C (230° ± 9°F) for at least 12 hours, or to constant weight to determine the moisture content. The moisture content sample shall weigh not less than 300 g.

5.3 Form a specimen by compacting the prepared soil-cement mixture in the mold, with the collar attached, in three equal layers so as to give a total compacted depth of about 127 mm (5 in.) Compact each layer by 25 blows from the rammer dropping free from a height of 304.8 mm (12 in.) above the elevation of each finally compacted layer when a stationary-mounted type rammer is used. The blows shall be uniformly distributed over the surface of the layer being compacted. During compaction, the mold shall rest on a uniform, rigid foundation. Following compaction, remove the extension collar, carefully trim the compacted mixture even with the top of the mold by means of the knife or straightedge, and weigh to the nearest 5 g (0.01 lb.) Multiply the weight of compacted specimen and mold, minus the weight of the mold by 1059.43 (30); record the result as the wet weight per cubic meter (per cubic foot), W_1, of the compacted soil-cement mixture.

6. METHOD B. USING MATERIAL PASSING A 19.0 mm (3/4 in.) mm SIEVE

6.1 Sample

6.1.1 When necessary, first dry the sample until it is friable under a trowel.

Drying may be accomplished by air drying or by the use of drying apparatus such that the temperature of the sample does not exceed 60°C (140°F). Prepare the soil for test by separating on the 75 mm (3 in.), 19 mm (3/4 in.) and 4.75 mm (No. 4) sieves. Break up any soil aggregation in such a manner as to avoid reducing the natural size of individual particles. The soil passing the 4.75 mm (No. 4) sieve shall be well mixed and stored in a covered container for the duration of the test.

6.1.2 Discard the material retained on the 75 mm sieve. Determine the percentage of material, by oven-dry weight, retained on the 19.0 mm (3/4 in.) and 4.75 mm (No. 4) sieves. Saturate the aggregate passing the 19.0 mm (3/4 in.) sieve and retained on the 4.75 mm (No. 4) sieve by soaking in potable water; surface dry the material as required for later testing.

6.1.3 Select a representative sample of the material passing the 4.75 mm (No. 4) sieve as described in Section 6.1.1 weighing approximately 11.3 kg (25 lbs.) To this sample add the aggregate separated out in Section 6.1.2 (which passed the 19.0 mm (3/4 in.) sieve and was retained on the 4.75 mm (No. 4) sieve in sufficient quantity to assure that the percentage of aggregate larger than the 4.75 mm (No. 4) sieve openings and smaller than the 19.0 mm (3/4 in.) sieve openings shall be the same as the percentage passing the 75 mm (3 in.) sieve and retained on the 4.75 mm (No. 4) sieve in the original sample.

6.1.4 Select three or more cement contents to mix with the soil such that the seven day unconfined compressive strengths of the different mixtures will bracket the minimum requirement of 2068 kPa (300 psi) after the strength correction specified in 10.31.9.2.4. At least one of the mixtures shall have a seven day maximum unconfined compressive strength less than 2068 kPa (300 psi) and at least one of the mixtures shall have a seven day maximum unconfined compressive strength greater than 2068 kPa (300 psi).

6.2 Procedure

6.2.1 Alternative Methods

6.2.1.1 Add to the soil the required amount of cement for any one cement content selected in Section 6.1.4 above. For proper proportioning use a 13.6 kg (30 lb.) (dry weight) sample of soil and the required amount of cement to achieve the cement content desired. All cement contents are to be calculated on the basis of the dry weight of the soil. Mix the cement and soil thoroughly to a uniform color. When the soil and cement have been intimately blended, separate the soil-cement material into five approximately equal portions, each at least 6 lbs. Each of the samples shall be representative of the total mixture.

Each of the separate portions shall be thoroughly mixed with amounts of water sufficient to cause the moisture contents of the individual samples to vary by one or two percentage points with the lowest moisture content being approximately four percentage points below the optimum moisture content. The moisture contents selected shall bracket the optimum moisture content, thus providing samples which, when compacted, will increase in weight to the maximum density and then decrease in weight. The samples of soil-cement and water shall be compacted within 60 minutes of the time it is mixed.

6.2.1.2 As an alternate to Section 6.2.1.1 above, individual samples of soil (at least 2.7 kg (6 lb.) by dry weight) may be selected from the material prepared as described in Section 6.1.3 above, and the required amount of cement added to each of the individual samples. As each sample is mixed with the cement, the desired moisture content may be obtained by adding water in sufficient quantity. Each of the samples so prepared shall be mixed with amounts of water sufficient to cause each of the moisture contents of the samples to vary by one or two percentage points with the lowest moisture content being approximately four percentage points below the optimum moisture content. The moisture contents selected shall bracket the optimum moisture content, thus providing samples which, when compacted, will increase in weight to the maximum density and then decrease in weight. The samples of soil-cement and water shall be compacted within 60 minutes of the time it is mixed. This alternate method offers the advantage of having only one sample at a time mixed and requiring immediate attention.

6.2.2 Immediately prior to compacting the material (prepared as described in Sections 6.1 and 6.2 above) it shall be remixed and a representative sample shall be taken for moisture content determination. The sample shall be weighed immediately and then dried in an oven at 110° ± 5°C (230° ± 9°F) for at least 12 hours, or to a constant weight to determine the moisture content. The moisture content sample shall weigh not less than 300 g.

6.2.3 Form a specimen by compacting the prepared soil-cement mixture in the mold (with the collar attached) and trim and weigh the compacted specimen as described for Section 4. During the trimming operation remove all particles that extend above the top level of the mold. Correct all irregularities in the surface by hand-tamping fine material into these irregularities and leveling the specimen again with the straightedge. Multiply the weight of the compacted specimen and mold, minus the weight of the mold, by 1059.43 (30); record the result as the wet weight per cubic meter (per cubic foot), W_1, of the compacted soil-cement mixture.

7. CURING OF TEST SPECIMENS

7.1 Each of the specimens compacted as described in Section 5.3 or Section 6.2.3, shall be extruded intact from the mold, taking care not to damage the specimen or subject it to any severe bumps or shocks. The specimens shall be covered or wrapped with moist paper or cloth on the top and sides if it is to be moist cured in an environment where the curing water would otherwise be sprayed directly onto the specimens. In an environment using indirect moisture vapor curing, it is not necessary to wrap the specimens.

7.2 The specimens shall then be delicately placed in the moist-curing environment and permitted to cure for a period of seven days. The moist-curing environment shall be such that a relative humidity of 98% ± 2% is maintained at a temperature of 22.2° ± 1°C (72° ± 2°F).

8. UNCONFINED COMPRESSION TESTING OF SPECIMENS

8.1 After the specimens have been moist-cured for seven days they shall be removed from the curing environment and allowed to drain to a saturated, surface dry condition.

8.2 The ends of each of the specimens shall be capped to provide parallel surfaces (within three degrees), which are plane with a tolerance of 0.51 mm (0.02 in.) across any diameter. The capping material shall be at least as strong as the soil-cement and may be composed of the high strength gypsum plaster (as specified in AASHTO T 231) or a compound similar to that specified in AASHTO T221-66, Section 4.1.

8.3 When the specimen caps have hardened sufficiently, the specimen shall be placed on a metal testing platen of a suitable compression device and another testing platen placed on top of the upper specimen cap. The minimum transverse dimension of the platen shall be at least as large as the specimen diameter plus a nominal 25.4 mm (one inch).

The platens shall be generally as described in AASHTO T22-74, Section 2.3. The compression device shall have a capacity in excess of 4082.3 kg (9,000 lbs.) and shall be able to apply the compression load at a rate of travel of 1.27 mm (0.05 inches) per minute for the moving head. The upper loading block shall be equipped with a spherical ball to transmit an axial load along the long axis of the specimen.

8.4 Place the plain (lower) bearing platen with its hardened face up, on the table or platen of the testing machine directly under the spherically seated (upper) bearing block. Wipe clean the bearing faces of the upper and lower bearing blocks and of the test specimen and place the test specimen on the lower bearing platen. Carefully align the axis of the specimen with the center of thrust of the spherically seated block. As the spherically seated block is brought to bear on the specimen, rotate its movable portion gently by hand so that uniform seating is obtained.

8.5 Apply the load continuously and without shock. In testing machines of the screw type the moving head shall travel at a rate of approximately 0.05 in. (1.3 mm)/min. when the machine is running idle. In hydraulically operated machines the load shall be applied at a constant rate within the range 138 to 345 kPa/sec (20 to 50 psi/sec).

8.6 Apply the load until the specimen fails, and record the maximum load carried by the specimen during the test.

9. CALCULATIONS

9.1 Moisture-Density Calculations - Calculate the moisture content and oven dry mass of the compacted soil-cement mixture for each trial as follows:

$$w = (A - B) / (B - C) \times 100$$

$$W = W_1 / (w + 100) \times 100$$

Where: w = percentage of moisture in the specimen,

A = mass of moisture can and wet soil-cement,
B = mass of moisture can and oven dry soil-cement,
C = mass of moisture can,
W = dry density in kg per m; (pounds per cubic foot) of compacted soil-cement,

And

W_1 = wet density in kg per m; (pounds per cubic foot) of compacted soil-cement

9.2 Moisture Density Relationship

9.2.1 The calculations in Section 9.1 above shall be made to determine the moisture content and corresponding oven dry mass per cubic meter (per cubic foot) (density) for each of the compacted soil-cement samples. The oven dry masses per cubic meter (per cubic foot) (densities) of the soil-cement mixture shall be plotted as ordinates and the corresponding moisture contents as abscissas.

9.2.2 Optimum Moisture Content - When the densities and corresponding moisture contents for the soil-cement mixture have been determined and plotted as indicated in Section 9.2.1, a smooth curve is produced.

The moisture content corresponding to the peak of the curve shall be termed the "optimum moisture content" of the soil-cement mixture under the compaction prescribed in these methods. (See Figure 1.)

9.2.3 Maximum Density - The oven dry mass per cubic meter (per cubic foot) of the soil-cement mixture at "optimum moisture content" shall be termed "maximum density" under the compaction prescribed in these methods. (See Figure 1)

9.2.4 Compressive Strength Calculations - Calculate the compressive strength of the specimen by dividing the maximum load carried by the specimen during the test by the cross-sectional area of the test specimens, and express the result to the nearest kPa (psi). The compressive strength shall then be multiplied by 0.85 and this reduced value used in all subsequent calculations.

9.3 Moisture-Strength Relationship

9.3.1 The compaction moisture (already calculated in Section 9.1) and the corresponding compressive strength, as determined in Section 9.2.4, shall be obtained for each of the compacted and cured soil-cement samples. The compaction moisture contents of the specimens, for a given cement content, shall be plotted as abscissas and the corresponding compressive strengths (as adjusted in Section 9.2.4) plotted as ordinates.

9.3.2 After the compressive strengths and corresponding moistures for a particular cement content have been determined and plotted as indicated in Section 9.3.1, a smooth curve is drawn. It should be noted that the curve produced may have an irregular shape and will not always assume the same general geometric form as other moisture-strength curves. The point on the curve having the maximum stress value is the peak stress with its corresponding moisture content for the cement content plotted. (See Figure 2)

9.4 Cement Content - Compressive Stress Relationship

9.4.1 The peak stress for each cement content shall be determined as described in Section 9.3.2. The peak stress shall then be plotted as ordinates and the cement content plotted as abscissas.

9.4.2 When the peak stresses in kPa (or psi) the corresponding cement contents (in percentage) have been plotted as indicated in Section 9.4.1, a smooth curve will be produced. (See Figure 3.) Frequently, but not always, this curve will approximate a straight line with a conventional positive slope. A horizontal line is then extended from the point on the ordinate at which the stress value is 2068 kPa (300 psi) until it intersects the curve. The line is then extended vertically downward from the intersection of the curve and the 2068 (300 psi) line to the abscissa. The point at which the vertical line intercepts the abscissa is the cement content corresponding to the required 2068 kPa (300 psi) design strength. The cement content to be specified is then adjusted to the nearest quarter-percentage. On occasion, it will be prudent to specify the next quarter-percentage upward, depending upon the slope of the curve.

9.5 Confirmation Check - This step is optional but will frequently give a better insight into the behavioral characteristics of the specified soil-cement blend. The cement content determined in Section 9.4.2 shall be used as a trial content and handled as specified in Sections 4.1 through 9.4. After having obtained Maximum Density and Optimum Moisture Content as well as Peak Stress with corresponding moisture content, the two curves may be reviewed simultaneously to determine the coincidence of moisture ranges for both high density and high strength (See Figure 4). As pointed out earlier, this step is optional. Because the contractor performing the field operations on the soil-cement mixture cannot achieve the same degree of accuracy as can be obtained in the laboratory, a field moisture density curve will be conducted upon the actual mixture with which he will work. Therefore, this confirmation check will actually be duplicated by the field moisture density test.

9.6 Cement Content Calculations (SI Units)

9.6.1 The cement content selected in Section 9.4.2 is the required percentage of cement by mass. Convert the percentage to a decimal and multiply it by the maximum dry density of the parent material or soil (as determined by AASHTO T 99). This gives the mass in kilograms per cubic meter of cement required. Divide this number by 1000 to obtain the mass in kilograms per square meter for each milimeter of mixing depth. By combining the above steps, the following equation is obtained:

$$R_{si} = (C_W\, W_{ps}) / 1000$$

Where: R_{si} = required cement spread in kilograms per square meter (per milimeter of depth).

C_W = cement content determined in Section 9.4.2 expressed as a decimal.

W_{ps} = maximum dry density of parent soil in kilograms per cubic meter.

To obtain the required mass of cement to be spread, multiply Rsi by the number of milimeters to which the soil-cement is to be mixed (the mix depth). More simply.

Where: $R_{su} = D\, R_{si}$

R_{su} = required cement spread to be used in kilograms per square meter

D = intended mixing depth in millimeters

R_{si} = required cement spread in kilograms per square meter per milimeter of mix depth

9.6.2 The required percentage of cement referred to above is calculated by mass. To convert this figure to percentage by volume, multiply the required cement content obtained in Section 9.4.2 (expressed as a decimal) by the maximum dry density of the parent soil (T 99) in kilograms per cubic meter, and divide the resulting product by 1505.74 kilograms per cubic meter (loose density of cement) in equation form:

Where: $C_v = (C_w W_{ps}) / 1505.74$
C_v = percentage of cement by volume in percent
C_w = percentage of cement by mass in percent
W_{ps} = maximum dry density of parent soil in kilograms per cubic meter

9.7 Cement Content Calculations (English Units)

9.7.1 The cement content selected in Section 9.4.2 is the required percentage of cement by weight. Convert the percentage to a decimal and multiply it by the maximum dry density of the parent material or soil (as determined by T 99). This gives the weight in pounds of cement required per cubic foot of soil. Multiply this number by 9 to obtain the weight in pounds of cement required per square yard of soil to a depth of one foot. Finally, divide this number by 12 to obtain the number of pounds of cement required per square yard of soil for each inch of mixing depth. By combining and simplifying the above steps, the following equation is obtained:

$$R_{si} = 0.75 C_W W_{ps}$$

Where: R_{si} = required cement spread in pounds per square yard per inch of depth
C_W = Cement content determined in Section 9.4.2 expressed as a decimal
W_{ps} = maximum dry density of parent soil in pounds per cubic foot.

To obtain the required weight of cement to be spread, multiply R_{si} by the number of inches to which the soil-cement is to be mixed (the mix depth). More simply:

$$R_{su} = D\,R_{si}$$

where: R_{su} = required cement spread to be used in pounds per square yard
D = intended mixing depth in inches
R_{si} = required cement spread in pounds per square

yard per inch of depth.

9.7.2 The required percentage of cement referred to above is calculated by weight. To convert this figure to percentage by volume, multiply the required cement content obtained in Section 9.4.2 (expressed as a decimal) by the maximum dry density of the parent soil (T 99) in pounds per cubic foot, and divide the resulting product by 94 pounds per cubic foot (loose density of cement) in equation form:

$$C_V = (C_W W_{ps}) / 94$$

where: C_V = percentage of cement by volume in percent
C_W = percentage of cement by weight in percent
W_{ps} = maximum dry density of parent soil in pounds per cubic foot.

10. REPORT

10.1 The report shall be a narrative form and shall adequately define the project or job for which the report is being issued, including such information as the project number, the road number or job name, the city and/or county, etc. Also, the parent soil(s) used in the mix design shall be well defined since the recommendations pertain only to that material. The report shall also contain a description of the mixing and testing techniques used in the mix design. If this procedure is used, reference to same will suffice.

10.2 The report shall include the maximum density and optimum moisture of the parent soil, a sieve analysis of the parent soil, the recommended percentage of the cement by mass, C_W, the recommended percentage of the cement by volume, C_V, the required spread of cement in kilograms per square meter per milimeter of mix depth (pounds per square yard per inch of mix depth), R_{si} and the required spread of cement to be used in kilograms per square meter (pounds per square yard), R_{su}.

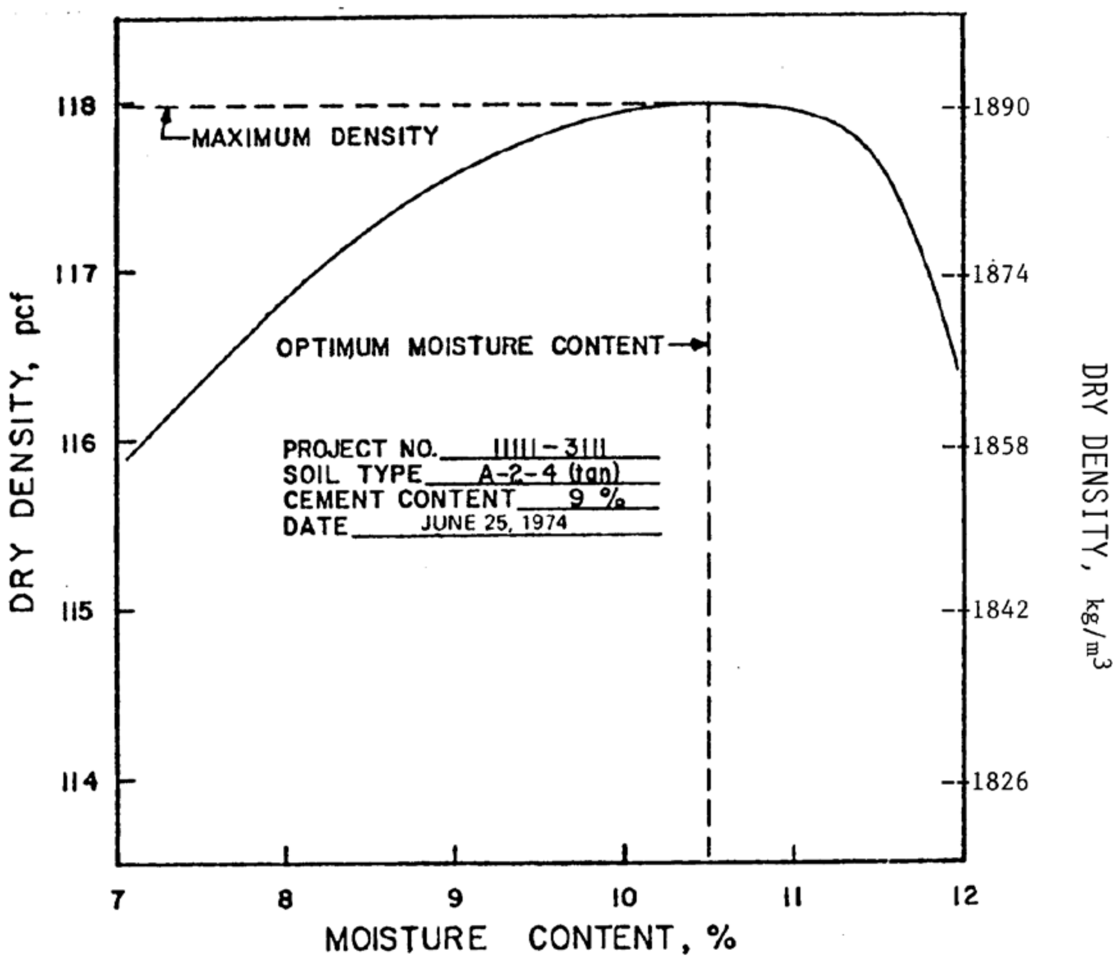

Figure 1

MOISTURE CONTENT VS. DRY DENSITY

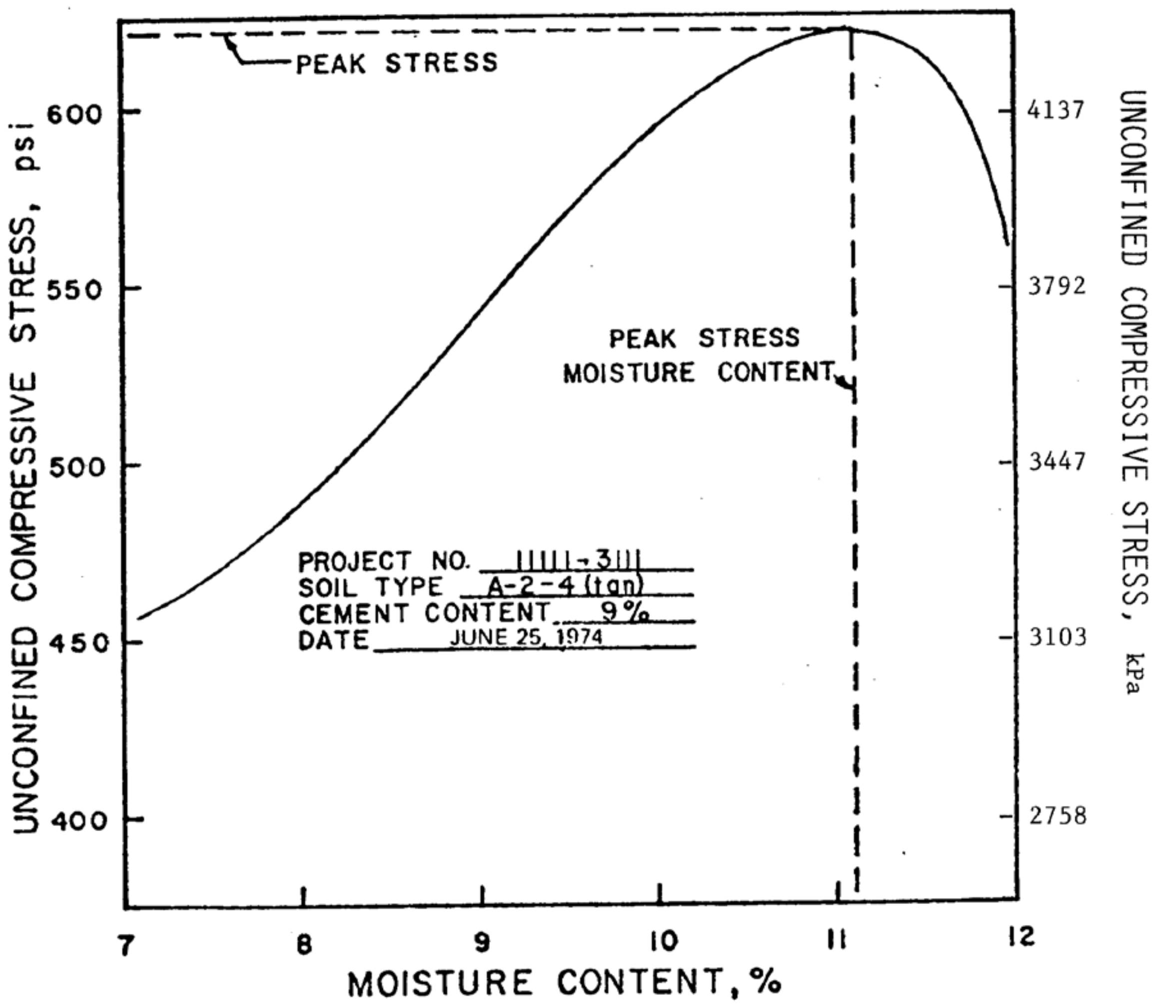

Figure 2

MOISTURE CONTENT VS. UNCONFINED COMPRESSIVE STRESS

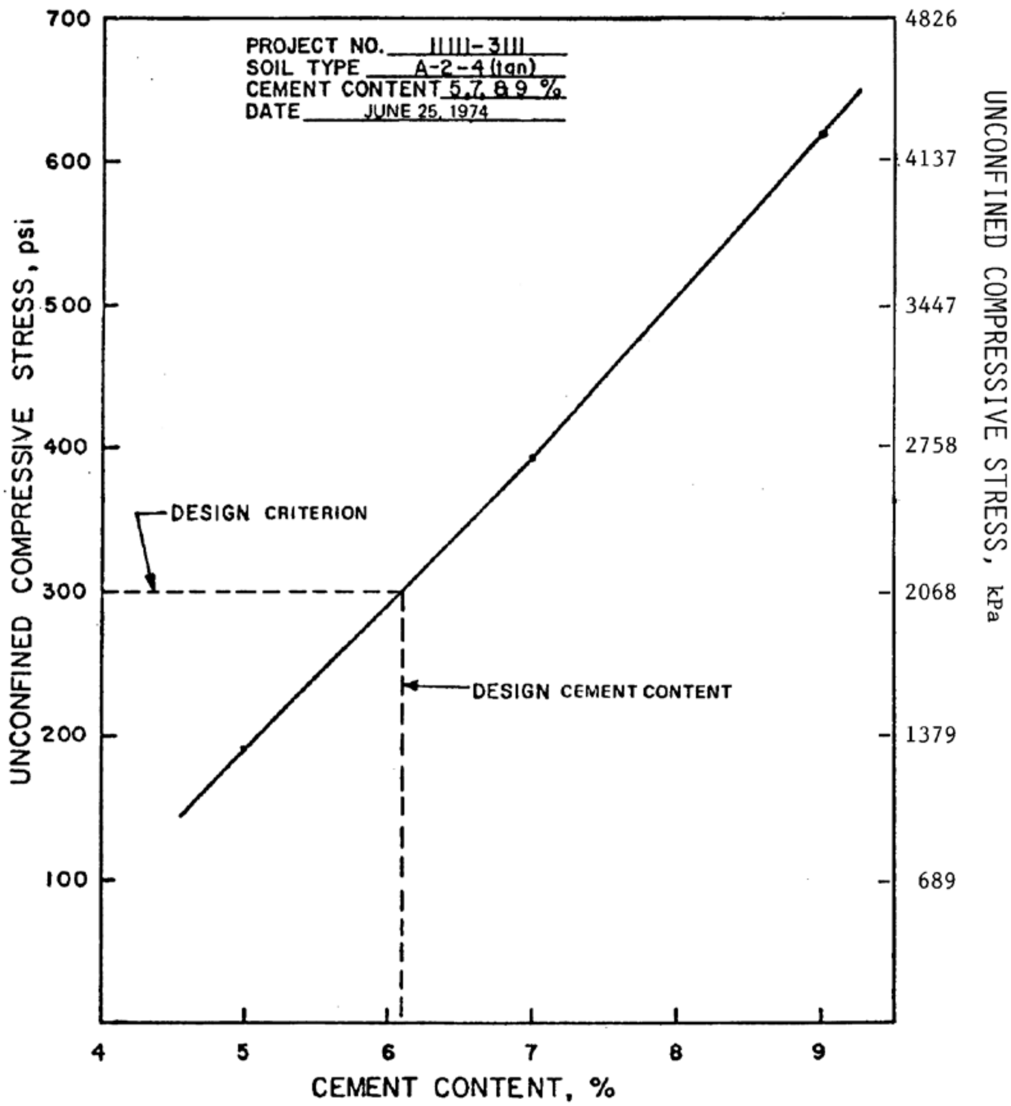

Figure 3

CEMENT CONTENT VS. UNCONFINED COMPRESSIVE STRESS

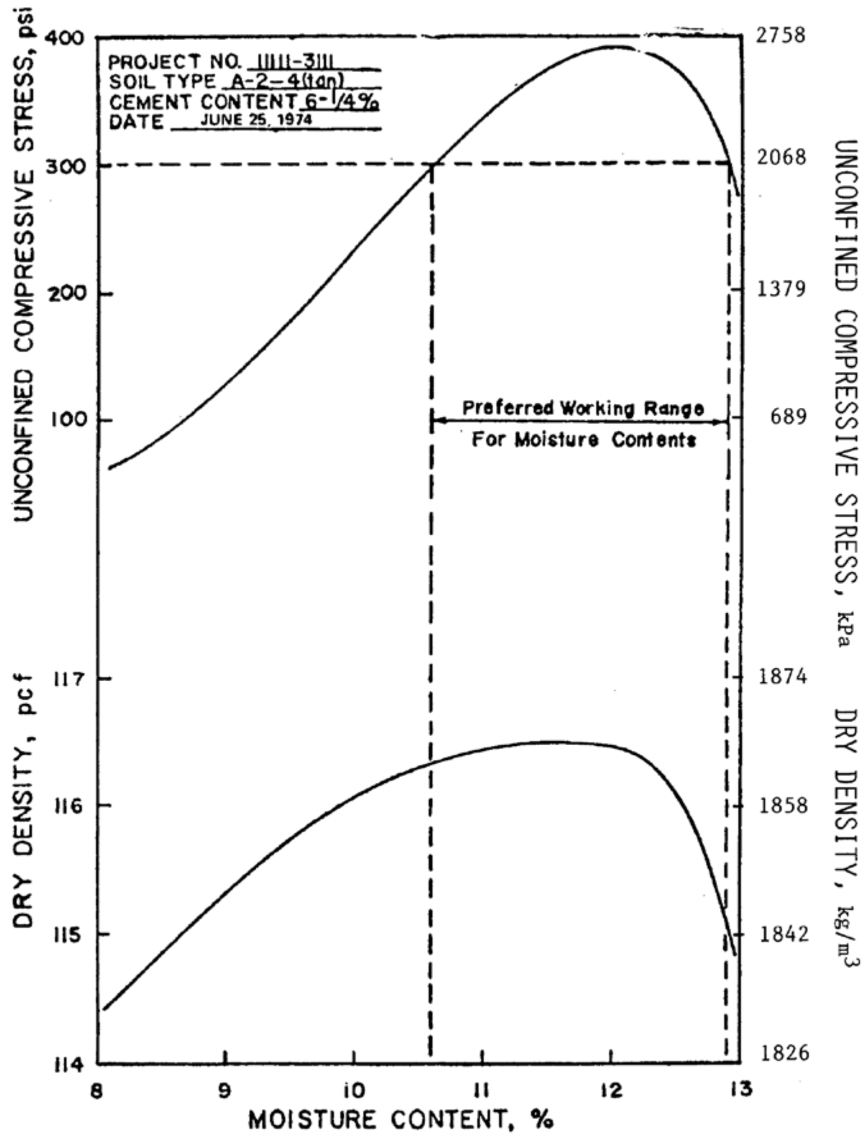

Figure 4
MOISTURE VS. DENSITY AND MOISTURE VS. STRENGTH
(for confirmation check)