

## Method of Test for CLASSIFICATION OF SOILS AND SOIL-AGGREGATE MIXTURES

DOTD Designation: TR423M/423-99

### I. Scope

A. This method describes the procedure for classifying soils and soil-aggregate mixtures by soil group, group index value, and textural name classification based on the results of laboratory tests. Materials which contain reclaimed or recycled asphaltic concrete, previously treated or stabilized soils, portland cement concrete, etc. shall not be classified by this procedure.

#### B. Reference Documents

1. DOTD TR 407, Mechanical Analysis of Soils
2. DOTD TR 411, Dry Preparation of Disturbed Samples for Tests
3. DOTD TR 413, Organic Material in Soils
4. DOTD TR 428, Determining the Atterberg Limits of Soils

### II. Apparatus

Soils/Soil-Aggregate Worksheet (DOTD Form No. 03-22-0723), completed with results from the reference documents. (Figure 1)

### III. Sample

No sample is required for this procedure.

### IV. Procedure

- A. If the organic content determined in accordance with DOTD TR 413 is 15% or greater, classify the soil as A-8 with a textural classification of organic from Table 1.
- B. If the organic content is less than 15%, use the adjusted percentages passing the 2.00 mm (No. 10), 425  $\mu\text{m}$  (No. 40), and 75  $\mu\text{m}$  (No. 200) sieves determined in accordance with DOTD TR 407, the liquid limit and plasticity index determined in accordance with DOTD TR 428, to identify the soil group or subgroup by process of elimination proceeding from left to right in Table 1.

**Note 1:** *The correct group classification is the first group from the left into which the test data will fit.*

C. Record the group and subgroup, if applicable, on the worksheet as "Group."

D. Determine the group index value.

1. For materials falling within groups A-1-a, A-1-b, A-2-4, A-2-5 and A-3, record the group index as zero (0) in parenthesis on the worksheet after the group classification.
2. For all other group classifications, determine the group index in accordance with Steps V.A. and B. and record in parenthesis on the worksheet after the group classification.

E. Determine the textural name classification using the unadjusted percent sand (from TR 407), the unadjusted percentage of silt (from TR 407), the unadjusted percent clay and colloids (from TR 407), and the triangular chart shown in Figure 2.

**Note 2:** As designated in DOTD TR 407, the total of these percentages should total 100.

1. On the triangular chart (Figure 2), locate the intersection of the horizontal and diagonal lines corresponding to the unadjusted percentages of sand, silt, and clay and colloids.
2. If the name classification falls on a borderline, apply the "to the right and up" rule as follows.
  - a. If the two textural names are adjacent horizontally, use the name on the right.
  - b. If the two names are adjacent vertically, use the top name.

**Note 3:** *If a sample contains zero (0) percent sand (100% passing the 75  $\mu\text{m}$  [No. 200 sieve]), use the borderline classification rule of "to the left and up."*

F. Determine the amount of coarse aggregate in the sample, using the percentages retained on the 25.0 mm (1 in), 19.0 mm (3/4 in), 12.5 mm (1/2 in) 4.75 mm (No. 4), and 2.00 mm (No. 10) sieves determined in DOTD TR 407, in accordance with Step V. C.

G. If the value determined in Step F. is five percent or more, assign a prefix to the textural name that describes the type of coarse aggregate present.

1. If the coarse aggregate consists of aggregate other than shell, record "G" on the worksheet as "Classification Prefix" if the material is "siliceous" (specific gravity 2.564) or N if it is "non-siliceous" to describe the type of coarse aggregate.
  2. If the coarse aggregate is shell, record "S" on the worksheet as "Classification Prefix".
- H. If the organic content determined in accordance with DOTD TR 413 is from 3 through 14 percent, include "and organic" following the textural name.

## V. Calculations

- A. Calculate the group index values of A-2-6 and A-2--7 soils to the nearest whole number using the following equation:

$$\text{Group Index} = 0.01 (F - 15)(PI - 10)$$

where:

F = adj. % passing the 75  $\mu\text{m}$  (No. 200) sieve

PI = plasticity index

example:

$$F = 30$$

$$PI = 30$$

$$\text{Group Index} = 0.01(30 - 15)(30 - 10)$$

$$= 0.01 (15) (20)$$

$$\text{Group Index} = 3$$

- B. Calculate the group index values of A-4, A-5, A-6, A-7-5, and A-7-6 soils to the nearest whole number using the following equation:

$$\text{Group Index} =$$

$$F - 35[0.2 + 0.005(LL - 40)] + 0.01 (F - 15)(PI - 10)$$

where:

F = matl. passing the 75 $\mu\text{m}$  (No. 200) sieve, %

LL = liquid limit

PI = plasticity index

example: *an A-6 soil with:*

$$F = 55$$

$$LL = 40$$

$$PI = 25$$

$$\text{Group Index} =$$

$$55 - 35[0.2 + 0.005(40 - 40)] + 0.01(55 - 15)(25 - 10)$$

$$= 20[0.2 + 0] + 0.01(40)(15)$$

$$= 4 + 6$$

$$\text{Group Index} = 10$$

- C. Calculate the total amount of coarse aggregate in the sample by adding the individual percentages on the 25.0 mm (1 in), 19.0 mm (3/4 in), 12.5 mm (1/2 in), 4.75 mm (No. 4), and 2.00 mm (No. 10) sieve:

example:

$$25.0 \text{ mm} = 0$$

$$19.0 \text{ mm} = 6$$

$$12.5 \text{ mm} = 2$$

$$4.75 \text{ mm} = 5$$

$$2.00 \text{ mm} = 13$$

$$0 + 6 + 2 + 5 + 13 = 26\%$$

## VI. Report

- A. Report all test results indicated by each test method used during classification of the sample. (Figure 1)
- B. Report the group classification followed by the group index value in parenthesis, as determined in Step IV.C. and D. Report group index values that were calculated to be negative as zero.
- C. Report the textural classification as determined in Step IV. E.
- D. Report the group classification of material containing 15% or more organic matter as A-8 and the textural name classification as "organic."

## VII. Normal Test Reporting Time

Normal test reporting time is three days.

**TABLE 1**

**Classification of Soils and Soil-Aggregate Mixtures (With Suggested Subgroups)**

General Classification	Granular Materials (35% or less passing 75 µm - No. 200)							Silt-Clay Materials (More than 35% passing 75 µm - No. 200)				Organic	
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-8	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5: A-7-6		
Sieve Analysis: Percent Passing 2.00 mm (No. 10) 425 µm (No. 40) 75 µm (No. 200)	50 Max.	-	-	-	-	-	-	-	-	-	-	-	-
	30 Max.	50 Max.	51 Min.	-	-	-	-	-	-	-	-	-	-
	15 Max.	25 Max.	10 Max.	35 Max.	35 Max.	35 Max.	35 Max.	36 Min.	36 Min.	36 Min.	36 Min.	36 Min.	-
Characteristics of Fraction Passing 425 µm (No. 40) Liquid Limit Plasticity Index	- 6 Max.	-	- N. P.	40 Max. 10 Max.	41 Min. 10 Max.	40 Max. 11 Min.	41 Min. 11 Min.	40 Max. 10 Max.	41 Min. 10 Max.	40 Max. 11 Min.	41 Min. 11 Min. *	-	-
Usual Types of Significant Constituent Materials	Stone Fragments Gravel and Sand		Fine Sand	Silty or Clayey Gravel and Sand				Silty Soils		Clayey Soils		15% or more Organic Matter	
Gen. Rating as Subgrade	Excellent to Good						Fair to Poor					Unsuitable	

\* Plasticity Index of A-7-5 subgroup is equal to or less than LL minus 30. Plasticity Index of A-7-6 subgroup is greater than LL minus 30



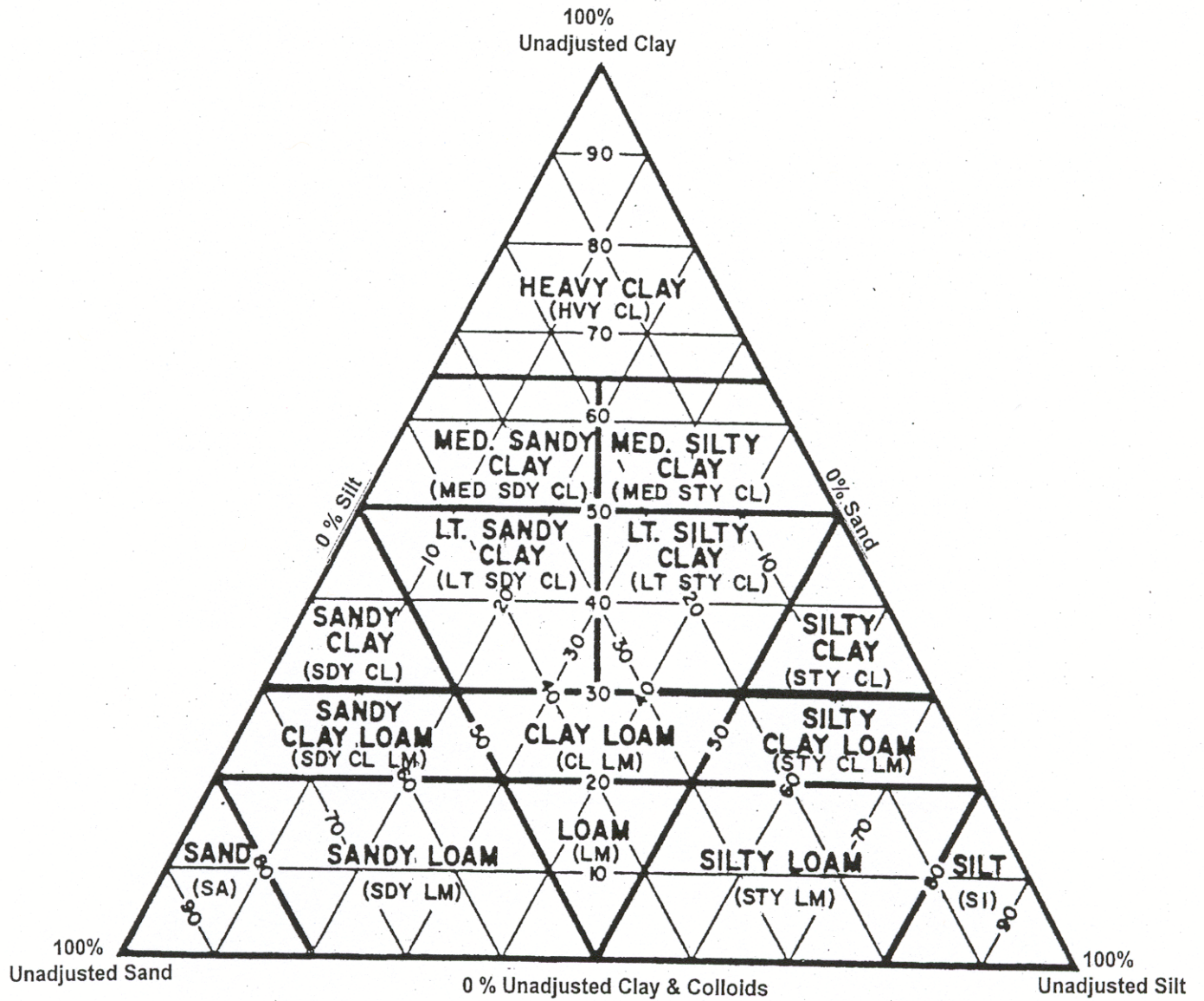


Figure 2  
 Triangular Chart