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Soil classification aashto m145 pdf

Division of Testing and Certification Program
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Classification of Soil and Soil-Aggregate Mixtures For Highway Construction Purposes AASHTO M-145-91 (2000) (Modified)

This practice describes a procedure for classifying soils into seven groups based on laboratory determination of particle-size distribution, liquid limit, and plasticity index. The group classification should be useful in determining the relative quality of the soil material for use in embankments, subgrades, and backfills. For detailed design of important structures, additional data concerning strength or performance characteristics of the soil under field conditions will usually be required.

Modification: Determination of Group Index will not be a part of certification, but taught as a useful tool for more accurate determination of soil classification.

Key Elements

- Determine sieve analysis.** Determine sieve analysis using AASHTO T-11 and AASHTO T-27 test procedures (Note 1). The 2.0 mm (No. 10) sieve, 4.75 mm (No. 40) sieve, and 75-µm (No. 200) sieve must be included to determine the particle size distribution as a basis for classification.
- Determine the liquid limit.** Determine the liquid limit of the material using AASHTO T-89 test procedures.
- Determine the plastic limit.** Determine the plastic limit and plasticity index of the material using AASHTO T-90 test procedures.
- Determine classification of material.** Using the test limits shown in Table 1 of AASHTO M-145, make the classification of the material. If a more detailed classification is desired, a further subdivision of the groups may be made using Table 2 of AASHTO M-145 (A.1). With required test data available, proceed from left to right in Table 1 or Table 2 and the correct group will be found by process of elimination (A.2). The first group from the left into which the test data will fit is the correct classification (A.2).
- Report classification.** All limiting test values are shown as whole numbers. If fractional numbers appear on test reports, convert to the nearest whole number for purposes of classification (A.3).

DESCRIPTION OF SOIL CLASSIFICATION GROUPS:

Silt Fractions According to the AASHTO system, soils are divided into two major groups as shown in Table 1 of AASHTO M-145. There are the granular materials with 35 percent or less passing the 75-µm (No. 200) sieve (A.1, Note 2) and the silt-clay materials with more than 35 percent passing the 75-µm (No. 200) sieve (A.2). Moreover, silt and clay fractions are recognized and often used in word descriptions of a material. These five fractions are defined as follows:

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Table 4.1 AASHTO Soil Classification System

General classification	Granular materials (35% or less passing US No. 200 sieve)			Silt-clay materials (More than 35% passing US No. 200 sieve)								
	A-1		A-3	A-2		A-4	A-5	A-6	A-7			
Group classification	A-1a	A-1b		A-2-4	A-2-5	A-2-6	A-2-7			A-7-5	A-7-6	
Sieve analysis												
Percent passing												
US No. 10 (2 mm)	50 max											
US No. 40 (420 µ)	30 max	50 max	51 max									
US No. 200 (75 µ)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min	
Characteristics of fraction passing US No. 40 (420 µ)												
Liquid limit												
Plasticity index	6 max		Non-plastic	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min	
Group Index	0		0	0		4 max		8 max	12 max	16 max	20 max	
Usual types of significant constituent materials	Stone fragments, gravel and sand			Fine Sand				Silty or clayey gravel and sand		Silty soils		Clayey soils
General rating as subgrade	Excellent to good							Fair to poor				

Note: A-8 is identified by visual classification, and is not shown in the Table.
Classification procedure: Proceeding from left to right in the chart, the correct group will be found by the process of elimination. The first group from the left consistent with the test data is the correct classification. A-7 group is subdivided into A-7-5 or A-7-6 depending on the plastic limit. For $w_p < 30$, the classification is A-7-6; for $w_p \geq 30$, it is A-7-5.

Table 2-1. Gradation of H.S. fine and coarse sands and Grading E and A of AASHTO M147

Sieve Size	Flow w/Clay	Flow w/Silt	Grading E	Coarse w/Clay	Coarse w/Silt	Grading A
1"	100.0	100.0	100	100.0	100.0	100
1/2"	100.0	100.0	100	90.0	90.0	100
3/8"	100.0	100.0	100	64.0	64.0	90-95
#4	99.8	99.8	99-100	49.0	49.0	75-85
#8	49.2	49.2	29.8	29.8	29.8	15-40
#15	41.6	42.5	40-100	23.6	24.6	10-30
#40	22.5	23.0	20-50	11.3	11.8	6-20
#200	7.1	6.9	6-20	7.0	7.0	2-8

Table 2-2. Sources and classifications of H.S. soil-aggregate blends according to AASHTO M145

Soil-Aggregate Type	Soil-Aggregate Classification (AASHTO M145)	Materials	Source
Fine-Graded (Grading E of AASHTO M147)	A3	Crushed Limestone (particle size passing #4 and retained on #8)	Lafarge Frederick, MD
		Washed Concrete Sand (Natural Sand Passing #8)	Aggrans in Hanover, MD
		Lean Clay (CL)	Aggregate Transport Corporation in Hanover, MD
		Silt (ML)	U.S. Army Corps of Engineers, Waterways Experimental Station in Vicksburg, MS
Coarse-Graded (Grading A of AASHTO M147)	A1	Crushed Limestone	Lafarge Frederick, MD
		Manufactured Fine Aggregate (Limestone Based Duct)	Aggregate Transport Corporation in Hanover, MD
		Lean Clay (CL)	Aggregate Transport Corporation in Hanover, MD
		Silt (ML)	U.S. Army Corps of Engineers, Waterways Experimental Station in Vicksburg, MS

2.2 Preliminary Study of AASHTO T180

A preliminary study was conducted at the AMRL laboratory to examine the compatibility of the selected materials and the rationality of the measured density and optimum moisture contents. Three replicates of each of the four materials were compacted using a 4.54-kg manually-operated rammer according to procedures B and D of AASHTO T180. Prior to the compaction, specific gravity of the soil-aggregate blends were determined according to AASHTO T84 and T85 (1). The specific gravity values were used to calculate the percent moisture that results in 100% saturation of the blends. The measured specific gravities are provided in Table 2-3.

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التراب (و)	التراب (ب)	التراب (ج)	التراب (د)	التراب (أ)	التراب (هـ)
100	100	100	100	100	100
100	100	47	100	100	100
78	41	48	78	100	100
68	71	61	68	71	100
68	60	60	68	70	100
60	48	70	60	60	100
43	48	48	43	—	—
11	11	30	17	NP	NP

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