

## METHOD OF TEST FOR DRY STRENGTH OF NON-PLASTIC SOILS

### 1.0 SCOPE

- 1.1 This method describes the procedure for determining the relative degree of cohesiveness of the fines fraction of soils by relating it to the dry strength of the minus 400  $\mu\text{m}$  material.
- 1.2 This recommended practice is to be used only when the Standard Test Method of Liquid Limit, Plastic Limit and Plasticity Index of Soils, ASTM D4318<sup>1</sup> is not applicable and the anticipated plasticity index value would be less than about 2.
- 1.3 This method of test is a procedure based on the Dry Strength Method in Section 14.2 of the Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), ASTM D2488.
- 1.4 Sample preparation and procedures incorporate part of the Suggested Method of Test for Cohesiveness of Nonplastic Granular Soils<sup>2</sup>, as submitted to ASTM by C.K. Preus<sup>3</sup>.

### 2.0 APPARATUS

- 2.1 Required Equipment
  - 2.1.1 Metal flat pan or tray.
  - 2.1.2 A supply of distilled water.
  - 2.1.3 Small metal hammer, approximately 300 g.
  - 2.1.4 Oven at 110°C.

### 3.0 SAMPLE

- 3.1 Obtain a representative sample of the laboratory crushed aggregate.
- 3.2 Separate the sample on the 5 000  $\mu\text{m}$  sieve and from the -5 000  $\mu\text{m}$  material obtain a representative sample weighing about 500 g.

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<sup>1</sup>Annual Book of ASTM Standards, Section 4, Volume 04.08.

<sup>2</sup>This suggested method has no official status in ASTM but was published as information only. This method is based on experience of the author.

<sup>3</sup>Materials and Research Engineer, Minnesota Highway Department, St. Paul, Minnesota.

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- 3.3 Sieve the -5 000  $\mu\text{m}$  material on the 400  $\mu\text{m}$  sieve and retain all the -400  $\mu\text{m}$  material.
- 3.4 Using a rubber covered pestle to break up the +400  $\mu\text{m}$  soil. Continue until all the fine soil particles are removed from the rocks and all lumps are broken down.
- 3.5 Repeat steps 3.3 and 3.4 until all the -400  $\mu\text{m}$  material is obtained.
- 3.6 From the material passing the -400  $\mu\text{m}$  sieve obtain a representative soil sample weighing about 60 g.

### 4.0 PROCEDURE

- 4.1 Place the soil sample in the palm of the hand and gradually add about 10 ml of water. Mix the soil and water by working the sample to distribute the water uniformly.
- 4.2 When the soil has become thoroughly saturated form it into a ball with a diameter between 25 and 30 mm. Place the ball in the container and dry it in an oven at 110°C for a period of at least 12 hours.

### 5.0 DRY STRENGTH (Classification and Reporting)

- 5.1 The comparative resistance to crushing of the dried soil as judged by the finger pressure required, is the basis for classifying the relative degree of cohesiveness of the soil. Classify the relative degree of cohesiveness of the soil as follows:
  - 5.1.1 If the dry ball crumbles under slight finger pressure, the result is classified as "non-plastic friable".
  - 5.1.2 If the dry ball crumbles under moderate finger pressure and can then be easily pulverized, the result is classified as "non-plastic low".
  - 5.1.3 If the dry ball crumbles under considerable finger pressure, the result is classified as "non-plastic medium".
  - 5.1.4 If the dry ball does not crumble under considerable finger pressure but breaks after a moderate hit with a hammer while held in the palm and the broken pieces crumble under considerable finger pressure, then it is classified as "non-plastic medium".
  - 5.1.5 If the dry ball can not be broken by finger pressure but breaks only after a solid hit with a hammer while held in the palm and if a piece of the broken sample does not break under considerable finger pressure, the result is classified as "non-plastic high".

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The moderate or solid hit of the hammer to break the ball aids in determining the classification of "non-plastic medium" or "non-plastic high". However, the resistance of the broken piece of ball to crumble under finger pressure is the final determining factor for classification.

- 5.2 If a "non-plastic high" classification is reported, carry out the following:
  - 5.2.1 Confirm that the original sample of prepared minus 400  $\mu\text{m}$  fines fraction of the aggregate is relatively non-plastic (i.e., A 3 mm thread cannot be rolled at any water content).
  - 5.2.2 If the fines fraction exhibits low plasticity, (i.e., A thread can barely be rolled and the lump cannot be formed when drier than the plastic limit) the Atterberg limits should be performed and reported.

## 6.0 PRECISION AND ACCURACY

- 6.1 The accuracy of this test method is heavily dependent on the evaluation of the technologist.
- 6.2 In relative terms, quantitative analysis of the dry strength classifications and those of Atterberg limits on the same samples suggest that a classification of non-plastic high will on average be comparable to a PI value of about 2.