

## Colorado Procedure – Laboratory 3104-15

### *Standard Method of Test for*

## **Determining the Durability of Shales for Use as Embankments**

(Designated as CP 26 prior to the 2010 FMM.)

### **1. SCOPE**

- 1.1 Shales, as Highway Embankments (or construction material), should be classified as Soil-like (non-durable) or Rock-like (durable). This method of test is intended to distinguish between durable shales that can be used in rock-fills from non-durable shales that must be placed and compacted as soil. This procedure describes two methods (A and B) which may be used in the Region or Central Laboratory.

### **2. REFERENCED DOCUMENTS**

2.1 *ASTM Procedures:*

D 4644-08 Standard Test Method for Slake Durability of Shales and Similar Weak Rocks

### **3. SUMMARY OF METHODS**

- 3.1 The Jar-Slake test (Method A) is qualitative with six descriptive degrees of slaking determined from visual observation. The Jar-Slake test is recommended as the basic screening test.
- 3.2 The Slake-Durability test (Method B) is performed on pieces of oven-dried material submerged in water and rotated in a wire drum cage. The Slake-Durability test is considered as the main index test.

### **METHOD A - JAR-SLAKE TEST**

### **4. APPARATUS**

- 4.1 *Drying Apparatus* - An oven or other suitable device.
- 4.2 *Jar* - A glass jar or other suitable glass container having a capacity of at least one pint (0.5 L).

### **5. PROCEDURE**

- 5.1 Oven dry the material to a constant weight (mass) at 230°F ± 9° (110°C ± 5°).
- 5.2 Place a chunk of the oven dried material (approx. 100 - 200g.) in the glass jar or container.
- 5.3 Fill the container with tap water so as to completely cover the sample.

5.4 The degree of slaking is determined from visual observation after 24 hours.

**NOTE 1:** The reaction to the Jar-Slake test usually occurs within the first 10 to 30 minutes. A standard of 24 hours is recommended for initial testing. As experience is gained within a particular formation, the time can be reduced to 2 hours or less.

## 6. ANALYSIS

6.1 The six values of the Jar-Slake index,  $I_j$ , are listed below:

$I_j$	<u>DESCRIPTIVE BEHAVIOR</u>
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1. Degrades into a pile of flakes or mud
2. Breaks rapidly and/or forms many chips
3. Breaks rapidly and/or forms few chips
4. Breaks slowly and/or forms several fractures
5. Breaks slowly and/or forms few fractures
6. No change

### METHOD B - SLAKE-DURABILITY TEST

## 7. APPARATUS

- 7.1 *Drying Apparatus* - An oven or other suitable device.
- 7.2 *Balance* - A balance of suitable capacity and sensitive to 1.0g. or less.
- 7.3 *Drum* - A wire drum cage (No. 10 screen) capable of being rotated at 20 rpm.

## 8. PROCEDURE

- 8.1 Oven dry the material to a constant weight (mass) at  $230^{\circ}\text{F} \pm 9^{\circ}$  ( $110^{\circ}\text{C} \pm 5^{\circ}$ ).
- 8.2 Obtain 10 representative pieces of oven-dried material weighing (with a mass of) approximately 40 to 60 grams each.
- 8.3 Obtain the weight (mass) of the total mass and record as the dry weight (mass) in grams before testing.
- 8.4 Place the total sample in the wire drum cage, submerge in water, and rotate at 20 rpm for 10 minutes.

- 8.5 Remove the sample retained in the wire drum cage and again oven-dry to a constant weight at 230°F ± 9° (110°C ± 5°).
- 8.6 Repeat the procedure as in 8.4 above.
- 8.7 Repeat the procedure as in 8.5 above.
- 8.8 Obtain the weight (mass) of the retained sample and record as the dry weight (mass) in grams after testing.
- 8.9 Calculate the Slake-Durability index,  $I_D$ , from the following formula:

$$I_D = \frac{\text{Dry weight after testing}}{\text{Dry weight before testing}} \times 100$$

## 9. CLASSIFICATION CRITERIA

- 9.1 Material with a Jar-Slake index ( $I_J$ ) of 1 or 2, obviously should be considered Soil-like without further testing.
- 9.2 Material with a Jar-Slake index ( $I_J$ ) greater than 2 should be subjected to the Slake-Durability test.
- 9.3 Recommended durability index tests and suggested classification criteria for shale like materials used as Highway Embankments is as follows:

### SLAKE-DURABILITY TEST

<u><math>I_D</math></u> <u>% Retained</u>	Type of Retained <u>Wet Material</u>	<u>Classification</u>
<60%	T <sub>2</sub> ,T <sub>3</sub>	S-N
60% to 90%	T <sub>1</sub> S,T <sub>3</sub>	S-N
60% to 90%	T <sub>1</sub> H,T <sub>2</sub>	R-D
>90%	T <sub>1</sub> S,T <sub>3</sub>	S-N
>90%	T <sub>1</sub> H,T <sub>2</sub>	R-D

**TYPE:**

T<sub>1</sub>S - Soft, can be broken apart or remolded.

T<sub>1</sub>H - Hard, cannot be broken apart.

T<sub>2</sub> - Retained particles consist of large and small hard pieces.

T<sub>3</sub> - Retained particles are all small fragments.

**CLASSIFICATION:**

S-N – Soil-like (Non-durable)

R-D – Rock-like (Durable)