

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

TYPE:

T₁S - Soft, can be broken apart or remolded.

T₁H - Hard, cannot be broken apart.

T₂ - Retained particles consist of large and small hard pieces.

T₃ - Retained particles are all small fragments.

CLASSIFICATION:

S-N – Soil-like (Non-durable)

R-D – Rock-like (Durable)