WEST VIRGINIA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
MATERIALS CONTROL, SOILS AND TESTING DIVISION

MATERIALS PROCEDURE

STANDARD METHOD OF TEST FOR PERCENT BY WEIGHT OF SHALE IN CRUSHED AGGREGATE

1.0 PURPOSE

1.1 To set forth a rapid standard method of test for obtaining quantitative information concerning the percent by weight of shale and aggregate pieces exhibiting shale characteristics contained in crushed aggregate.

1.2 In cases where more detailed examination is considered necessary, other methods described in ASTM C-295 should be followed.

2.0 SCOPE

2.1 This method of test is applicable to that portion of crushed aggregate which is retained on the 4.75 mm when that material is being used for applications where the standard specifications places a requirement on the percent of shale in crushed aggregate.

3.0 EQUIPMENT

3.1 A balance or scale capable of weighing 5000 grams with an accuracy of one tenth gram.

3.2 The following sieve sizes conforming to AASHTO M-92; 25.0 mm, 19.0 mm, 12.5 mm, 9.5 mm, and 4.75 mm.

3.3 Jones Riffle Splitter with pans.

3.4 Large flat pans for spreading the aggregate in thin layers.

3.5 Beakers - 600 ml capacity suggested.

3.6 Water source

4.0 DEFINITIONS

4.1 Although shale is defined by many noted authors in numerous ways, Walter T. Huang, PhD (Petrology, 1962) defines shale in a manner best suited for Division of Highways quality determinations. Therefore, Huang's definition will act as a guideline and is defined as follows: "Shale is a laminated and thinly bedded fine grained clastic rock containing mainly silt and clay and including many particles less than 1 or 2 microns in diameter." According to the same reference, most shale is made up of 1/3 quartz, 1/3 clay minerals, and 1/3 miscellaneous substances. "In addition, it may be said that shale usually has a relatively smooth or soapy texture, can be scratched with a copper penny and powder can be produced by scraping a piece of shale with a knife."

4.1.1 In addition to the above characteristics, shale, when in contact with a moist environment, softens considerably due primarily to the clay constituent and bedding properties and often exhibits the property of slaking. This is one of the primary characteristics which causes shale to be considered deleterious when contained in aggregate to be used in highway construction.

5.0 TEST PROCEDURE

5.1 Obtain from the field sample a test portion of the appropriate size by use of a sample splitter.

5.2 Approximate weight of the test portion of crushed aggregate.

MAXIMUM NOMINAL SIZE OF PARTICLES	MINIMUM WEIGHT OF TEST PORTION
19 mm	3000 grams
37.5 mm	5000 grams
75 mm	10000 grams

5.3 Wash the coarse aggregate over a 4.75 mm and discard the minus 4.75mm material. This step removes dust or mud from the particles and provides a workable size for analysis.

5.4 Dry the test portion to a constant weight in an oven maintained at 110? ± 5? C and record the weight.

5.5 Divide the test sample of coarse aggregate (known weight) into the following sizes by sieving: 25.0 mm, 19.0 mm, 12.5 mm, 9.5 mm, and 4.75 mm.

5.6 Spread each sieve fraction of the total test sample (known weight) in a thin layer on the bottom of a large flat pan.

5.7 Examine each sieve fraction for shale and separate the shale from the remainder of the crushed aggregate fraction and weigh and record.

5.7.1 In the case of pieces of aggregate resembling shale but not exhibiting all the properties of shale, weigh, and soak in water for 24 hours and re-examine.

5.7.1.1 If after 24 hours the suspect pieces of aggregate remain sound, they should be considered satisfactory and not be included with other deleterious material.

5.7.1.2 If after soaking in water for 24 hours the suspect pieces of aggregate show evidence of slaking or if slight hand pressure causes disintegration, the weight of the original pieces should be recorded as being deleterious.

6.0 CALCULATIONS

6.1 Calculate the percentage of shale as follows:

$$S = \frac{W_1}{W_2} \times 100$$

Where:

S - Total percent of shale or shale like pieces (other deleterious material) in the test sample.

W_1 - Total weight of shale or shale like pieces contained in all applicable sieve fractions of the test sample.

W_2 - Total weight of coarse aggregate test sample coarser than a 4.75 mm.

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