FLORIDA DEPARTMENT OF TRANSPORTATION
State Materials Office
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Florida Method
for
SAMPLING AND TESTING RIP-RAP MATERIAL

Designation: FM 5-538

1. SCOPE

These methods describe procedures for obtaining and testing samples of rip-rap from stockpiles, trucks, barges, railcars, or material already in place on a project.

2. APPLICABLE DOCUMENTS

State of Florida Department of Transportation Standard Specifications, Project Plans, Supplemental Specifications and Special Provisions.

3. APPARATUS

3.1 Dump Truck - Capacity required may vary with the grade of rip-rap.

3.2 Approved portable truck scales capable of weighing the truck being used, loaded to capacity.

3.3 Approved platform scales.

3.4 An approved dynamometer, properly calibrated.

3.5 Front-end loader or other equipment to lift the stones.

3.6 Miscellaneous small tools - 1/2 inch sieve, ruler, hammer, etc.

4. GRADATION

4.1 Determination of Sample Size

Because of the size and weight of rip-rap material, it is extremely difficult to handle, and presents unique problems in representative sampling. Consequently, sampling and testing may be accomplished at the same time.

4.1.1.1 Stockpile Samples –
A section of a stockpile, which is visually representative of all the material in the stockpile, as determined by the Engineer, may be

selected. Minimum size of the "sample" should be equivalent to the thickness of the layer to be placed multiplied by the area in the Table in Section 4.1.4.

4.1.1.2 Barge and Railcar Samples - Should be treated the same as Stockpiles in Section 4.1.1.

4.1.3 Truck Samples - Truck loads of material in-transit may be used as a sample. Minimum size samples should be equivalent to the thickness of the layer to be placed, multiplied by the area in the Table in Section 4.1.4. This may require several truck loads to equal one sample.

4.1.4 Material In-Place - For material which has been placed, a sample consisting of a site-size of placed stone, visually representative of all the material in-place shall be selected by the Engineer. Sample site-size shall be determined from the following table:

Grade	Sample-site Size (ft)	Grade	Sample-site size (ft)
1	10 x 10	4	25 x 25
2	15 x 15	5	30 x 30
3	20 x 20	6	35 x 35

4.2 Gradation Sampling and Testing

4.2.1 Select sample-site size or sample volume.

4.2.2 Weigh the unloaded truck to be used in the testing procedure and record (tare wt.).

4.2.3 Select individual key stones which represent as close as possible W-max, W-50 and W-min. Weigh and mark these stones, and place them adjacent to the test area (where test is to be made).

4.2.4 As the material is removed from the sample-site, truck, railcar or barge, visually compare the rock size with the key stones established in Section 4.2.3 above, and place in appropriate piles, i.e., pieces that are larger than W-max; pieces smaller than W-max but larger than W-50; pieces that are smaller than W-50 but larger than W-min. pieces that are smaller than W-50 but larger than W-min; pieces that are smaller than W-min but larger than 1/2 inch (Dirt and Fines). Pieces too difficult to judge (due to shape, etc.) should be individually weighed and placed in the appropriate stockpile.

NOTE: 1 Pieces which are so large that they are difficult to handle may be weighed while being removed from the sample-site, truck, etc., by using a

dynamometer; record the weight and place the stone aside, so that it doesn't have to be rehandled or reweighed. The percent Dirt and Fines may not be determinable from in-place samples.

4.2.5 Place in the test truck the stockpile of material bigger than W-max, weigh and record (total wt. minus the tare wt. of the truck). Repeat as necessary. Empty the truck.

4.2.6 Repeat the procedure in Section 4.2.5 for the stockpiles of W-max to W-50 material, W-50 to W-min material, W-min to 1/2 inch material, and Dirt and Fines (minus 1/2 inch).

NOTE 2: Be sure to include the weight of the "key" stones established in Section 4.2.3, in the appropriate stockpile weights.

4.3 Calculations

4.3.1 Calculate the percent of specified sized where:

A = total wt of those pieces larger than W-max.
B = total wt of those pieces smaller than W-max but larger than W-50.
C = total wt of those pieces smaller than W-50 but larger than W-min.
D = total wt of those pieces smaller than W-min but larger than 1/2 inch.
E = total wt of those pieces sampler than 1/2 inch (Dirt and Fines).

4.3.2 Percent of sample weighing more than W-max.

$$\frac{A}{A+B+C+D+E} \times 100 = \%$$

4.3.3 Percent of sample weighing less than W-max but more than W-50.

$$\frac{B}{A+B+C+D+E} \times 100 = \%$$

4.3.4 Percent of sample weighing less than W-50 but more than W-min.

$$\frac{C}{A+B+C+D+E} \times 100 = \%$$

4.3.5 Percent of sample weighing less than W-min but more than 1/2 inch in size.

$$\frac{D}{A+B+C+D+E} \times 100 = \%$$

4.3.6 Percent of sample smaller than 1/2 inch in size (Dirt and Fines).

$$\frac{E}{A+B+C+D+E} \times 100 = \%$$

5. FLAT AND ELONGATED PIECES

5.1 Sample Size - The sample size shall be as established in Section 4.1.4. The Flat and Elongated Pieces test may be made on gradation samples as they are being graded.

5.2 Flat and Elongated Pieces Determination - Each stone in the sample should be measured to determine if it meets the Flat and Elongated criteria. If it does not, it should be weighed and recorded. Upon completion of all measurements and weighings, the percent of flat and elongated pieces shall be determined as follows:

$$\frac{\text{wt. of flat and elongated pieces}}{\text{total wt of sample}} \times 100 = \%$$

6. SOUNDNESS, SPECIFIC GRAVITY, ABSORPTION AND L.A. ABRASION

6.1 Minimum sample sizes are as follows:

Soundness and L.A. Abrasion	200 lbs (approx.)*
Specific Gravity and Absorption	7,000 g (approx. 15 lbs)**

* = The same sample can be collected for the Soundness and L.A. Abrasion tests

** = The same sample can be collected for the Specific Gravity and

Absorption tests

6.2 Sampling

Smaller pieces of rip-rap, or pieces broken off of larger stones, should be collected. The sample should consist of no fewer than three individual stones, which visually represent the stockpile, truckload, railcar, or material in-place. These individual stones should be obtained from different areas of the stockpile, etc.

6.3 Testing - All tests shall be performed as per the Florida Manual of Sampling and Testing Methods, as follows, except as noted:

Soundness	AASHTO T104-99 (2011)
Specific Gravity	FM 1 T-085
Absorption	FM 1-T 085
L.A. Abrasion	FM 3-C 535