

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

MATERIALS PROCEDURE

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DETERMINING FREE MOISTURE IN FINE AGGREGATE USING A  
"SPEEDY MOISTURE TESTER"

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1.0 PURPOSE

- 1.1 To establish a standard method of test for determining free moisture (moisture above saturated surface dry) in fine aggregate using a "Speedy Moisture Tester".

2.0 SCOPE

- 2.1 This method of test is applicable to free moisture determination when using either the 20 gram or 26 gram "Speedy Moisture Tester".

3.0 GENERAL

- 3.1 Concrete design computations are based on aggregates which are in the SSD condition. Therefore, in this procedure the expression of free moisture is based on the SSD weight of the material.
- 3.2 The dial reading on the "Speedy Moisture Tester" is the percent total moisture based on the wet weight of the sample. The average absorption for limestone and silica sand is approximately 1.5 percent based on the dry weight of the material. Conversion tables calculated from this average are provided on Attachment I to yield the percent free moisture in the sample from the dial reading of the "Tester".
- 3.3 If it is known that the absorption should not be based on the 1.5 percent average (when the absorption is less than 1 or greater than 2) then the method for calculating the free moisture from the dial reading is given in Section 6.0.

#### 4.0 EQUIPMENT

4.1 All equipment is contained in a "Speedy Moisture Tester" kit as obtained from a laboratory equipment supplier and consists of the following:

- a) 20 gram or 26 gram tester - body and cap
- b) Simple beam type scale
- c) Reagent measurer
- d) Reagent - calcium carbide
- e) Cleaning cloth and brush

#### 5.0 PROCEDURE

- a) Place the scale in operating position and clean the pan.
- b) Ensure the inside of the body of the tester is free from all foreign matter.
- c) Add three measures of the reagent to the body of the tester.
- d) Accurately weigh the sample (20 g or 26 g) on the scale. The accuracy of the scale should be established periodically.
- e) Place the weighed sample in the cap of the tester.
- f) With the pressure vessel in an approximately horizontal position, insert the cap in the pressure vessel and seal the unit by tightening the clamp, taking care that no reagent comes in contact with the aggregate until a complete seal is achieved.
- g) Place the tester in a vertical position (cap end up) so that the aggregate will fall into the pressure vessel.
- h) Shake the tester vigorously from end to end. At the first movement of the dial needle, turn the dial end up.
- i) When the needle stops moving, read the dial while holding the instrument in a horizontal position at eye level. Read to the nearest 0.1 percent.

- j) The percent free moisture is determined by entering the conversion chart (Attachment I) with the dial reading and obtaining the corresponding value of free moisture in the opposite column, or by substituting the dial reading into the equation shown in Section 6.0 - whichever the case may be.

## 6.0 SAMPLE CALCULATION

- 6.1 The following method for determining free moisture should be used when the absorption capacity of the aggregate is known to be outside the range of 1 percent to 2 percent (average 1.5 percent) of the aggregate dry weight (see Section 3.3).

<u>Symbols</u>	<u>Given</u>
$W_D$ = Dry Weight	AB = 3.0%
$W_{SSD}$ = Saturated Surface Dry Weight	DR = 10.0
$W_w$ = Wet Weight (Sample Weight)	* $W_w$ = 20.0 or 26.0
DR = Dial Reading	
AB = Absorption	*Dependent upon size tester used
FM = Free Moisture	

1. Determine the sample dry weight:

$$W_D = W_w - \frac{(W_w) DR}{100}$$

Substituting:

$$W_D = 26 - \frac{26(10)}{100}$$

$$W_D = 26 - 2.6$$

$$W_D = 23.4 \text{ g (dry weight)}$$

2. Determine from the dry weight the SSD weight:

$$W_{SSD} = W_D + \frac{W_D (AB)}{100}$$

Substituting:

$$W_{SSD} = 23.4 + \frac{23.4 (3.0)}{100}$$

$$W_{SSD} = 23.4 + 0.702$$

$$W_{SSD} = 24.1 \text{ g (SSD weight)}$$

3. Determine from the SSD weight the percent free moisture:

$$\%FM = \frac{(W_{SSD}) 100}{W_{SSD}}$$

Substituting:

$$\%FM = \frac{(26 - 24.1) 100}{24.1}$$

$$\%FM = \frac{190}{24.1}$$

$$\%FM = 7.9 \text{ (percent free moisture)}$$

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SPEEDY MOISTURE TESTER CONVERSION CHART

<u>SPEEDY DIAL</u>	<u>FREE MOISTURE</u>	<u>SPEEDY DIAL</u>	<u>FREE MOISTURE</u>
<u>READING</u>	<u>SATURATED-SURFACE</u>	<u>READING</u>	<u>SATURATED-SURFACE</u>
<u>WET BASIS</u>	<u>DRY BASIS</u>	<u>WET BASIS</u>	<u>DRY BASIS</u>
1.0% .....	----	17.0% .....	18.7%
1.5% .....	----	17.5% .....	19.4%
2.0% .....	0.5%	18.0% .....	20.1%
2.5% .....	1.0%	18.5% .....	20.8%
3.0% .....	1.6%	19.0% .....	21.6%
3.5% .....	2.1%	19.5% .....	22.4%
4.0% .....	2.6%	20.0% .....	23.1%
4.5% .....	3.2%	20.5% .....	23.9%
5.0% .....	3.7%	21.0% .....	24.7%
5.5% .....	4.2%	21.5% .....	25.5%
6.0% .....	4.8%	22.0% .....	26.3%
6.5% .....	5.4%	22.5% .....	27.1%
7.0% .....	5.9%	23.0% .....	27.9%
7.5% .....	6.5%	23.5% .....	28.8%
8.0% .....	7.1%	24.0% .....	29.6%
8.5% .....	7.7%	24.5% .....	30.4%
9.0% .....	8.3%	25.0% .....	31.3%
9.5% .....	8.9%	25.5% .....	32.2%
10.0% .....	9.5%	26.0% .....	33.1%
10.5% .....	10.1%	26.5% .....	34.0%
11.0% .....	10.7%	27.0% .....	34.9%
11.5% .....	11.4%	27.5% .....	35.8%
12.0% .....	12.0%	28.0% .....	36.8%
12.5% .....	12.6%	28.5% .....	37.8%
13.0% .....	13.2%	29.0% .....	38.7%
13.5% .....	13.9%	29.5% .....	39.7%
14.0% .....	14.6%	30.0% .....	40.7%
14.5% .....	15.2%	30.5% .....	41.8%
15.0% .....	15.9%	31.0% .....	42.8%
15.5% .....	16.6%	31.5% .....	43.8%
16.0% .....	17.3%	32.0% .....	44.9%
16.5% .....	18.0%	32.5% .....	46.0%
---- .....	---	33.0% .....	47.0%