

## Test Method for Determining the Moisture Content of Fine Lightweight Aggregate in Stockpiles

The content of this test method was reproduced from the field-portion sections of the “New York State Department of Transportation, Test Method number NY 703-19 E, Issue Date August 2008, Subject Code 7.42-5” for the convenience of the user. Several editorial notes have been added for clarity within the text. They are *[in brackets, blue, and the text is italicized]* for identification.

### SCOPE:

This method describes the procedures for determining the total, absorbed and surface (free) moisture of Fine Lightweight Aggregate to be used for Internal Curing of concrete. *[This includes concrete that contains both portland cement and supplementary cementitious materials (SCM).]*

### EQUIPMENT:

1. Sampling container: Non-absorbent, sealable, bag or tub with a capacity sufficient for holding approximately 2000 grams of fine aggregate.
2. Scoop, shovel or large spoon.
3. Sheet of non-absorbent cloth, canvas or polyethylene (approximate size, 24" [600 mm] x 24" [600 mm]).
4. Drying apparatus: A ventilated oven capable of maintaining temperature of  $230 \pm 9^{\circ}\text{F}$  ( $110 \pm 5^{\circ}\text{C}$ ) for 24 hours. In cases where the aggregate is not altered by overheating, other sources of heat, such as electric or gas hotplates, electric heat lamps or a ventilated electric microwave oven may be used.
5. Disposable paper towels: Commercial grade, typically manufactured from post-consumer recycled paper *[commonly referred to as ‘brown paper towels’]*.
6. Heat resistant pans: With sufficient capacity to hold a minimum of 500 grams of fine aggregate in an oven or on a hot plate at the specified temperature. If a microwave oven is used for drying, the container shall be non-metallic.

### SAMPLING:

For determination of surface moisture content at the concrete batching facility (for adjustments to target batch weights) prior to batching:

After the required soaking *[wetting or pre-wetting]* and draining of the stockpiles has been completed, obtain a representative sample from the stockpile or plant storage bin in accordance with sampling procedures described in Materials Method (MM) 9.1, Plant Inspection of Portland Cement Concrete *[or*

*as described in ASTM D75 Standard Practice for Sampling Aggregates*]. Obtain a minimum sample size of 1500 grams. Immediately upon obtaining the composite sample, place it in a non-absorbent container to prevent loss of moisture prior to testing.

**TESTING:**

Reduce the sample, by quartering, into four subsamples of approximately 350 grams each. Immediately determine the initial weight of one subsample by weighing to the nearest 0.1 grams. This subsample will be known as "Sample #1." Record the initial weight of Sample #1 as  $W_T$ . Place Sample #1 in the drying apparatus. Dry Sample #1 to a constant weight, so that the loss in weight between subsequent measurements does not change by more than 0.1 % of the original weight. After drying, allow Sample #1 to cool sufficiently, so as to not damage the weighing equipment. Measure the weight of Sample #1 to the nearest 0.1 grams and record the weight as  $W_{OD}$ . The mathematical difference between the initial weight ( $W_T$ ) and the oven dried weight ( $W_{OD}$ ) represents the "total" (absorbed and surface) moisture.

Calculate the "% Total Moisture" content of Sample #1 (expressed as a percent of the oven dried weight) as follows:

$$\text{Total Moisture: } (M_T) = 100 \times (W_T - W_{OD}) / W_{OD}$$

Place another subsample, which will be known as "Sample #2," on a 2 - 3 foot long sheet of clean, dry paper towel. Spread the sample uniformly across the paper towel while patting the sample with another paper towel. Continue patting and spreading the sample, replacing the sheets of paper towel whenever the paper becomes too damp or dirty to absorb moisture. This process should be conducted as quickly and carefully as possible. Repeat the patting and spreading of the sample until no further moisture appears on the clean paper towels. Immediately weigh Sample #2 to the nearest 0.1 gram. Since the surface moisture has been removed, this weight represents only the moisture that has absorbed into the sample. Record this weight as  $W_{TD}$ .

Place Sample #2 in the drying apparatus. Dry Sample #2 to a constant weight so that the loss in weight between subsequent measurements does not change by more than 0.1% of the original weight. Measure the weight of Sample #2 to the nearest 0.1 grams and record the weight as  $W_{2OD}$ .

Calculate the "% Absorbed Moisture" content of Sample #2 as follows:

$$\% \text{ Absorbed Moisture: } (M_A) = 100 \times (W_{TD} - W_{2OD}) / W_{2OD}$$

Calculate the "% Surface Moisture" content as follows:

$$\% \text{ Surface Moisture: } (M_S) = \text{Total Moisture } (M_T) - \text{Absorbed Moisture } (M_A)$$

$$\text{Example: } M_S = M_T - M_A$$

$$M_S = 20.3\% - 16.4\% = 3.9\% \text{ Surface Moisture.}$$

Report the Surface Moisture to the nearest 0.1 %.

This value will be used to adjust the pre-programmed target weight of the fine lightweight aggregate and water in the batching facility's automated batching system. Consult MM 9.1 for more information on automated batching systems.

*[Alternate method of testing Sample #2: Making moisture adjustment during batching is very important, however, the process of getting the data to make these adjustments need not be complicated or time consuming. For example, removing the drying portion of the procedure for Sample #2 can shorten the time it takes to calculate the internal Absorbed Moisture. Results may be slightly less accurate but when the tolerances of batching systems and variations in controls (as commonly seen in the field) are taken into consideration, the deviation from laboratory testing is minimal.*

*Alternate field testing modifications are as follows:*

*Record the initial weight of Sample #2 and record as **W<sub>2T</sub>**. Then follow the procedures for towel drying and record the weight as **W<sub>TD</sub>**.*

*Calculate the "% Absorbed Moisture" content of Sample #2 as follows:*

$$\text{\% Absorbed Moisture: } (MA) = 100 \times (W_{2T} - W_{TD}) / W_{TD}$$

*Then calculate the "% Surface Moisture" content as shown above using **MA**:*

$$M_s = M_T - MA$$

*This method will save time and provide accurate information for surface moisture adjustments at the batch plant, however the user is advised to run both methods and compare the results before using.]*

Note: the test method references New York State Test Method MM 9.1 Plant Inspection of Portland Cement Concrete. This test method can be found at:

<https://www.dot.ny.gov/divisions/engineering/technical-services/materials-bureau-repository/mm9-1.pdf>.