T 255/ T 265

TOTAL EVAPORABLE MOISTURE CONTENT OF AGGREGATE BY DRYING

FOP FOR AASHTO T 255

LABORATORY DETERMINATION OF MOISTURE CONTENT OF SOILS

FOP FOR AASHTO T 265

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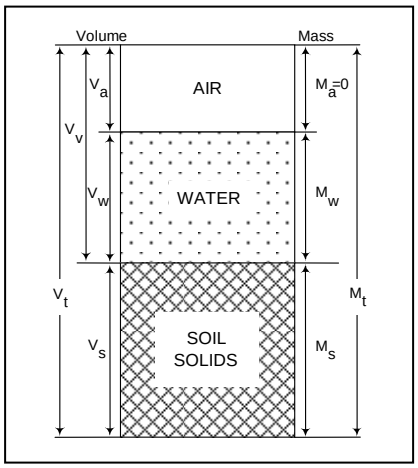

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Phase diagram

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Apparatus

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Significance

The amount of water contained in many materials influences design and construction practices. Road bases are difficult to compact if they are too dry or too wet. If too dry, water must be added, and the amount to be added depends on how much is already present.

Scope

This procedure covers the determination of moisture content of aggregate and soil in accordance with AASHTO T 255 and AASHTO T 265. It may also be used for other construction materials.

Apparatus

- Balance or scale: capacity sufficient for the principle sample mass, accurate to 0.1 percent of sample mass or readable to 0.1 g. Meeting the requirements of AASHTO M 231.
- Containers, capable of being sealed
- Suitable drying containers
- Microwave safe containers
- Thermometer reading to 400 ±10°F
- Heat source , controlled
  - Forced draft oven
  - Ventilated / convection oven
- Heat source, uncontrolled
  - Microwave oven (600 watts minimum)
  - Infrared heater, hot plate, fry pan, or any other device/method that will dry the sample without altering the material being dried
- Utensils such as spoons
- Hot pads or gloves

06 ## Sample Preparation

For aggregate, select the proper sample size based on Table 1 or other information that may be specified by the agency. Obtain the sample in accordance with the FOP for AASHTO T 2.

Immediately seal or cover samples to prevent any change in moisture content.

07 **TABLE 1**

Sample Sizes for Moisture Content of Aggregate

Nominal Maximum Size* (in.)	Minimum Sample Mass g (lb)
No. 4	500 (1.1)
3/8	1500 (3.3)
1/2	2000 (4)
3/4	3000 (7)
1	4000 (9)
1½	6000 (13)
2	8000 (18)
2½	10,000 (22)
3	13,000 (29)
3½	16,000 (35)
4	25,000 (55)
6	50,000 (110)

***** One sieve larger than the first sieve to retain more than 10 percent of the material using an agency specified set of sieves based on cumulative percent retained. Where large gaps in specification sieves exist, intermediate sieve(s) may be inserted to determine nominal maximum.

For soil, select the proper sample size based on Table 2 or other information that may be supplied by the agency.

TABLE 2

Sample Sizes for Moisture Content of Soil

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Maximum Particle Size (in)	Minimum Sample Mass g
No. 40	10
No. 4	100
1/2	300
1	500
2	1000

Procedure

09 For aggregate, determine and record all masses to the nearest 0.1 percent of the sample mass or to the nearest 0.1 g. For soil, determine and record all masses to the nearest 0.1 g.

10

1. Determine and record the mass of the container.
2. Place the wet sample in the container, and record the total mass of the container and wet sample.
3. Determine the wet mass of the sample by subtracting the mass in Step 1 from the mass in Step 2.
4. Dry the sample to a constant mass in accordance with the directions given under Directions for Drying below. Measures will be taken to protect the scale from excessive heat while determining constant mass.
5. Allow the sample to cool and record the total mass of the container and dry sample.
6. Determine the dry mass of the sample by subtracting the mass in Step 1 from the mass in Step 5.

Forced Air Oven

Directions for Drying Aggregate

11 • Controlled - Forced Draft, Ventilated, or Convection Oven

12 1. Spread sample in the container

2. Dry to constant mass at 230 ±9°F. Constant mass has been reached when there is **less than** 0.10 percent change after an additional 30 minutes of drying.

• Uncontrolled

13 Where close control of temperature is not required (such as with aggregate not altered by higher temperatures, or with aggregate that will not be used in further tests, or where precise information is not required), higher temperatures or other suitable heat sources may be used. Other heat sources may include microwaves, hot plates, or heat lamps.

14 - Microwave Oven

1. Heap sample in pile in the center of the container and cover. This cover must allow moisture to escape.

2. Dry to constant mass. Constant mass has been reached when there is **less than** 0.10 percent change after at least an additional 10 minutes of drying.

Caution: Some minerals in the sample may cause the aggregate to overheat altering the aggregate gradation.

15 - Hot plate, heat lamp, etc.

1. Spread sample in container.

2. Stir the sample frequently to avoid localized overheating and aggregate fracturing.

3. Dry to a constant mass. Constant mass has been reached when there is **less than** 0.10 percent change after at least an additional 20 minutes of drying.

Directions for Drying Soil

16

- Oven (Preferably Forced Draft/Air)
  1. Place sample in container.
  2. Dry to constant mass at 230 ±9°F. Constant mass has been reached when there is no change after an additional 1 hour of drying. A sample dried overnight (15 to 16 hours) is sufficient in most cases.

Note 1: Soils containing gypsum or significant amounts of organic material require special drying. For reliable moisture contents dry these soils at 140°F. For more information see FOP for AASHTO T 265, Note 2.

Calculation

Constant Mass:

17

Calculate constant mass using the following formula:

$$\frac{M_p - M_n}{M_p} x100 = \%Change$$

Where: M_p = previous mass measurement

M_n = new mass measurement

Example:

Mass of container: 1232.1 g

18

Mass of the container & sample after first drying cycle: 2637.2 g

Mass, M_p, of possibly dry sample: 2637.2 g - 1232.1 g = 1405.1 g

Mass of container and dry sample after second drying cycle: 2634.1 g

Mass, M_n, of dry sample: 2634.1 g - 1232.1 g = 1402.0 g

$$\frac{1405.1 - 1402.0}{1405.1} \times 100 = 0.22$$

0.22% is not less than 0.10%, so continue drying

Mass of container and dry sample after third drying cycle: 2633.0 g

19

Mass, M_n, of dry sample: 2633.0 g - 1232.1 g = 1400.9 g

$$\frac{1402.0 - 1400.9}{1402.0} \times 100 = 0.08$$

0.08% is less than 0.10% constant mass has been reached for an aggregate, but continue drying for soil.

Moisture Content: 20

Calculate the moisture content, as a percent, using the following formula:

$$\frac{M_W - M_D}{M_D} \times 100 = w$$

where: w = moisture content, percent

M_W = wet mass

M_D = dry mass

Example:

Mass of container: 1232.1 g 21

Mass of container and wet sample: 2764.7 g

Mass, M_W, of wet sample: 2764.7 g - 1232.1 g = 1532.6 g

Mass of container and dry sample **(COOLED)**: 2633.1 g

Mass, M_D, of dry sample: 2633.1 g - 1232.1 g = 1401.0 g

$$w = \frac{1532.6\,g - 1401.0\,g}{1401.0\,g} \times 100 = \frac{131.6\,g}{1401.0\,g} \times 100 = 9.39\% \text{ rounded to } 9.4\%$$

22

Report

Results shall be reported on standard forms approved for use by the agency. Include:

- M_W, wet mass
- M_D, dry mass
- w, moisture content to nearest 0.1 percent

23

Tips!

- Let the sample cool before determining final dry mass.
- Divide by M_D, not M_W.

REVIEW QUESTIONS

1. What extra care should be taken when using a microwave to dry aggregates?

2. What are the maximum temperatures that a sample should be allowed to attain when using the various types of ovens?

3. How is “constant mass” defined according to this FOP:

   For Aggregate?

   For Soil?

PERFORMANCE EXAM CHECKLIST

TOTAL EVAPORABLE MOISTURE CONTENT OF AGGREGATE BY DRYING FOP FOR AASHTO T 255

LABORATORY DETERMINATION OF MOISTURE CONTENT OF SOILS FOP FOR AASHTO T 265

Participant Name _____ Exam Date _____

Record the symbols "P" for passing or "F" for failing on each step of the checklist.

Procedure Element	Trial 1	Trial 2
1. Representative sample of appropriate mass obtained?	_____	_____
2. Mass of container determined to 0.1 g?	_____	_____
3. Sample placed in container and mass determined to 0.1 g?	_____	_____
4. Test sample mass conforms to the required mass?	_____	_____
5. Wet sample mass determined to 0.1 g?	_____	_____
6. Loss of moisture avoided prior to mass determination?	_____	_____
7. Sample dried by a suitable heat source?	_____	_____
8. If aggregate heated by means other than a controlled oven, is sample stirred to avoid localized overheating?	_____	_____
9. For aggregate: if other than a forced draft, microwave or conventional oven, is aggregate heated for an additional 20 minutes and then mass determined and compared to previous mass – showing less than 0.10 percent loss?	_____	_____
10. For soil: Is soil heated for an additional 1 hour and then mass determined and compared to previous mass - showing no loss?	_____	_____
11. Sample cooled, dry mass determined & recorded to the nearest 0.1 percent?	_____	_____
12. Moisture content calculated correctly and recorded to the nearest 0.1 percent?	_____	_____

Comments: First attempt: Pass ☐ Fail ☐ Second attempt: Pass ☐ Fail ☐

_____

_____

_____

_____

Examiner Signature _____WAQTC #:_____