

1204 SPECIFIC GRAVITY & ABSORPTION of COARSE AGGREGATE AASHTO Designation T 85 (Mn/DOT Modified)

1204.1 GENERAL

This test method is intended for use in determining the bulk and apparent specific gravity, and absorption of coarse aggregates (retained on the 4.75mm [#4] sieve).

1204.2 APPARATUS

- A. Balance - A balance conforming to the requirements of AASHTO M 231 (Class G5) with a minimum capacity of 5000g, a readability and sensitivity of 1g and an accuracy of 1g or 0.1%. The balance shall be equipped with suitable apparatus for suspending the sample container in clean water from the center of the weighing platform or pan of the balance.
- B. Sample Container - A wire basket of 3.35mm (#6) mesh or finer with sufficient capacity to handle a 5000g sample. The container shall be so constructed as to prevent trapping of air when the container is submerged.
- C. Absorbent Toweling - Terry cloth has been found to work well.
- D. Water Tank - A watertight tank into which the sample is placed while suspended below the balance, equipped with an overflow outlet for maintaining a constant water level and of sufficient capacity so that the sample and container cannot touch the sides of the tank and there is at least 25mm (1") of water above and below the container when suspended.

NOTE 1: Since the water in the tank must be maintained at 23 ± 1.7 °C (73.4 ± 3 °F) it is recommended that it be equipped with an immersion heater/circulator capable of maintaining that temperature.
- E. Sieves - As needed, conforming to ASTM E 11.
- F. Oven - Capable of maintaining a temperature of 110 ± 5 °C (230 ± 9 °F).
- G. Thermometer- Capable of measuring the temperature of water and materials in solution. Conforming to the requirements of AASHTO M339. Which includes a minimum temperature range of 16 to 27°C (60 to 80 °F), with an accuracy of ± 0.5 °C (± 0.9 °F).

1204.3 TEST SAMPLES

For concrete aggregate and possibly other aggregates it may be desirable to test the aggregate in separate size fractions as follows:

When the aggregate is tested separately prepare three samples **each** of the following sizes and weights (as available):

| SIZE FRACTION (mm) | SIZE FRACTION | SAMPLE WEIGHT (g) |
|--------------------|--------------------|-------------------|
| Larger than 37.5 | Larger than 1 1/2" | 5000 |
| 37.5 - 19.0 | 1 1/2 - 3/4" | 3000 |
| 19.0 - 9.5 | 3/4 - 3/8" | 2500 |
| 9.5 - 4.75 | 3/8" - #4 | 1500 |

NOTE 2: If the coarse aggregate contains a substantial quantity of material finer than the 4.75mm (#4) sieve (such as pea rock) split and wash the material over a 2.36mm (#8) sieve. The sample weight for this will be 1500g.

For bituminous aggregates and other aggregates that are not being separated into size fractions prepare three samples of the following size and weight:

| <u>SIZE FRACTION, mm</u> | <u>SAMPLE WEIGHT, g</u> |
|--------------------------|-------------------------|
| Larger than 4.75 (#4) | 2500 + |
| Smaller than 4.75 (#4) | 1500 + |

1204.4 PROCEDURE

The aggregate test samples shall be thoroughly washed, oven dried to a constant weight at a temperature of 110 ± 5 °C (230 ± 9 °F) and then air cooled before being soaked in clean water at room temperature for a period of 17 ± 2 hours.

- A. After the required soaking time empty the sample onto a table covered with damp toweling. Surface-dry the sample by rolling the particles in the toweling. Larger pieces may have to be dried individually. It has been found useful to use another damp towel to pat dry while rolling the aggregate particles.

NOTE 3: When the aggregate is at a saturated surface-dry state it will appear damp; but will not glisten. A glistening, shiny appearance indicated that free moisture is still present. Take care to avoid the evaporation of water from the aggregate pores.

Perform the surface-drying operation as quickly as possible to avoid evaporation of absorbed water.

- B. Making certain that no aggregate particles were trapped in the toweling, immediately weigh the sample to the nearest gram and record the **saturated surface-dry weight** (B in the calculation).
- C. It is recommended that the basket be tared each time prior to use. To tare the basket immerse it in the 23 ± 1.7 °C (73.4 ± 3 °F) water tank and suspend it from the balance. Shake the basket to remove any entrapped air. Fill the tank with enough clean water so that it spills out the overflow. When the balance stabilizes (usually when the overflow ceases to drip) read the tare weight of basket.
- D. Place the sample into the tared, mesh basket, immerse it in the 23 ± 1.7 °C (73.4 ± 3 °F) water tank and suspend it from the balance.

NOTE 4: The technician should watch for all of the following:

- 1) The wire used to suspend the basket and sample from the balance should be as thin as possible.
 - 2) The basket (including the handle if any) and the sample are completely immersed.
 - 3) The basket is not touching the sides or bottom of the tank. (See tank requirements - Section 1204.2D)
 - 4) Assist in removing any trapped air bubbles by tapping or shaking the basket while immersing.
- E. When the balance readout has stabilized, record the **immersed weight** (C in the calculation) to the nearest gram.
- F. Place the sample into a suitable drying pan and dry to a constant weight at 110 ± 5 °C (230 ± 9 °F). (It has been determined that 12 hours is an adequate time to achieve a constant weight.) Allow the sample to cool at room temperature until it can be comfortably handled, usually 1-3 hours. Weigh the sample and record the **oven-dry weight** (A in the calculation) to the nearest gram.

1204.5 CALCULATIONS

- A. Bulk Specific Gravity:

$$\text{Bulk sp gr} = \frac{A}{B - C}$$

- B. Bulk Specific Gravity (Saturated Surface-Dry):

$$\text{Bulk sp gr (SSD)} = \frac{B}{B - C}$$

C. Apparent Specific Gravity:

$$\text{Apparent sp gr} = \frac{A}{A - C}$$

D. Absorption:

$$\text{Percent Absorption} = \frac{B - A}{A} \times 100$$

Where:

A = Weight of the oven-dry sample in air, g.

B = Weight of the saturated surface-dry sample in air, g.

C = Weight of the saturated sample immersed in clean water, g.

1204.6 PRECISION

The acceptable range of test results among individual samples is as follows:

Bulk Sp. Gr. (Dry) = 0.025

Apparent Sp. Gr. = 0.020

% Absorption = 0.25

Any individual test that falls outside of any of the above acceptable ranges it shall not be included in the reported average. If no two of the three individual tests fall within the above acceptable ranges the tests shall be re-run using the same material (after drying to a constant weight) or using (if available) additional material, properly split or quartered, from the same sample.

1204.7 REPORT

Average the values for the three samples in each size fraction. Report the average bulk specific gravity (dry) and the average apparent specific gravity to the nearest 0.001. Report the average percent absorption for each size fraction to the nearest 0.1%. Also report the weighted average for any sample that has more than one size fraction tested.

Results must fall within: 0.025 for Bulk Specific Gravity (Dry), 0.020 for Apparent Specific Gravity and 0.25% for Absorption. It is permissible to report the average of two of the sample results if only one falls outside the limits. If no two fall within the limits all three samples must be re-done.

1204.8 **EXAMPLE WORK SHEET (Mn/DOT Form #24151)**

SPECIFIC GRAVITY AND ABSORPTION OF COARSE AGGREGATE

AASHTO T85

Laboratory No. CO-CA24-0001 Type of Material Gravel

Source Stockpile – Bob’s Pit

Location N ½ SW ¼ 10-101-32

Tested by JN Date 1/19/24

| Description | 1 | 2 | 3 | Average |
|---|----------|----------|----------|---------|
| A. Saturated Surface-Dry Wt. Sample | 3689.2 | 3682.8 | 3659.7 | |
| B. Immersed Wt. Sample | 2329.9 | 2323.1 | 2312.9 | |
| C. Pan Ident. | <i>A</i> | <i>B</i> | <i>C</i> | |
| D. Dry Wt. Pan + Sample | 3741.3 | 3746.6 | 3720.4 | |
| E. Pan Tare Wt. | 101.7 | 113.2 | 106.6 | |
| F. Dry Wt. Sample D-E | 3639.6 | 3633.4 | 3613.8 | |
| <u>Calculations</u> | | | | |
| Absorption A-F | 49.6 | 49.4 | 45.9 | 48.3 |
| Percent Absorption $\frac{A-F}{F} \times 100$ | 1.4 | 1.4 | 1.3 | 1.4 |
| Bulk (Dry) Specific Gravity $\frac{F}{A-B}$ | 2.678 | 2.672 | 2.683 | 2.678 |
| Apparent Specific Gravity $\frac{F}{F-B}$ | 2.779 | 2.773 | 2.778 | 2.777 |

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