1205 SPECIFIC GRAVITY & ABSORPTION of FINE AGGREGATE

AASHTO Designation T 84 (Mn/DOT Modified)

1205.1 GENERAL

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

1205.2 APPARATUS

A. Balance - A balance conforming to the requirements of AASHTO M 231 (Class G2) with a minimum capacity of 2000g, a readability and sensitivity of 0.1g and an accuracy of 0.1g or 0.1%.

B. Pycnometer - A 500ml capacity, graduated, narrow-mouth Erlenmeyer flask (Corning/Pyrex Model #4980). The volumetric measurements of the pycnometer must be reproducible within 0.1 cm.

NOTE 1: The top of the pycnometer must be flat and level. If it is not, grind it flat by rubbing the lip of the pycnometer in a circular motion on a piece of emery cloth laid on a flat surface.

C. Glass Plate – A flat and level glass plate to be used as a calibration capacity mark for the pycnometer.

D. Mold - A metal mold in the form of the frustum of a cone with dimensions as follows: 40 ± 3mm inside diameter at the top, 90 ± 3mm inside diameter at the bottom, 75 ± 3mm in height with the metal having a minimum thickness of 800μm.

D. Tamper - A metal tamper weighing 340 ± 15g and having a flat, circular tamping face 25 ± 3mm in diameter.

E. Oven - Capable of maintaining a temperature of 110 ± 5 °C (230 ± 9 °F).

F. Drying Apparatus - A suitable surface-drying apparatus (heat lamps and a large, flat pan with a non-absorbing surface). An oscillating fan may be used to assist in drying.

G. Pyrex Pan

NOTE 2: The use of other apparatus as described in AASHTO T-84 will also be allowed.

1205.3 CALIBRATION OF THE ERLENMEYER FLASK

A. Record the identification of the Erlenmeyer flask/glass plate. ("B" in EXAMPLE WORK SHEET, Section 1205.9)

B. Fill with clean water at 23 ± 1.7 °C (73.4 ± 3 °F) and allow air bubbles to escape. Carefully slide the glass plate across the top of the flask ensuring that the flask is completely full of water and void of air.

C. Wipe all moisture from the exterior of the flask/plate and weigh the filled flask/plate to the nearest 0.1g. ("D" in Calculations, Section 1205.6)

D. Empty the flask and repeat Steps B and C (above). Repeated weightings should agree within 0.2g. Once calibrated, the flask/plate are considered a matched set to be used for testing purposes.

1205.4 TEST SAMPLE

Using a splitting method (See Section 1002.2) select three 1500g (3.3 lb.) samples of thoroughly mixed, moist material from the parent sample method. (Two will be run and the third used for back-up.)

1205.5 PROCEDURE

A. In a suitable pan, oven-dry the sample to a constant weight at 110 ± 5 °C (230 ± 9 °F).

B. Allow the sample to cool to a comfortable handling temperature, cover with clean water and allow to soak for 17 ± 2 hours.

C. Carefully pour off the excess water. Spread the entire sample in a large, flat, non-absorbent pan exposed to a gently moving current of warm air. (Suspended heat lamps with an oscillating fan work well.) Stir the sample frequently to obtain uniform drying.

NOTE 3: The purpose of this drying is to bring the fines to a saturated surface-dry condition. In this condition moisture fills the pores of each particle while the surface of the particles is dry. If non-uniform drying is allowed the results obtained may be in error; because, over-dried portions of the aggregate will not be saturated.

D. Remove the heat source (turn off heat lamps) when the sample reaches a free-flowing condition.

E. Immediately place the mold (large diameter down) on a smooth, level, firm, non-absorbent surface and fill with the partially dried material. Fill the cone to overflowing and heap additional material above the top of the mold by holding it with the cupped fingers of the hand molding the mold. **Lightly** tamp the surface of the material in the mold 25 times with the tamper.

Each drop of the tamper should start 5mm (0.2") above the top of the fine aggregate. Permit the tamper to fall freely on each drop. Adjust the starting height after each drop. Distribute the 25 drops of the tamper evenly over the entire surface.

Remove the material spilled around the mold and lift the mold vertically. If surface moisture is still present the material will retain the molded shape and requires additional drying.

If it slumps on the first try the material has dried past the saturated surface-dry state. It is possible to get the fine aggregate too dry on the first attempt, but the test need not be scrapped. A few ml of clean water can be added to the sample, mixed in, covered and allowed to set for 30 minutes before re-checking. (Only one re-check is permitted.)

F. Continue drying with constant stirring and test at frequent intervals until the tamped fine aggregate slumps slightly upon removal of the mold. This indicates that it has reached the saturated surface-dry condition.

G. Partially fill the flask with water. Immediately, introduce into the Erlenmeyer flask 500 ± 10g of the surface-dry material.

H. Fill the Erlenmeyer flask with clean water at 23 ± 1.7 °C (73 ± 3 °F) to approximately 90% of capacity, place a stopper in the flask, and roll it to remove all entrapped air bubbles.

NOTE 4: All the air bubbles **must** be removed. Exercise care, this requires good technique and judgement for if the bubbles are not completely removed the results will be erratic. It normally takes about 15 to 20 minutes to eliminate air bubbles by manual methods.

NOTE 5: A mechanical agitator shall be considered acceptable for use if comparison tests for each six months of use show variations less than the acceptable range of test results in Section 1205.7.

Remove the stopper, and if necessary disperse foam by dipping the tip of a paper towel into the flask. Completely fill the Erlenmeyer flask with clean water at 23 ± 1.7 °C (73 ± 3 °F) as in Section 1205.3B & C and weigh to the nearest 0.1g. ("C" in Calculations, Section 1205.6)

NOTE 6: Adjustment of the flask, sample and water to the required temperature may be accomplished through immersion in a temperature-controlled water bath.

I. Carefully, pour the sample and the balance of the water into a tared pan. Rinse the residue from the Erlenmeyer flask into the pan with a squeeze bottle.

J. Oven-dry the sample to a constant weight at 110 ± 5 °C (230 ± 9 °F), allow to cool to room temperature for 1/2 to 1 hour and record the dry weight. ("I" in Calculations, Section 1205.6)

NOTE 7: The alternate method of determining the oven-dried weight as described in AASHTO T84 (Note 5) is acceptable.

1205.6 CALCULATIONS

Where:

A = Weight of the saturated surface-dry materials in air, g.

C = Weight of the flask with materials, water and plate, g.

D = Weight of the flask, water and plate, g.

E = Weight of the immersed materials, g. (C-D)

G = Weight of the pan with the sample, g.

H = Tare weight of the pan, g.

I = Dry weight of the sample, g. (G-H)

A. Bulk Specific Gravity

$$\text{Bulk sp gr} = \frac{I}{A - E}$$

C. Apparent Specific Gravity

$$\text{Apparent sp gr} = \frac{I}{I - E}$$

D. Absorption

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

1205.7 PRECISION

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

Bulk Sp. Gr. (Dry)= 0.032
Apparent Sp. Gr. = 0.027
% Absorption = 0.31

The two individual tests must fall within the above acceptable ranges. If they do not a third sample shall be run and compared with the two run previously. If two of the three tests fall within the acceptable ranges above those two shall be used in the report. If no two of the three tests fall within the acceptable ranges the entire test must be re-run using new material properly split or quartered from the original sample.

1205.8 REPORT

Report the bulk specific gravity (dry) and apparent specific gravity to the nearest 0.001. Report the percent absorption to the nearest 0.1%.

1205.9 EXAMPLE WORK SHEET (Mn/Dot Form #24120)

SPECIFIC GRAVITY AND ABSORPTION OF FINE AGGREGATE

AASHTO T84 (Mn/DOT Modified)

Laboratory No. *CO-CA99-0001* Type of Material *-#4*

Source *Stockpile – Bob's Pit*

Location *N ½ SW ¼ 10-101-32*

Tested by *RDV* Date *1/20/99*

Description	1	2	3	Average
A. Wt. Saturated Surface-Dried Materials 500g (±10)	*500.0*	*500.0*		
B. Flask/Plate Id.	*1*	*2*		
C. Wt. Flask + Water + Materials + Plate	*1071.0*	*1028.3*		
D. Wt. Flask + Water + Plate	*762.8*	*719.7*		
E. Wt. Immersed Material C-D	*308.2*	*308.6*		
F. Pan Ident.	*A*	*B*		
G. Dry Wt. Pan + Sample	*1451.8*	*1449.8*		
H. Pan Tare Wt.	*955.3*	*954.6*		
I. Dry Wt. Sample G-H	*496.5*	*495.2*		
Calculations Absorption A-I	*3.5*	*4.8*		*4.2*
Percent Absorption $\frac{A-I}{I} \times 100$	*0.7*	*1.0*		*0.8*
Bulk (Dry) Specific Gravity $\frac{I}{A-E}$	*2.589*	*2.587*		*2.588*
Apparent Specific Gravity $\frac{I}{I-E}$	*2.637*	*2.654*		*2.646*