EXPERIMENT NO.- 09

EXPERIMENT NAME:

SPECIFIC GRAVITY & ABSORPTION CAPACITY OF FINE AGGREGATE

INTRODUCTION

- Aggregates generally contain pore, both permeable and impermeable, for which specific gravity has to be carefully defined.
- With this specific gravity of each constituent known, its weight can be converted in to solid volume and hence a theoretical yield of concrete per unit volume can be calculated.
- Specific gravity of aggregate is also required in calculating the compacting cater in connection with the measurements.
- This test method covers the determination of bulk and apparent specific 23/23°C (73.4/73.4°F) and absorption of fine aggregate.
- Bulk specific gravity is defined as the ratio of the weight of the aggregate (oven-dry or saturated surface dry) to the weight of water occupying a volume equal to that of the solid including permeable pores. This is used for-

❖ Calculation of the volume occupied by the aggregate in various admixtures containing aggregate on an absolute volume basis,

❖ The computation of void in aggregate ,and

❖ The determination of moisture in aggregate.

INTRODUCTION (Contd..)

- Apparent specific gravity is the ratio of the weight of the aggregate dried in an oven at 100 to 100^{o}C,(212 to 230^{o}F) for 24 hrs. to the weight of water occupying a volume equal to that of the solid excluding permeable pores.
- This pertains to the relative density of the solid material making up the constituent particles not including the pore space within the particles that is accessible to water.
- Absorption values are used to calculate the change in the weight of an aggregate due to water absorbed in the pore spaces within the constituent particles, compared to the dry condition.
- For an aggregate that has been in contact with water and that has free moisture on the particle surfaces, the percentage of free moisture can be determined by deducting the absorption from the total moisture content.
- This test method conforms to the ASTM standard requirements of specification C128.

REFERENCED DOCUMENTS

- ASTM C29/C 29M - for unit weight and voids in aggregate.
- AASHTO T 84 - for Specific Gravity and Absorption of Fine Aggregates.

APPARATUS

Balance: Sensitive to 0.1 g or less.

Pycnometer:

A flask or other suitable container of 1000 ml capacity .The volume of the container filled to mark shall be at least 50 % greater than the space required to accommodate the test sample of fine aggregate.

Mold:

A metal mold in the form of a frustum of a cone with dimensions as follows :

- 40 ± 3 mm inside diameter at the top
- 90±3 mm inside diameter at the bottom
- 75±3 mm in height
- 0.8 mm minimum thickness of metal

Tamper:

A metal tamper weighting 350±15 g and having a flat circular tamping face 25 ± 3 mm in diameter.

PREPARATION OF TEST SPECIMEN

- Obtain approximately 1 kg sample of fine aggregate.
- Dry it in a suitable pan or vessel to constant weight at a temperature of 110 ±5^{o}C (230±9^{o}F).
- Allow it to cool to comfortable handling temperature, cover with water, either by immersion or by addiction of at least 6 % moisture to the fine aggregate and permit to stand for 24 ±4 Hrs.
- Decant excess water with care to avoid loss of fines, spread the sample on a flat non-absorbent surface exposed to a gently moving current of warm air, and stir frequently to secure homogeneous drying.
- Continue this operation until the test specimen approaches a free –flowing condition.

PREPARATION OF TEST SPECIMEN (Contd..)

- *Cone test for surface moisture* –Place a portion of the partially dried fine aggregate loosely in the mold by filling it to overflowing and heaping additional material above the top of the mold by holding it with the cupped fingers of the hand holding the mold.
- Lightly tamp the fine aggregate into the mold with 25 light drops of the tamper.
- Each drop should start about 5 mm (0.2in) above the top surface of the fine aggregate.
- Permit the tamper to fall freely under gravitational attraction on each drop.
- Adjust the stirring height to the new surface elevation after each drop and distribute the drops over the surface.
- Remove loose sand from the vase and lift the mold vertically.

PREPARATION OF TEST SPECIMEN (Contd..)

- If surface moisture is still present, the fine aggregate will retain the molded shape.
- Continue drying with constant stirring and test at frequent intervals until the cone of the sand slumps up on the removable of mold.
- When the fine aggregate slumps slightly it indicates that it has reached a surface –dry condition.
- These various stages are shown diagrammatically in figure 9.1.
- If the first trial of the surface moisture test indicates that moisture is not present on the surface, it has been dried past the saturated surface –dry condition.
- In this case thoroughly mix a few mil liters of water with the fine aggregate and permit the specimen to stand in a cover container for 30 minutes.
- Then resume the process of drying and testing at frequent interval for the onset of the surface –dry condition.

PROCEDURE

- Partially fill the pycnometer with water.
- Immediately introduce in to the pycnometer 500±10(***S***) gm of saturated surface –dry fine aggregate prepared and fill with additional water approximately 90 % of capacity.
- Roll, invert, and agitate the pycnometer to eliminate all air bubbles.
- Adjust its temperature to 30±1.7^{o}C(73.4±3^{o}F),if necessary by immersion in circulating water, bring the water level in the pycnometer to its calibrated capacity.
- Determine the total weight of the pycnometer, specimen and water (***C).***
- Remove the fine aggregate from the pycnometer, dry to constant weight at a temperature of 110±5^{o}C(230±9^{o}F),cool in air at room temperature for ,and weigh(***A***).
- Determine the weight of the pycnometer filled to its calibration capacity with water at 23±1.7^{o}C (73.4±3^{o}F) (***B***).

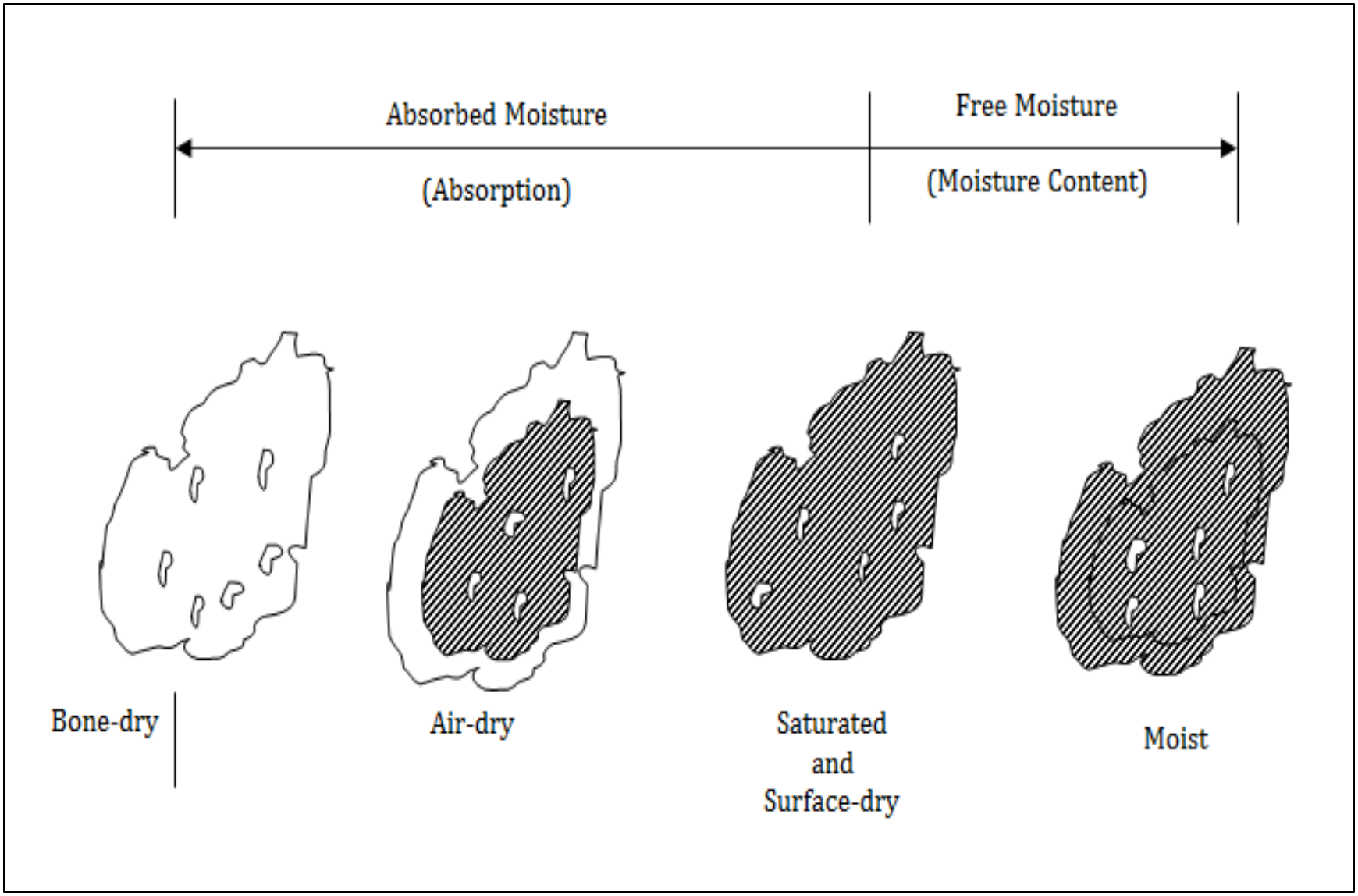

Figure 9.1: Diagrammatic representation of moisture in aggregate

CALCULATION

- **Bulk specific Gravity (oven-dry basis) , S_d**
- Calculate the bulk specific gravity 23/23°C (73.4/73.4°F) as follows:

$$\text{Bulk Specific Gravity} = \frac{A}{B + S - C}$$

Where,

A = weight of oven − dry specimen in air

B = weight of pycnometer filled with water, gm

S = weight of the saturated surface − dry specimen, gm

C = weight of pycnometer with specimen and water to calibration mark, gm

Bulk Specific Gravity (Saturated Surface-dry Basis), S_s

- Calculate the bulk specific gravity, 23/23°C(73.4/73.4°F),on the basis of weight of saturated surface dry aggregate as follows:

$$Bulk\,Specific\,Gravity = \frac{S}{B + S - C}$$

Apparent Specific Gravity, S_a

- Calculate the apparent specific gravity, 23/23°C (73.4/73.4°F), as follows:

$$Apparent\,Specific\,Gravity = \frac{A}{B + A - C}$$

Absorption, A:

- Calculate the percentage of absorption as follows:

$$Absorption\,(\%) = \frac{S - A}{A} \times 100$$

or

$$Absorption\,(\%) = \frac{S_a - S_s}{S_a(S_s - 1)} \times 100$$

RESULT

- Report specific gravity results to the nearest 0.01 and absorption to the nearest 0.1%.

QUESTIONS??

- What is the distinction between apparent and bulk specific gravity?
- How would the determination of bulk specific gravity of the fine aggregate (surface-dry basis) be affected by the 500 gm sample being drier than the surface – dry condition? Explain. Assume that the aggregate becomes saturated during the test.
- Would the apparent specific gravity be affected in the same manner as in question no.2? Explain.

EXPERIMENT 09
Data Sheet
Specific Gravity & Absorption Capacity of Fine Aggregate

Weight of Oven-dry Specimen in Air, *A* (gm)	Weight of Pycnometer +Water, *B* (gm)	Weight of S.S.D. Specimen, *S* (gm)	Weight of Pycnometer+ Specimen+Water , *C* (gm)	Weight of Moist Sand, *W* (gm)

Results

Tests	Formulae	Calculations	Results
Apparent Specific Gravity, S_a	$\frac{A}{B+A-C}$		
Bulk Specific Gravity (Oven-dry basis), S_d	$\frac{A}{B+S-C}$		
Bulk Specific Gravity (S.S.D. basis), S_s	$\frac{S}{B+S-C}$		
Absorption Capacity (%)	$\frac{S-A}{A} \times 100$		
Free Moisture, M (%)	$\frac{W-S}{S} \times 100$		
Weight of Free Moisture (gm)	$\frac{MW}{M+100}$		

Student No. :
Group :
Date :

Signature of Course Teacher