



## COMBINED COARSE AND FINE AGGREGATE SPECIFIC GRAVITY AND ABSORPTION

(An Arizona Method)

### 1. SCOPE

(a) This procedure describes the method which is used to determine the combined coarse and fine aggregate specific gravity and absorption when the specific gravity and absorption of the fine aggregate and the coarse aggregate are known. Arizona Test Method 210 describes the procedure for determining the coarse aggregate specific gravity and absorption. Arizona Test Method 211 describes the procedure for determining the fine aggregate specific gravity and absorption.

(b) This procedure also contains provisions for calculating the combined specific gravity and combined absorption when it is desired to perform those calculations for coarse aggregate, fine aggregate, and mineral admixture.

(c) See Appendix A1 of the Materials Testing Manual for information regarding the procedure to be used for rounding numbers to the required degree of accuracy.

### 2. CALCULATIONS

(a) Combined Bulk (Oven Dry), Bulk (SSD), or Apparent specific gravity for coarse aggregate and fine aggregate is determined by the following:

$$\text{Combined Specific Gravity} = \frac{P_c + P_f}{\frac{P_c}{G_c} + \frac{P_f}{G_f}}$$

Where:  $P_c$  = Percent of Coarse Aggregate  
 $P_f$  = Percent of Fine Aggregate  
 $P_c + P_f$  = 100  
 $G_c$  = Specific Gravity of Coarse Aggregate  
 $G_f$  = Specific Gravity of Fine Aggregate

Example:

$$\begin{aligned} P_c &= 41 \\ P_f &= 59 \\ G_c &= 2.597 \\ G_f &= 2.626 \end{aligned}$$

$$\text{Combined Specific Gravity} = \frac{41 + 59}{\frac{41}{2.597} + \frac{59}{2.626}} = 2.614$$

(b) Combined Bulk (Oven Dry), Bulk (SSD), or Apparent specific gravity for coarse aggregate, fine aggregate, and mineral admixture, is determined by the following:

$$\text{Combined Specific Gravity} = \frac{P_c + P_f + P_{\text{admixture}}}{\frac{P_c}{G_c} + \frac{P_f}{G_f} + \frac{P_{\text{admixture}}}{G_{\text{admixture}}}}$$

Where:  $P_c$  = Percent of Coarse Aggregate  
 $P_f$  = Percent of Fine Aggregate  
 $P_{\text{admixture}}$  = Percent of Mineral Admixture, by weight of the mineral aggregate  
 $P_c + P_f + P_{\text{admixture}}$  = 100 + % Mineral Admixture  
 $G_c$  = Specific Gravity of Coarse Aggregate  
 $G_f$  = Specific Gravity of Fine Aggregate  
 $G_{\text{admixture}}$  = Specific Gravity of Mineral Admixture  
           Type I or II Cement = 3.14  
           Type IP Cement = 3.00  
           Hydrated Lime = 2.20

Example:

$$\begin{aligned} P_c &= 41 \\ P_f &= 59 \\ P_{\text{admixture}} &= 1.0\% \\ G_c &= 2.597 \\ G_f &= 2.626 \end{aligned}$$

Type of Mineral Admixture = Hydrated Lime  
 Mineral Admixture Specific Gravity = 2.20

$$\text{Combined Specific Gravity} = \frac{41 + 59 + 1.0}{\frac{41}{2.597} + \frac{59}{2.626} + \frac{1.0}{2.20}} = 2.609$$

(c) Combined absorption for coarse aggregate and fine aggregate is determined by the following:

$$\text{Combined Absorption} = \frac{(P_c \times A_c) + (P_f \times A_f)}{P_c + P_f}$$

Where:  $P_c$  = Percent of Coarse Aggregate  
 $P_f$  = Percent of Fine Aggregate  
 $P_c + P_f$  = 100  
 $A_c$  = Percent water absorption of coarse aggregate  
 $A_f$  = Percent water absorption of fine aggregate

NOTE: The equation shown above for combined absorption differs from that currently shown in Arizona Test Methods 210 and 211. In the future, appropriate changes in these test methods will be made to reflect the above equation, but in the interim period the calculation shall be performed as shown above.

Example:

$P_c$  = 41  
 $P_f$  = 59  
 $A_c$  = 1.51  
 $A_f$  = 1.43

$$\text{Combined Absorption} = \frac{(41 \times 1.51) + (59 \times 1.43)}{41 + 59} = 1.46\%$$

(d) Combined absorption for coarse aggregate, fine aggregate, and mineral admixture, is determined by the following:

$$\text{Combined Absorption} = \frac{(P_c \times A_c) + (P_f \times A_f) + (P_{\text{adm}} \times A_{\text{adm}})}{P_c + P_f + P_{\text{adm}}}$$

Where:  $P_c$  = Percent of Coarse Aggregate  
 $P_f$  = Percent of Fine Aggregate  
 $P_{\text{admix}}$  = Percent of Mineral Admixture, by weight of the mineral aggregate  
 $P_c + P_f + P_{\text{admix}}$  = 100 + % Mineral Admixture  
 $A_c$  = Percent water absorption of coarse aggregate  
 $A_f$  = Percent water absorption of fine aggregate  
 $A_{\text{admix}}$  = Percent water absorption of mineral admixture (assumed to be 0.0%)

Example:

$P_c$  = 41  
 $P_f$  = 59  
 $P_{\text{admix}}$  = 1.0  
 $A_c$  = 1.51  
 $A_f$  = 1.43  
 $A_{\text{admix}}$  = 0.0

$$\text{Combined Absorption} = \frac{(41 \times 1.51) + (59 \times 1.43) + (1.0 \times 0.0)}{41 + 59 + 1.0} = 1.45\%$$

### 3. REPORT

(a) Report combined Bulk (Oven Dry), Bulk (SSD), or Apparent specific gravity to the nearest 0.001, and indicate the type of specific gravity, whether Bulk (Oven Dry), Bulk (SSD), or Apparent.

(b) Report combined absorption to the nearest 0.01%.

(c) Report whether the combined specific gravity and absorption is for coarse aggregate and fine aggregate, or whether the combined specific gravity and absorption is for coarse aggregate, fine aggregate, and mineral admixture.