METHOD OF ADJUSTING CONCRETE MIXES FOR VARIATION IN AGGREGATE MOISTURE CONTENT

(An Arizona Method)

Scope

1. This method is intended for determining the field batch weights for a concrete mix on a Saturated Surface-Dry, or an Oven Dried basis.

The objective is to correct the field mix design for the percentage of moisture in the aggregates, either on an SSD or OD basis.

Apparatus and Procedure

2. If oven dried basis is desired refer to paragraph (a). For S.S.D. basis, paragraphs (b) and (c) shall be adhered to.

(a) Use the apparatus and follow the procedure for determining the percent total moisture content and the percent surface moisture content of coarse and fine aggregate on a oven dried basis. (AASHTO T 255)

(b) Determine the percent surface moisture of the coarse aggregate on a S.S.D. basis as shown below:

1) Weigh and record the weight of a representative sample of wet coarse aggregate as sampled from the stockpile. The sample should weigh at least 1500 g.

2) Place the sample on a towel or absorbent cloth and dry by rubbing or rolling until the sample still appears damp but no sheen caused by reflected light from free water on the surface of the particles. This is the "saturated surface-dry" state.

3) Weigh and record the weight of the "Saturated Surface Dry" sample. Care shall be taken during the weighing operation to prevent loss of moisture by evaporation.

4) The calculations are as follows:

$$\% \text{ Surface Moisture} = \frac{\text{Wet wt.} - \text{SSD wt.}}{\text{SSD wt.}} \times 100$$

Example:

Wet wt. = 2056 g.

SSD wt. = 2040 g.

$$\% \text{ Surface Moisture} = \frac{2056 - 2040}{2040} \times 100 = 0.8\%$$

(c) Determine the percent surface moisture of the fine aggregate (sand) on a S.S.D. basis as shown below:

1) Fill a Chapman flask with water to the 200 ml. mark on the lower neck. The temperature of the water shall be from 65° F to 85° F.

2) Pour a moist sample weighing exactly 500 g. down the neck of the flask.

3) Agitate or roll so as to remove all air bubbles.

4) After all air bubbles have been removed, record the level of the liquid on the scale on the upper neck of the flask.

5) The percent surface moisture shall be calculated as follows:

$$M = \frac{V - \left(\frac{W_w}{\text{Sp. Gr.}}\right) - V_w}{W_w + V_w - V} \times 100$$

Where:

M = Percent Surface Moisture

V = Volume of combined water and sand, ml.

Sp. Gr. = Bulk Specific Gravity of Sand (S.S.D.)

W_w = Wet wt. of sand = 500 g.

V_w = Volume of water = 200 ml.

Example:

Volume of water and sand = 399 ml.

Specific Gravity of Sand = 2.653

$$M = \frac{399 - \left(\frac{500}{2.653}\right) - 200}{500 + 200 - 399} \times 100 = \frac{10.5}{301} = 3.5\%$$

NOTE: The specific gravity of sand from any one source usually may be considered as constant; however, periodic determinations should be made to verify this. The specific gravity reported with the mix design may be used in the calculation. If no specific gravity has been recorded it may be determined for the sample in accordance with AASHTO T-84, Specific Gravity and absorption of fine aggregate.

Calculations and Example (for Oven-dry Basis)

3. The following serves to illustrate adjustments on an oven-dried (OD) basis:

(a) Moisture contents as determined in 2(a) on an oven dried basis:

Total: Sand = 5.9% water

Coarse = 3.0% water

Surface: Sand = 4.9% water

Coarse = 1.0% water

Asportion: Sand = 1.0%

Coarse = 2.0%

(b) Mix Design (Oven dry basis):

Cement = 94 lb. (one sack)

Sand = 203 lb.

Coarse = 301 lb.

Water = 7.6 gal. (@ 8.33 lb/gal) = 63 lbs.

(c) Batch weight adjustment:

Cement = 94 lb. (unchanged)

$$\text{Sand} = \frac{(\text{O.D. wt.})\ (100 + \%\ \text{total water})}{100}$$

$$= \frac{(203)\ (105.9)}{100} = 215 \text{ lb.}$$

$$\text{Coarse} = \frac{(\text{O.D. wt.})\ (100 + \%\ \text{total water})}{100}$$

$$= \frac{(301)\ (103.0)}{100} = 310 \text{ lb.}$$

$$\text{Surface moisture in sand} = \frac{(\%\ \text{surface water})\ (\text{O.D. wt.})}{100}$$

$$= \frac{(4.9)\ (203)}{100} = 10 \text{ lb.}$$

$$\text{Surface moisture in coarse} = \frac{(\%\ \text{surface water})\ (\text{O.D. wt.})}{100}$$

$$= \frac{(1.0)\ (303)}{100} = 3 \text{ lb.}$$

Total surface moisture = 10 + 3 = 13 lb.

$$\text{Gallons of surface moisture} = \frac{13 \text{ lb.}}{8.33 \text{ lb./gal.}} = 1.6 \text{ gals.}$$

Mix water required = 7.6 — 1.6 = 6.0 gals.

(d) Adjusted batch weights:

Cement = 94 lb.

Sand = 215 lb.

Coarse = 310 lb.

Water = 6.0 gals. (@8.33 lbs/gal) = 50 lbs.

Calculations and Example (for S.S.D. basis)

4. The following serves to illustrate adjustments, on a SSD basis:

(a) Percent surface moisture as determined in 2(b) and (c) on a SSD basis:

Sand = 3.5% water

Coarse = 0.8% water

(b) Mix Design (Saturated Surface-Dry basis):

Cement = 94 lb. (1 sack)

Sand = 205 lb.

Coarse = 307 lb.

Water = 6.5 gal. (@ 8.33 lb/gal) = 54 lbs.

(c) Batch weight adjustment:

Cement = 94 lb. (unchanged)

$$\text{Sand} = \frac{(\text{SSD wt.})\ (100 + \%\ \text{water})}{100}$$

$$= \frac{(205)\ (103.5)}{100} = 212 \text{ lb.}$$

$$\text{Coarse} = \frac{(\text{SSD wt.})\ (100 + \%\ \text{water})}{100}$$

$$= \frac{(307)\ (100.8)}{100} = 309 \text{ lb.}$$

Surface moisture in sand = 212 — 205 = 7 lb.

Surface moisture in coarse = 309 — 307 = 2 lb.

Total Surface Moisture = 7 + 2 = 9 lb.

$$\text{Gallons of surface moisture} = \frac{9 \text{ lb.}}{8.33 \text{ lb. gal.}} = 1.1 \text{ gal.}$$

Gallons of mixing water required = 6.5 — 1.1
= 5.4 gal.

(d) Adjusted batch weights:

Cement = 94 lb. (unchanged)

Sand = 212 lb.

Coarse = 309 lb.

Water = 5.4 gal. (@ 8.33 lb./gal/) = 45 lbs.

Report

5. Report adjusted batch weights to the nearest 1 lb., and water content to the nearest 0.1 gal.