Consider the following example: The 28-day compressive strength should be 4,000 psi. The slump should be between 3 and 4 in. and the maximum aggregate size should not exceed 1 in. The coarse and fine aggregates in the storage bins are wet.

The properties of the materials are as follows:

- Cement: Type I, specific gravity = 3.15
- Coarse Aggregate: Bulk specific gravity (SSD) = 2.70; absorption capacity = 1.1%; dry-rodded unit weight = 105 lb./ft.³; surface moisture = 1%
- Fine Aggregate: Bulk specific gravity (SSD) = 2.67; absorption capacity = 1.3%; fineness modulus = 2.70; surface moisture = 1%

**Step 1.** Required material information (already given).

**Step 2.** The slump is given, consistent with Table 1.

**Step 3.** Maximum aggregate size. Given: 1 in.

**Step 4.** Estimation of mixing water and air content. From Table 2, the recommended air content is 1.5%; the water requirement is 325 lb./yd.³.

**Step 5.** Water/cement ratio. From Table 3, the estimate for required w/c ratio to give a 28-day strength of 4,000 lb./in.² is 0.57.

**Step 6.** Calculation of cement content. Based on steps 4 and 5, the required cement content is:

\[
\text{weight of cement} = \frac{325 \text{ lb./yd.}^3}{0.57} = 570 \text{ lb./yd.}^3.
\]

**Step 7.** Estimation of coarse aggregate content. Interpolating Table 4 for the fineness modulus of the fine aggregate of 2.70.
The coarse aggregate will occupy:

\[
\text{Volume}_c = 0.68 \times 27 \text{ ft.}^3/\text{yd.}^3 = 18.36 \text{ ft.}^3/\text{yd.}^3
\]

Value from Table 4

The OD weight of the coarse aggregate

\[
\text{Weight}_c = 18.36 \text{ ft.}^3/\text{yd.}^3 \times 105 \text{ lb./ft.}^3 = 1,928 \text{ lb./yd.}^3
\]

Dry-Rodded Unit Weight

**Step 8.** Estimation of fine aggregate content by the absolute volume method.

<table>
<thead>
<tr>
<th>Water (ft³)</th>
<th>Water (lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>325 lb.</td>
</tr>
<tr>
<td>62.4 lb./ft³</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cement (ft³)</th>
<th>Cement (lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>570 lb./(3.15 x 62.4 lb./ft³)</td>
</tr>
<tr>
<td>3.15 x 62.4 lb./ft³</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coarse Aggregate (ft³)</th>
<th>Coarse Aggregate (lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1,928 lb./(2.70 x 62.4 lb./ft³)</td>
</tr>
<tr>
<td>2.70 x 62.4 lb./ft³</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Air (ft³)</th>
<th>Air (%) x 27 ft³/yd³</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.5% x 27 ft³/yd³</td>
</tr>
</tbody>
</table>

Total: 19.96 ft³

Therefore, the fine aggregate must occupy a volume of:

\[
27 \text{ ft.}^3 - \text{Volume}_c = \text{Volume}_f = 19.96 \text{ ft.}^3
\]

The SSD weight of the fine aggregate is:

\[
\text{Weight}_f = \text{Volume}_f \times \text{SG}_f \times \text{Unit Weight of Water}
\]

Specific Gravity of Fine Aggregate

Unit Weight of Water

\[
\text{Weight}_f = 7.04 \text{ ft.}^3 \times 2.67 \times 62.4 \text{ lb./ft.}^3 = 1,173 \text{ lb.}
\]
Class ACI Mix Design Example

- **Step 9.** Adjustment for moisture in the aggregate.

The weight of aggregate from the stock pile is:

\[ \text{Weight}_{\text{Stock\ Pile}} = \text{Weight}_{\text{OD}} (1 + MC) \]

The change in the weight water due to the moisture of the aggregate from the stock pile is:

\[ \Delta \text{Weight}_{\text{Water}} = \text{Weight}_{\text{OD}} \times (SM) \]

Adjusted Weight Water = Weight Water - \Delta Weight Water

Class ACI Mix Design Example

- **Step 9.** Compute stockpile weight based on moisture content

Fine aggregate required from the stockpile is:

1,173 lb. \((1 + 0.028)\) = 1,206 lb./yd.³

Moisture Content 2.8%

Coarse aggregate required from the stockpile is:

1,928 lb. \((1 + 0.021)\) = 1,968 lb./yd.³

Moisture Content 2.1%

Class ACI Mix Design Example

- **Step 9.** Adjust the amount of water based on moisture content

The required mixing water required is:

325 lb. - 1173 lb. \((0.015)\) \(\leftarrow\) fine aggregate

- 1,928 lb. \((0.01)\) \(\leftarrow\) coarse aggregate

= 288 lb./yd.³

Surface moisture 1.5%

Thus the estimated batch weights per yd.³ are:

<table>
<thead>
<tr>
<th>Material</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>288 lb.</td>
</tr>
<tr>
<td>Cement</td>
<td>570 lb.</td>
</tr>
<tr>
<td>Coarse aggregate</td>
<td>1,968 lb.</td>
</tr>
<tr>
<td>Fine aggregate</td>
<td>1,206 lb.</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>4,031 lb./yd.³</strong></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>149.3 lb./ft.³</strong></td>
</tr>
</tbody>
</table>