DENSITY
OF
CONCRETE
AASHTO T 121

APPARATUS

[ ] Measure, in accordance with AASHTO T 121 or the measuring bowl of an air meter

[ ] Balance
[ ] Class G20, in accordance with AASHTO M 231
[ ] Range extends from weight of measure empty to weight of measure plus contents at 160 lb/ft³

[ ] Tamping Rod
[ ] Round straight steel rod 5/8 ± 1/16 inch diameter
[ ] At least 4 inches longer than the measure used
[ ] Maximum length of 24 inches
[ ] Tamping end rounded to hemispherical tip with same diameter as the rod

[ ] Internal Vibrator
[ ] Rigid or flexible shaft powered by electric motor
[ ] Minimum frequency of vibration of 7000 vibrations per minute
[ ] Outside diameter or side dimension at least 3/4 in. and not greater than 1 1/2 in.
[ ] Length of shaft at least 24 in.

[ ] Strike-Off Plate
[ ] Flat rectangular metal plate at least 1/4 in. thick or a glass or acrylic plate at least 1/2 in. thick
[ ] Length and width at least 2 in. greater than diameter of measure
[ ] Edges straight and smooth within a tolerance of 1/16 in.

[ ] Mallet
[ ] Rubber or rawhide head
[ ] Weight of 1.25 ± 0.50 lb for use with measures 0.5 ft³ or smaller
[ ] Weight of 2.25 ± 0.50 lb for use with measures larger than 0.5 ft³

[ ] Scoop
[ ] Large enough to ensure material is representative
[ ] Small enough not to spill material during placement in the measure
PROCEDURE

[ ] Compaction method of concrete

[ ] Measures smaller than 0.4 ft³ by rodding
[ ] Measures 0.4 ft³ or larger the method as follows:

<table>
<thead>
<tr>
<th>Slump</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 3 in.</td>
<td>Rodding</td>
</tr>
<tr>
<td>1 to 3 in.</td>
<td>Rodding or Vibration</td>
</tr>
<tr>
<td>&lt; 1 in.</td>
<td>Vibration</td>
</tr>
</tbody>
</table>

Note: For PCCP, the compaction method for beams shall be by vibration

Rodding Method

[ ] Measure dampened and leveled on a flat firm surface
[ ] Measure filled in three layers of approximately equal volume. For each layer, the scoop is moved around the perimeter of the mold opening to ensure even distribution and minimal segregation of the concrete
[ ] Top layer filled to avoid overfilling
[ ] Each layer rodded 25 strokes when 0.5 ft³ or smaller measures are used
[ ] Each layer rodded 50 strokes when 1 ft³ or larger measure is used
[ ] Bottom layer rodded uniformly over the cross section of the measure and throughout its depth without rod forcibly striking the bottom of the measure
[ ] Second and top layer rodded throughout its depth, so that the strokes penetrate about 1 in. into the underlying layer
[ ] Measure tapped smartly 10 to 15 times with mallet after each layer is rodded
[ ] An excess of concrete is protruding approximately 1/8 in. above the top of the measure after rodding and tapping
[ ] Top surface struck off with plate and finished smooth
[ ] Plate pressed on top surface of measure covering two-thirds of surface and plate withdrawn with sawing motion
[ ] Plate again placed over original two-thirds of surface and advanced with vertical pressure and sawing motion
[ ] Several final strokes are made with the inclined edge of the plate to produce smooth finished surface
[ ] Exterior of measure cleaned and measure weighed to obtain gross weight
[ ] Unit weight calculated as follows:

\[
\text{Density}, \text{lb/ft}^3 = \frac{M_c - M_m}{V_m}
\]

where:

\( M_c \) = weight of the measure filled with concrete, lbm
\( M_m \) = weight of the measure, lbm
\( V_m \) = volume of measure, ft³
Vibration Method

[ ] Measure dampened and leveled on a flat firm surface
[ ] Measure filled in two layers of approximately equal volume. For each layer, the scoop is moved around the perimeter of the mold opening to ensure even distribution and minimal segregation of the concrete
[ ] All of concrete for each layer placed in measure before starting vibration
[ ] Vibrator inserted at three different points of each layer
[ ] Vibrator not resting on or touching the bottom or sides of measure when compacting bottom layer
[ ] Vibrator penetrates into the underlying layer approximately 1 in. when compacting top layer
[ ] Vibrator withdrawn in such manner that no air pockets are left in the concrete
[ ] Duration of vibration is such that the surface of the concrete is relatively smooth and proper consolidation is achieved, (overvibration may cause segregation and loss of appreciable quantities of intentionally entrained air)
[ ] An excess of concrete is protruding approximately 1/8 in. above the top of the measure after vibration
[ ] Top surface struck off with the inclined edge of the plate and finished smooth
[ ] Exterior of measure cleaned and measure weighed to obtain gross weight
[ ] Unit weight calculated as follows:

\[
\text{Unit Weight, lb/ft}^3 = \frac{\text{Net Weight}}{\text{Volume of Measure}}
\]

where:

Net Weight = gross weight minus the weight of the measure calculated to the nearest 0.01 lbm
Volume of Measure = ft³, as stated on calibration form

NA - Not Applicable
X - Requires Corrective Action
√ - Satisfactory

Acceptance Technician

____________________________________________________________
INDOT                Date

Comments: ____________________________________________________________________
_____________________________________________________________________________
_____________________________________________________________________________
FIELD VERIFICATION OF WEIGHING DEVICES USED IN THE TESTING OF CONCRETE

Type of Weighing Device:

[ ] General Purpose Balance Direct-Reading Balance
[ ] General Purpose Balance Equal-Arm Balance
[ ] Scale

Manufacturer, Model No. & Serial No.:
______________________________________________________________________________
______________________________________________________________________________

Readability: (Smallest unit of weight that can be read)

[ ] 5 g or 0.005 kg

Sensitivity: (Weight required to produce a change in reading)

[ ] 5 g or 0.005 kg

Accuracy: (Maximum permissible deviation of reading from true value within applicable tolerances)

[ ] Range of use is identified as follows:

__________ kg through __________ kg (_________ lbm through _________ lbm)

[ ] Test Loads applied and readings confirm accuracy of 5 g or 0.1 % of test load, whichever is greater, throughout range of use (see table below)

<table>
<thead>
<tr>
<th>Weight Applied, g</th>
<th>Indication on Balance, g</th>
<th>Weight Difference, g</th>
<th>Percent of Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>3,500</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5,000</td>
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<tr>
<td>10,000</td>
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<td>15,000</td>
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<tr>
<td>20,000</td>
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</table>

Remarks: _____________________________________________________________________
______________________________________________________________________________

Verified by: _________________________________________________ Date: _____________