

**MAKING AND CURING
CONCRETE TEST SPECIMENS
IN THE FIELD
AASHTO T 23**

APPARATUS

- Cylinder Molds, in accordance with AASHTO M 205
- Beam Molds
 - Inside surface smooth
 - Sides, bottom, and ends at right angles to each other, straight and true, and free of warpage
 - Maximum variation from nominal cross section does not exceed 1/8 in.
 - Length of inside of beam mold is greater than 19 15/16 in.
- Tamping Rod
 - Round, straight steel rod
 - Tamping end rounded to hemispherical tip
 - Rod dimensions as follows:

Diameter of Cylinder Or Width of Beam	Rod Dimensions	
	Diameter	Length
< 6 in.	5/16 - 7/16 in.	8-16 in.
6 in.	9/16 - 11/16 in.	16-24 in.
9 in.	9/16 - 11/16 in.	22-30 in.

Table 1

- Internal Vibrator
 - Rigid or flexible shaft powered by electric motor
 - Minimum frequency of vibration of 7000 vibrations per minute while in concrete
 - Diameter of round vibrator no more than one-fourth diameter of cylinder mold or one-fourth width of beam mold
 - Other shaped vibrators have perimeter equivalent to circumference of appropriate round vibrator
 - Combined length of shaft and vibrating element exceeds maximum depth of section being vibrated by at least 3 in.
- Mallet
 - Rubber or rawhide head
 - Mass of 1.25 ± 0.50 lbm
- Sampling and Mixing Receptacle, suitable heavy gage metal pan, wheelbarrow, or flat, clean nonabsorbent mixing board
- Small tools, shovels, pails, trowels, wood float, metal float, blunted trowels, straightedge, feeler gage, scoops, and rules

PROCEDURE -- MOLDING SPECIMENS

- [] Specimens molded on a level, rigid, horizontal surface, free from vibration and other disturbances, and near as practicable to storage location
- [] Concrete placed in molds with scoop, blunted trowel, or shovel
- [] Concrete remixed in mixing pan with shovel or trowel to prevent segregation during molding
- [] Scoop, trowel, or shovel moved around the perimeter of mold opening when adding concrete to ensure even distribution of concrete
- [] Specimens made in layers of approximately equal volumes and rodded as follows:

Specimen Type and Size	Number of Layers of Approximately Equal Depth	Number of Roddings Per Layer
Cylinder Diameter **		
4 in.	2	25
6 in.	3	25
9 in.	4	50
Beam Width		
6 to 8 in.	2	1 per 2 in. ² top surface area
> 8 in.	3 or more equal depths, each not exceeding 6 in.	1 per 2 in. ² top surface area

Table 2

- [] Specimens made in layers by vibration as follows:

Specimen Type and Size	Number of Layers	Number of Vibrator Insertions per Layer	Approximate Depth of Layer
Cylinder Diameter**			
4 in.	2	1	1/2 depth of specimen
6 in.	2	2	1/2 depth of specimen
9 in.	2	4	1/2 depth of specimen
Beam Width			
6 to 8 in.	1	*	depth of specimen as near as practicable
>8 in.	2 or more	*	depth of specimen as near as practicable

Table 3

* Vibrator inserted at intervals not exceeding 6 in. along center of line of long dimension of specimen. For specimens wider than 6 in., use alternating insertions along two lines.

** Cylinders at least three times the nominal maximum size of the coarse aggregate

- [] Final layer placed in an amount that will fill mold after compaction
- [] Underfilled molds adjusted with representative concrete during consolidation of top layer
- [] Compaction method of concrete as follows:

Slump	Method
> 1 in.	Rodding or Vibration
≤1 in.	Vibration

Consolidation -- Rodding

- [] Each layer rodded with rounded end of tamping rod in accordance with Table 2
- [] Rodding distributed uniformly over cross section of mold
- [] Bottom layer rodded throughout its depth
- [] Rod penetrates through layer being rodded and into the layer below approximately 1 inch
- [] After each layer is rodded, mold is lightly tapped 10 to 15 times with open hand or mallet
- [] After tapping, beam mold is spaded along the sides and ends with a trowel or other suitable tool for each layer

Consolidation -- Vibration

- [] Number of insertions per layer in accordance with Table 3
 - [] All of concrete for each layer placed in mold before starting vibration
 - [] Vibration maintained for uniform time period each insertion
- Note: Usually, sufficient vibration has been applied as soon as the surface of the concrete has become relatively smooth and larger air bubbles cease to break through the top surface. Generally, no more than 5s of vibrations should be required for each insertion to adequately consolidate concrete with a slump greater than 3 in. Longer times may be required for lower slump concrete, but the vibration time should rarely have to exceed 10 s per insertion.
- [] Vibrator inserted slowly and not allowed to rest on bottom or sides of mold
 - [] Vibrator withdrawn slowly in such a manner that no air pockets are left in concrete
 - [] Shaft of vibrator penetrates into bottom layer approximately 1 in.
 - [] After each layer is vibrated, mold is tapped at least 10 times with mallet (For cylinders that are susceptible to damage if tapped with a mallet, an open hand should be used)When the final layer is placed, overfilling by more than 1/4 in. should be avoided.

Finishing -- Cylinders

- [] Excess concrete struck off from surface
- [] Top surface finished by striking off with tamping rod where consistency of the concrete permits or with wood float or trowel
- [] Finishing performed with minimum manipulation that produces a flat even surface level with rim of mold
- [] Surface or concrete has no depressions or projections larger than 1/8 in.

Finishing -- Beams

- [] After consolidation, excess concrete struck off from surface
- [] Finishing performed with minimum manipulation that produces a flat even surface level with mold (wood float may be used)

PROCEDURE -- STANDARD CURING SPECIMENS**Cylinders -- Initial Curing**

- [] After finishing, cylinders immediately moved to initial curing place where they have remained undisturbed
- [] Initial curing done by completely submerging cylinders in water at a temperature of 60 to 80°F for no less than 16 nor more than 48 h (QC/QA Superstructure Only)
- [] Satisfactory temperature environment controlled by use of ventilation, ice, thermostatically controlled heating or cooling devices, heating methods such as stoves or light bulbs, or other suitable methods
- [] Container of water is level to within 1/4 in. / ft
- [] Container of water shielded from direct rays of sun and radiant heating devices
- [] Cylinders that are transported are protected with suitable cushioning to prevent damage from jarring and freezing. Moisture loss prevented by wrapping specimens in plastic, wet burlap, or surrounding them with wet sand or tight fitting plastic caps on plastic molds
- [] Transportation of cylinders to laboratory after initial curing did not exceed 4 hours
- [] Cylinders are left in molds until received in laboratory and placed in final curing

Cylinders -- Final Curing

- [] Upon completion of initial curing, molds are removed and within 30 minutes specimens stored in moist condition with free water maintained on their surfaces at all times at a temperature of $73 \pm 3^\circ\text{F}$. Temperatures between 68 and 80° F are permitted for a period not to exceed 3 h immediately prior to test if free moisture is maintained on the surface of the cylinders at all times.
- [] Moist storage obtained by immersion in water, or storage in a moist room or cabinet complying with AASHTO M 201
- [] When capping with sulfur mortar compound, the ends of the cylinder are dried before capping

Beams -- Initial Curing

- [] After finishing, beams immediately moved to initial curing place where they have remained undisturbed
- [] Immediately after molding and finishing, beams are stored at a temperature of 60 to 80°F for no less than 24 nor more than 48 hours
- [] Beams stored in a moist environment such as water saturated with calcium hydroxide, damp sand pit, closed plastic bag, covered with plastic sheets or nonabsorbent plates and damp burlap (the burlap shall not contact the concrete surface), or other suitable methods
- [] Satisfactory temperature environment controlled by use of ventilation, ice, thermostatically controlled heating or cooling devices, heating methods such as stoves or light bulbs, or other suitable methods
- [] Curing location shielded from direct rays of sun and radiant heat devices
- [] Transportation of beams to laboratory after initial curing did not exceed 4 hours, if applicable
- [] Beams are left in molds until placed in final curing

Beams -- Final Curing

- [] Upon completion of initial curing, molds are removed and within 30 minutes beams are stored in a moist condition with free water maintained on their surface at all times at a temperature of $73 \pm 3^\circ\text{F}$.
- [] Moist storage obtained by immersion in water storage tank, or storage in a moist room or cabinet complying with AASHTO M 201
- [] Beams stored in water saturated with calcium hydroxide at $73 \pm 3^\circ\text{F}$ at least 20 hr prior to testing
- [] Drying of surfaces of the beams prevented between removal from water storage and completion of testing

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

Acceptance Technician

INDOT

Date

Comments: _____
