Method of Making and Curing Concrete Specimens in the Field for Compression Tests

---

1. Scope:

This is the procedure for making and curing concrete specimens to be used for compression tests.

2. Apparatus:

2.1 Cylinder mold - Inside measurements will be 6” in diameter by 12” high or 4” in diameter by 8” high.

A. Reusable molds metallic split type held together by clamps and have a rigid base that can be attached by clamps. The diameter of the molds used for 28 day cylinders will not differ from the nominal diameter by more than ± 0.02” inches.

B. Single use molds will be plastic and have a tightly fitting plastic top cap used that will maintain the circular shape at the top of the cylinder.

NOTES:

All 28 day and 28 day backup cylinders will be cast using 6” x 12” metallic molds.

Early break cylinders will be cast using 6” x 12” or 4” x 8” plastic or metallic molds. When the nominal maximum size of the coarse aggregate is greater than 1 in. 6” x 12” molds will be required.

In RCP pipe, precast, and prestressed concrete, all cylinders will be 6” x 12” unless an alternate curing system requiring 4”x 8” cylinders approved by the Concrete Engineer is used. RCP pipe, precast, and prestressed concrete with a specified design strength, as indicated in approved shop drawings, of more
than 6,000 psi may use 4” x 8” cylinders when approved by the Concrete 23
Engineer.

2.2 Tamping rods - A round smooth straight steel rod with diameter conforming to the following table, having both ends rounded to a hemispherical tip of the same diameter as the rod. The length of the tamping rod will be at least 4 inches greater than the depth of the mold in which rodding is being performed, but not greater than 24 inches.

Cylinder Size	Rod Diameter (in.)
4" X 8"	3/8 ± 1/16
6" X 12"	5/8 ± 1/16

2.3 Mallet - A mallet (with a rubber or rawhide head) having a mass of 1.25 ± 0.50 lb.

2.4 Scoop - A scoop of a size large enough so a representative amount of concrete is obtained and small enough that concrete is not spilled during placement in the measure.

2.5 Finishing Tools – Straightedge, handheld float, or trowel.

3. Procedure:

3.1 Molding specimens.

A. Obtain a sample of concrete in accordance with SD 402.

B. Mold the specimens in layers as indicated in the following table:

23

Cylinder Size	Number of Layers of Approximately Equal Depth	Number of Roddings per Layer
6" X 12"	3	25
4" X 8"	2	25

Rod the lower layer to its total depth, but the rod must not forcibly strike the bottom of the bucket so as to cause excessive vibration. Rod the second and third layers with the rod penetrating slightly (Approximately 1 inch) into the layer below. Distribute the strokes uniformly over the cross section of the layer being rodded.

After each layer is rodded, tap the outsides of the mold 10 to 15 times with the rubber mallet. Tap with enough force to close any holes left by rodding and to release any large air bubbles that may have been trapped. For concrete with a slump of less than 2 in. the number of taps may be increased to achieve consolidation.

Heap the concrete above the top of the mold for the final layer, adding additional concrete, as required, to keep the surface above the mold as it is rodded.

Self-Consolidating Concrete – Mold the specimens as described in 3.1.B without layers or consolidation.

C. Strike off surface with a straightedge or trowel.

D. Curing and Transporting the Cylinders.

(1) Cover each cylinder individually with non-absorbent material (Plastic) and seal to prevent moisture loss.

(2) If it is necessary to move the cylinders a short distance (carrying distance), do so immediately while the concrete is still in a plastic state. Prevent damage to the top of the concrete surface, the top of cylinders must be flat.

(3) Store specimens where they are not subject to vibration or being moved for 24 ± 8 hours after molding. Schedule moving of the cylinders as close to the 24 hour time frame as possible.

To check for excess vibration, drive a 2” x 2” stake into the ground and place a glass of water on top. If ripples are visible in the glass of water, vibration is excessive.

(4) Cylinders should never be exposed to the direct rays of the sun or be in direct contact with radiant heating or radiant cooling devices. Pavement surfaces act as a radiant heater or radiant cooler. Therefore, use insulating material between the pavement and cylinders or choose a more acceptable location.

(5) If extra cylinders are made, they can be field cured until tested to determine when to put concrete into service, protection/curing of the concrete, or form removal timing. The temperature and moisture of field cured cylinders will be kept as close as possible to the represented concrete. Leave the specimens in the molds until tested or forms or blankets are removed from the represented concrete whichever comes first.
Where the cylinders can be stored under the blankets, field 23
curing extra cylinders may be desirable for pavement repair or fast track concrete.

(6) The temperature surrounding the cylinders (except for field curing) should be maintained as closely as practical between 60° and 80°F. If additional measures are needed for temperature control, the below hot or cold weather options will be used:

A. Hot weather concreting.

The following are possible options depending on forecasts and current weather conditions.

- Move the plastic specimens a short distance (carrying distance) and place them in a temperature controlled job facility immediately after molding.

- Place individually covered cylinders in a cool shady area and cover with wet burlap and white plastic.

- Fill a 5-gal. bucket or comparable container to within 1/2” of the top of the cylinders with cool water. Cover container to reduce temperature changes and water evaporation. Consider drilling a hole in the bucket at the high water mark to prevent water from contacting the top of the cylinder until after initial set.

- Use a large cooler or other suitable insulated container and open the top for ventilation to allow the heat from the cylinders to escape. Ice may be used inside the container, but do not let the ice or ice water come in direct contact with the cylinders.

- Make a small pit in the ground or sand to accommodate the cylinders. After the cylinders are placed in the pit, cover the top of the pit area with wet burlap and white plastic or wet sand.

B. Cold weather concreting.

The following are possible options depending on forecasts and current weather conditions.

- Move the plastic specimens a short distance (carrying distance) and place them in a temperature controlled job facility immediately after molding.

- Use a large cooler or other suitable insulated container and close the top to retain the heat from the cylinders.

- Place individually covered cylinders in a sunny area and cover with wet burlap and black plastic.

- Place specimens adjacent to the freshly placed concrete under blankets or other insulating material to utilize the heat from the freshly placed concrete in maintaining the temperature of the cylinders, provided the cylinders will not be subjected to vibration.

(7) Transport the cylinders in the mold, within 24 $\pm$ 8 hours after casting, to a facility with lime (calcium hydroxide) water tank.

Schedule moving of the cylinders as close to the 24 hour time frame as possible. Remove cylinders from the mold and place in lime water solution.

The lime water in the curing tank should have a concentration of 1 teaspoon of lime to 1 gallon of water and will be maintained at a temperature range of 70° to 77°F. Stir the lime water daily.

In lieu of a lime water curing tank, a moist room may be used. The moist room will maintain a temperature range of 70° to 77°F and a relative humidity of not less than 95%.

NOTE: Before placing the cylinders into the lime water solution, make sure the necessary identification data has been written on the top and side of each cylinder (Figure 2 and 3).

(8) Cylinders will be placed in plastic cylinder bags for transporting to Area or Central Office to keep cylinders moist at all times. Cylinders must be protected from jarring or excessive bumps while in vehicle. Transporting may also be done by placing the specimen in a bed of sand.

If a cylinder is dropped or mishandled in any way (curing problems, excessive heat or cold, dryness, etc.) make a note on the DOT-23.

Only one cylinder is to be sent to the Central Laboratory for the 28 day test. The 28 day cylinder will be sent in between 15 and 21 days. In the event that the 14 day cylinder fails to meet strength, the backup cylinder will be sent in with the original.

4. Report:

DOT-7 (Central Office)
DOT-23

5. References:

AASHTO M 205
SD 402
DOT-7
DOT-23

Sample ID 2225664 **Concrete Worksheet** DOT-23

File No. 3 -19

PROJECT PH 0066(00)15 COUNTY Aurora, Ziebach PCN B015

Charge to (if not above project)

Type of Concrete 11" Nonreinforced PCC Pavement Contractor Roads, Inc

Conc. Class

Supplier Roads Inc Subcontractor

Submitted By Tester, One Send Results To

Project Engineer Koch, John Fresh Concrete Tested By Tester, One

Fresh Concrete Test

Fresh Concrete Test Date	04/29/2019	
Field Cylinder/Beam No.	01	
Field No.	03(01)	
Truck No.	15	
Time		
Station / Location	Mainline - SBL	
Description	59+00	
Quantity Represented (Cu Yd)	132	Spec Limits
% Air Content (SD 403)	5.5	5.0 - 7.5
Slump. IN. (SD 404)	1.50	0.00 - 2.00
Concrete Temp. (Deg F) (SD 408)	72	50 - 90
Air Temp. (Deg F)	68	
Fresh Unit Weight Lb / Ft ^{3} (SD 411)	143.3	
W/C Ratio	0.400	
WRA (Y/N)	Y	

Compressive Strength Information

Lab Test No.						
Field Cylinder/Beam No.	01	01A	01B	01C		
Date Made	04/29/2019	04/29/2019	04/29/2019	04/29/2019	04/29/2019	04/29/2019
Age	28		14	7		
Date Broken	05/27/2019		05/13/2019	05/06/2019		
Diameter, IN.	6.00	6.00	6.00	6.00	6.00	6.00
Area, SQ. IN.	28.27	28.27	28.27	28.27	28.27	28.27
Max Load Lbs.						
Fracture Type	SHEAR	SHEAR	SHEAR	SHEAR	SHEAR	SHEAR
CompressiveStr. PSI (SD 420)	5550		5020	4570		
CompressiveStr. Corr. to 28-day						
Cylinder Lbs.	28.60		28.40	28.40		
Cylinder Unit Weight Lbs/ft ^{3}	145.4		144.7	144.7		

Comments:

Figure 1

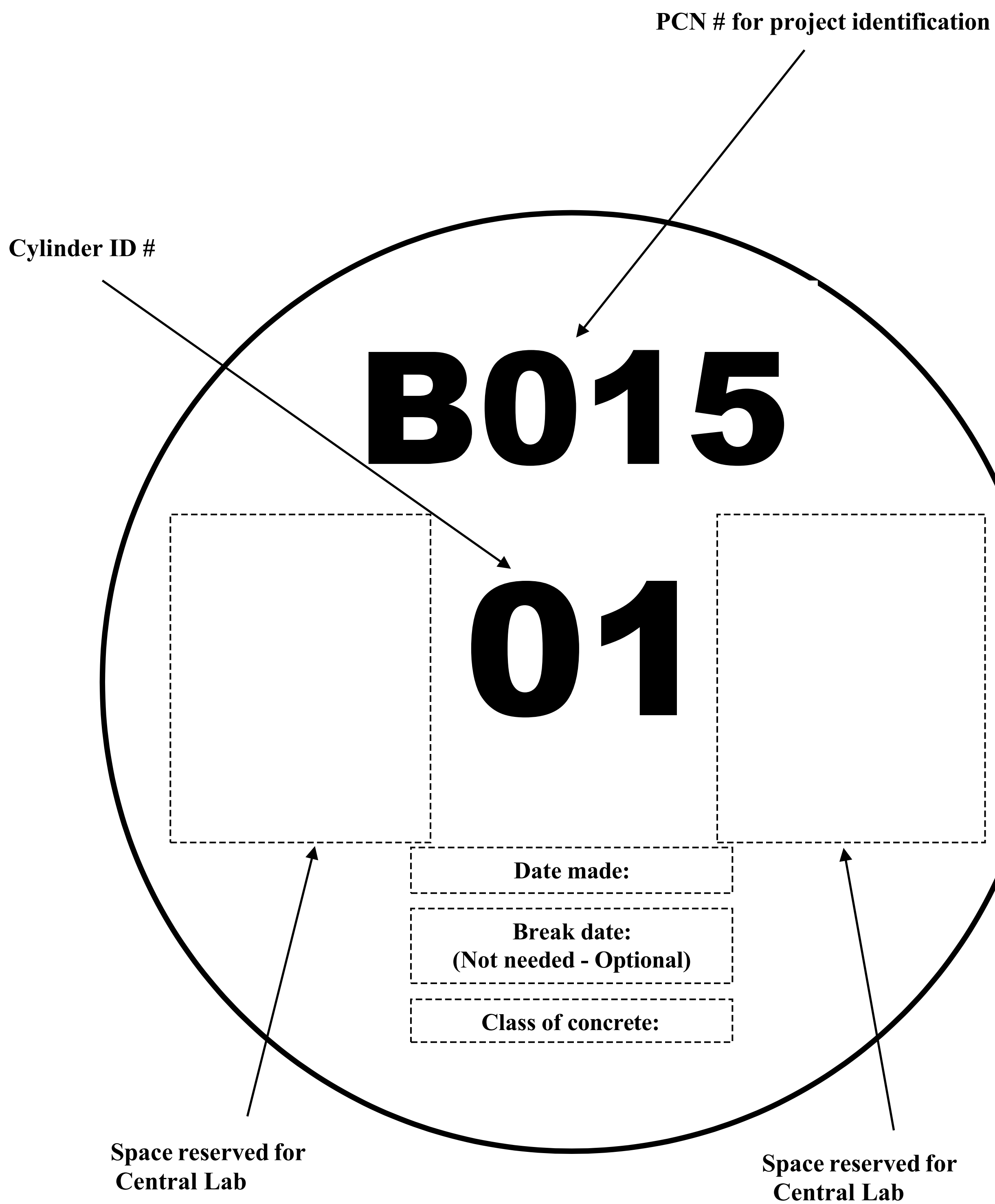
PCN # for project identification
Cylinder ID #
B015
01
Date made:
Break date:
(Not needed - Optional)
Class of concrete:
Space reserved for
Central Lab
Space reserved for
Central Lab

Figure 2

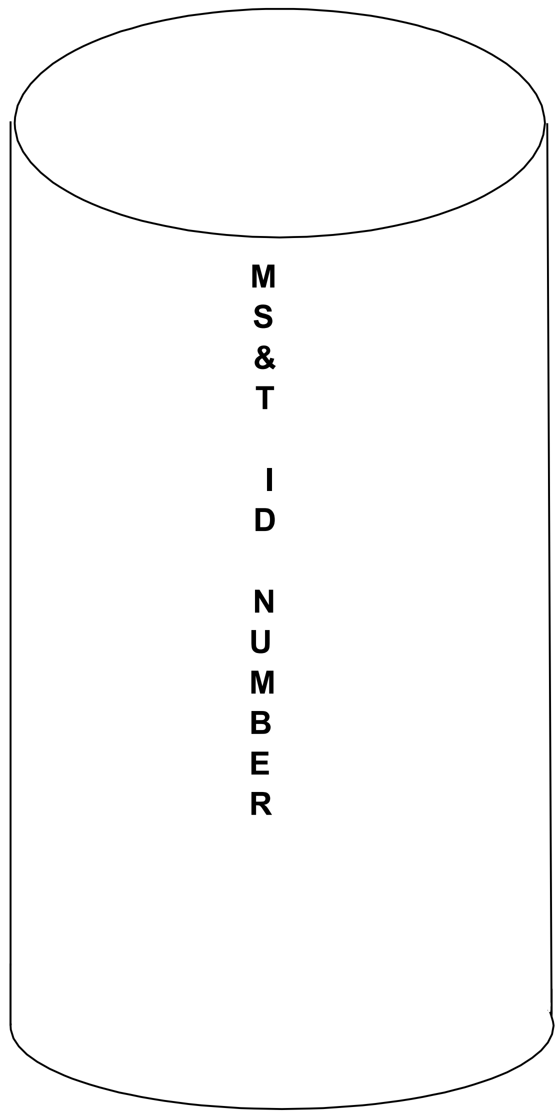

Figure 3