

Method of Test for Determining Compressive Strength of Concrete

1. Scope:

This test is for determining compressive strength of 6" diameter x 12" long and 4" diameter x 8" long molded concrete cylinders. The test is limited to concrete having a unit weight in excess of 50 lbs./ft³.

2. Apparatus:

- 2.1 A power operated hydraulic type compression test machine shall be used. The testing machine must have sufficient capacity, be capable of providing the rates of loading prescribed in section 3.4, and be capable of applying load consistently without shock or intermittence.
- 2.2 The test machine shall be fitted with two steel bearing blocks with hardened faces (Rockwell hardness of no less than 55HRC) and with a minimum dimension 3% greater than the test specimen's diameter.
- 2.3 The test machine shall include a spherically seated block (Lubricated with petroleum-type oil such as conventional motor oil) that will bear on the upper surface of the specimen. The sphere shall have a diameter of at least 75% of the diameter of the specimen to be tested. The bearing face shall have a diameter no greater than 10" when testing a 6" diameter cylinder and no greater than 6 ½" when testing a 4" diameter specimen.
- 2.4 Extrusion controllers shall be fitted with elastomeric pads satisfying AASHTO T 22. Elastomeric pads shall have a diameter 1/16" smaller than the inside diameter of the extrusion controller and have 1/2" ± 1/16" of compressible material.

NOTE: Pads should be visually inspected approximately every 25 tests and be replaced if cracks or splits longer than 3/8" are present. Scuffing or abrasion of the perimeter is permissible provided it does not reduce the thickness of the pad. The pad inspection and record of when they are changed is recorded on the DOT-12.

- 2.5 The cavity of the extrusion controller must have a diameter of no less than 102% and no greater than 107% of the diameter of the cylinder. The depth of the cavity shall be twice the thickness of the elastomeric pad.

3. Procedure:

- 3.1 Compression tests on specimens shall be made as soon as practicable after removal from moist storage. A 28-day test shall be performed within ± 20 hours of the 28th day.

- 3.2 Clean the bearing faces of the bearing blocks, test specimen, and extrusion controllers (Elastomeric caps) so that they are free of any debris.
- 3.3 Place the test specimen in the lower extrusion controller, place the top extrusion controller on the specimen. Check the spacing between the sides of the specimen and the extrusion controllers to ensure no contact between the cylinder and the controllers. Slide the specimen and extrusion controller configuration into the compression machine and center it with the concentric circles on the upper bearing block.
- 3.4 Apply the load to the specimen. The load shall be applied at a rate of 28 to 42 psi/second. During the first half of the anticipated loading phase, a higher loading rate shall be permitted. Adjustments to maintain the specified loading rate may be made until the ultimate load is being approached and the stress rate is decreasing due to cracking in the specimen.

NOTE: For 6" diameter specimens, the loading rate shall be 790 to 1190 lbs./second. For 4" diameter specimens, the loading rate shall be 350 to 530 lbs./second.

- 3.5 Apply the load until the specimen fails, and record the maximum load (Q) supported by the specimen during the test rounded to the nearest 100 lb.
- 3.6 Record the type of fracture pattern according to figure 2. If the fracture pattern is not one of the typical patterns shown in figure 2, describe the pattern and sketch if necessary.

4. Report:

- 4.1 Calculations.

$$CS = Q/(\pi \times R^2)$$

Which reduces to:

$$\begin{aligned} \text{For 6" diameter specimen CS} &= Q/ 28.274 \\ \text{For 4" diameter specimen CS} &= Q/ 12.566 \end{aligned}$$

Where:

$$\begin{aligned} CS &= \text{Compressive strength (psi)} \\ Q &= \text{Load at failure (lb.-force)} \\ \pi &= 3.1416 \\ R &= \text{Radius of specimen (in.)} \end{aligned}$$

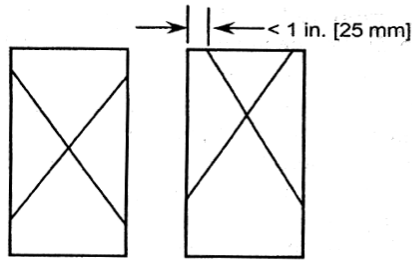
- 4.2 Report the compressive strength to the nearest 10 psi. If compressive strength needs to be corrected to 28 day strength, use correction factor in figure 1.

Age-Days	Factor
7	0.66
8	0.70
9	0.73
10	0.76
11	0.78
12	0.81
13	0.825
14	0.845
15	0.86
16	0.88
17	0.89
18	0.91
19	0.92
20	0.93
21	0.94
22	0.95
23	0.96
24	0.97
25	0.975
26	0.98
27	0.99
28	1
29	1.005
30	1.01
31	1.015
32	1.02
33	1.027
34	1.033

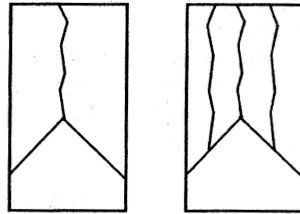
Age-Days	Factor
35	1.04
36	1.045
37	1.05
38	1.055
39	1.06
40	1.064
41	1.068
42	1.072
43	1.076
44	1.08
45	1.083
46	1.087
47	1.09
48	1.093
49	1.097
50	1.1
51	1.103
52	1.107
53	1.11
54	1.113
55	1.117
56	1.12
57	1.1225
58	1.125
59	1.1275
60	1.13
61	1.1325
62	1.135

Age-Days	Factor
63	1.1375
64	1.14
65	1.1425
66	1.145
67	1.1475
68	1.15
69	1.1525
70	1.155
71	1.1575
72	1.16
73	1.1617
74	1.1634
75	1.165
76	1.1667
77	1.1684
78	1.17
79	1.1717
80	1.1734
81	1.175
82	1.1767
83	1.1784
84	1.18
85	1.1817
86	1.1834
87	1.185
88	1.1867
89	1.1884
90	1.19

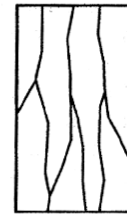
Figure 1



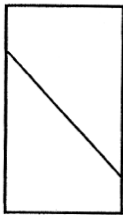
Type 1
Reasonably well-formed
cones on both ends, less
than 1 in. [25 mm] of
cracking through caps



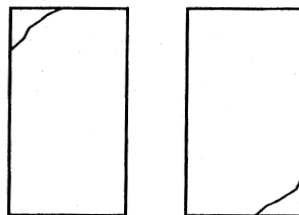
Type 2
Well-formed cone on one
end, vertical cracks running
through caps, no well-
defined cone on other end



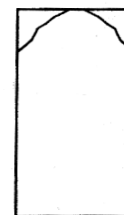
Type 3
Columnar vertical cracking
through both ends, no well-
formed cones



Type 4
Diagonal fracture with no
cracking through ends;
tap with hammer to
distinguish from Type 1



Type 5
Side fractures at top or
bottom (occur commonly
with unbonded caps)



Type 6
Similar to Type 5 but end
of cylinder is pointed

Figure 2

5. References:

AASHTO T 22
ASTM C39
ASTM C1231
DOT-12