1407 COMPRESSIVE STRENGTH OF CYLINDRICAL CONCRETE SPECIMENS

ASTM C39

1407.1 SCOPE

This method describes the procedure for determining if concrete used in road and bridge construction meets the specified strength requirements.

1407.2 TRAINING

Personnel performing this test must hold current certification in Strength Testing by either ACI, MnDOT or WisDOT.

1407.3 SIGNIFICANCE and USE

This test is performed in the laboratory to determine if the strength of concrete meets specification requirements. It is used as an indication of the potential of the materials used in a structure.

1407.4 RECEIVING CYLINDERS

A. Specimens are typically prepared in the field and fabricated in accordance with ASTM C 31 (AASHTO T 23).

B. Remove cylinder from mold.

C. Compare the information on the sample identification card with markings on the cylinder. Transfer any missing information to the cylinder top. If the information doesn't coincide notify the Lab Supervisor. Contact Project staff if further information or clarification is needed.

D. Inspect the cylinder in accordance with ASTM C 39 (Section 6, SPECIMENS) and notify the Lab supervisor of any imperfections that might make the cylinder not suitable for testing. If the Lab supervisor determines the cylinders can’t be corrected for testing, notify field personnel immediately.

E. Note (on the I.D. card) the break date, the date received and the required strength. Also make note of any break requirements other than 28 days. Any cylinder scheduled to be broken on a weekend or holiday may be rescheduled to the closest workday after the required break date (ie. no standard strength specimens should be broken prior to 28-days).

F. Place cylinders in a curing tank or moist room meeting the requirements of ASTM C 511 (AASHTO M 201).

G. Cap cylinders in accordance with ASTM C 617 or C 1231.

- Each end of the cylinder must receive the same type of cap treatment. (i.e. if using an un-bonded cap then each end must have an un-bonded cap.)
- Sulfur caps may be applied in either the horizontal or vertical position. When capped horizontally, the cylinder is suspended on a stand and a mold is placed on each end adjacent to the capping plate. This allows both ends to be capped at the same time. All other requirements of C 617 still apply including planeness and soundness.
- According to ASTM C 1231, when using unbonded neoprene caps, observe the following acceptable testing strengths and maximum uses for each neoprene cap hardness.
- During testing, the same surface of the neoprene cap shall bear on the concrete cylinder for all tests performed with that cap. Pads exhibiting cracks exceeding 3/8in. (10mm) in length, regardless of number of uses, must be replaced immediately.

Compressive Strength, psi	Shore A Durometer Hardness	Maximum Reuses
< 1,500	Use Bonded Cap Method	N/A
1,500 to 6,000	50	100
2,500 to 7,000	60	100
4,000 to 7,000	70	100
7,000 to 12,000	70	50
>12,000	Use Bonded Cap Method	N/A

1407.5 TESTING CYLINDERS

A. When removing cylinders from curing tank or moist room, cover with a damp towel or take other measures to make sure cylinders do not dry out. Cylinders must be tested in a moist condition.

B. Test the cylinders to failure according to the procedure in ASTM C 39, Section 7, taking into consideration the loading rate for the strength and size of the cylinder being tested. See Note 1.

NOTE 1: Calibrate machines annually or when moved.

C. Record the actual breaking load in the proper box on the cylinder I.D. card. Then calculate the breaking strength as described in Section 8 of ASTM C 39. Record the result on the I.D. card.

D. Record the break type (See Figure 1):
- Cone (a): Well-formed cones on both ends
- Cone and Split (b): Well-formed cone on one end, vertical cracks running through the other end.
- Cone and Shear (c): Well-formed cone on one end, with a diagonal fracture extending to the other end.
- Short Shear (d-s): Diagonal fracture occurs within a half of the cylinder's length, fractures through either end.
- Long Shear (d-l): Diagonal fracture with no cracking through either end.
- Columnar (e): Vertical cracking through both ends, no well-formed cones.
- Crumbling (f): Typical of low-strength concrete. Similar to type a, but with no well-formed cones.
- Crushing (g): Occurs in the top ¼ of the cylinder. Indicative of defective cylinder.

E. Standard 28-day Strength Cylinders (Sets of 3):
- When breaking, save all 3 cylinders until breaks are completed.
- Use the comments section to describe any observations related to the cylinders.
- If the average of 3 cylinders is more than 500 psi below required, take pictures and retain cylinders until the cause of low strengths is determined.

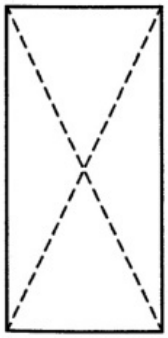
1407.6 REPORT

A. Include in report:
- Average measured diameter
- Cross sectional area
- Maximum Load (lbs.)
- Compressive Strength (nearest 10 psi.)
- Type of fracture
- Any defects
- Age at break
- Field Results
  - Batch Ticket Number
  - Air Temperature
  - Concrete Temperature
  - Slump
  - Air Content (%)

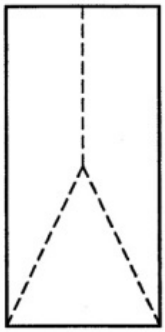
B. Enter data from I.D. cards into the computer and print reports.

C. Send cylinder test reports to the Engineer and the concrete plant using the email listed at the bottom of the test report.

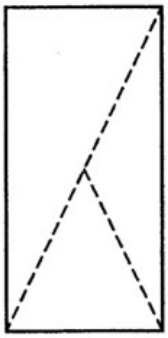
NOTE 2: Mark low strength cylinders as "High Importance" or indicate "Low Strength" in the subject line of email and send to the Concrete Unit.



Cone (a)

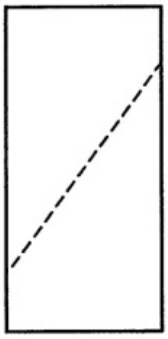


Cone and Split (b)

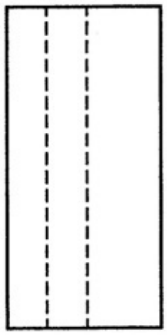


Cone and Shear (c)

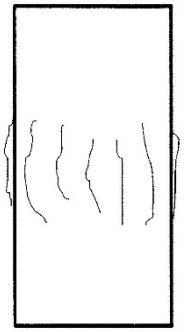
Short Shear (d-s)



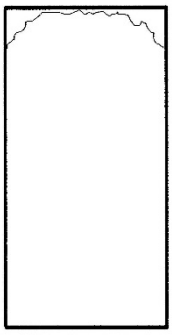
Long Shear (d-l)



Columnar (e)



Crumbling (f)



Top ¼ Crushing (g)

Figure 1: Compression Fracture Types