

DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES
Transportation Laboratory
5900 Folsom Boulevard
Sacramento, California 95819-4612



METHOD OF TEST FOR BALL PENETRATION IN FRESH PORTLAND CEMENT CONCRETE

A. SCOPE

This test method describes the procedure for determining the consistency of fresh concrete by measuring the depth of penetration of a metal mass into plastic concrete under the force of gravity. This method is a modification of ASTM Designation: C 360 and AASTHO Designation: T-183.

B. REFERENCES

ASTM C 360 - Ball Penetration in Freshly Mixed Hydraulic Cement Concrete
AASTHO T-183 - Test of Ball Penetration in Freshly Mixed Hydraulic Cement Concrete

C. APPARATUS

The ball penetration apparatus consists of a 6 in. steel cylinder with a hemispherically shaped bottom, which is machined to a smooth finish. The penetrator is attached to a shaft graduated to measure penetration to the nearest $\frac{1}{4}$ in. The mass of the apparatus (ball, shaft, and handle), exclusive of the yoke, is 30 ± 0.1 lb.

1. **Lightweight Concrete:** A modified ball is used for determining the consistency of fresh lightweight concrete. The modified ball is identical in shape and size to the 30 lb ball, but the mass of the lightweight apparatus (ball, shaft, and handle), exclusive of the yoke, is 20 ± 0.1 lb.
2. **Calibration:** Zero reading is established by placing the ball and the feet of the yoke on a plane surface. The shaft is then adjusted by turning the threaded shaft in the ball penetrator to obtain a zero reading at the top of the sleeve. The lock nut at the top of the penetrator is then tightened, see Figure 1.

D. TEST PROCEDURE

1. The ball penetration test may be made on concrete in a wheelbarrow, buggy, or other container, or after it has been deposited in the forms or on the subgrade. The depth of the concrete above the bottom of the container or reinforcement shall be at least 6 in. for 1 in. maximum size aggregate or smaller, and 8 in. for larger maximum-size aggregate.
2. The surface of the concrete to be tested is struck off level over an area of about 3 ft². Do not tamp, vibrate or consolidate the concrete. Scream the minimum amount required to obtain a reasonably level surface. Overworking may flush excess mortar to the surface and cause erroneously high penetration readings.
3. Hold the device by the handle; lower it slowly over the prepared area until the feet of the yoke touch the surface of the concrete. Make certain the shaft is in a vertical position and free to slide through the yoke. Gradually lower the ball penetrator

into the concrete, maintaining enough restraint on the handle so that penetration is due to the dead load of the ball only and not to any force generated by acceleration of the mass. When the ball comes to rest, release the handle and read the penetration to the nearest $\frac{1}{4}$ in. Penetration of the feet of more than $\frac{1}{8}$ in. may indicate that the concrete has been overworked in screeding the surface, or that the yoke is binding on the shaft.

4. Take a minimum of three individual readings for each penetration determination. Individual readings shall be at least 9 in. between centers. The minimum horizontal distance from the centerline of the handle to the nearest edge of the level surface on which the test is made shall be 6 in. The reported penetration shall be the average of the first three successive readings, which agree within $\frac{1}{2}$ in. of penetration.

E. REPORTING OF RESULTS

Report to the nearest $\frac{1}{4}$ in., the average of the three readings as “ ____ in. of penetration.”

F. NOTES

Accuracy is impaired if the surface of the ball is roughened by scratches, dents, or adhering mortar. It should be cleaned carefully after each test and always kept in the carrying case when not in use to prevent damage.

G. SAFETY AND HEALTH

It is the responsibility of the user of this test method to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Prior to handling, testing or disposing of any materials, testers must be knowledgeable about safe laboratory practices, hazards and exposure, chemical procurement and storage, and personal protective apparel and equipment.

Caltrans Laboratory Safety Manual is available at:

http://www.dot.ca.gov/hq/esc/ctms/pdf/lab_safety_manual.pdf

End of Text
(California Test 533 contains 3 pages)



FIGURE 1
Picture of Ball on Table Showing Condition at Zero Penetration