

State of Nevada
Department of Transportation
Materials Division

METHOD OF TEST FOR BALL PENETRATION IN FRESH PORTLAND CEMENT CONCRETE

SCOPE

This test method describes the procedure for determining the consistency of fresh concrete by measuring the depth of penetration of a metal weight.

APPARATUS

Ball penetration apparatus, consists of a 150 mm (6 in.) diameter steel cylinder with a height of 118 mm (4 5/8 in.) with a hemispherically shaped bottom that is machined to a smooth finish. The penetrator is attached to a shaft graduated to measure penetration to the nearest 6 mm (1/4 in.). The weight of the apparatus (ball, shaft, and handle), exclusive of the yoke, is 13.61 ± 0.05 kg (30 ± 0.1 lb). The handle shall be a metal rod, 13 mm (1/2 in.) in diameter and graduated in increments of 6 mm (1/4 in.), with each inch numbered from the zero point at the top of the yoke or sleeve. The handle may be T-shaped or a closed rectangle at the top to permit grasping by the hand.

For 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 13.61 kg (30 lb) ball, but the weight of the lightweight apparatus (ball, shaft, and handle), exclusive of the yoke, is 9.1 ± 0.05 kg (20 ± 0.1 lb).

CALIBRATION

To calibrate, a zero reading is established by placing the ball and the feet of the yoke on a flat 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 yoke or sleeve. The lock nut at the top of the penetrator is then re-tightened.

PROCEDURE

1. The test may be performed on concrete in a wheelbarrow, buggy, other container, 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 150 mm (6 in.) for 25 mm (1 in.) maximum size aggregate or smaller, and 200 mm (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 three square feet. Do not tamp, vibrate or consolidate the concrete. Screed 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. Holding 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 weight of the ball only and not to any force generated by dropping the ball. When the ball comes to rest, release the handle and read the penetration to the nearest 6 mm (1/4 in.). Penetration of the feet of more than 3 mm (1/8 in.) may indicate that the concrete has been overworked in screeding the surface, or that the yoke is binding on the shaft. Do not overwork the surface and re-test in another location.
4. For one penetration determination take three individual readings. Individual readings shall be at least 230 mm (9 in.) apart and at least 150 mm (6 in.) from a vertical edge. The reported penetration determination shall be the average of the first three individual readings.

Ex. $25 \text{ mm (1 in.)} + 30 \text{ mm (1 1/4 in.)} + 25 \text{ mm (1 in.)} = 80 \text{ mm (3.25 in.)} / 3 = 25 \text{ mm (1 in.)}$

REPORT

Report the average of the three readings to the nearest 6 mm (1/4 in.) of penetration determination. Results should be recorded on NDOT form 020-017.