PENETRATION TEST FOR STATIC SEGREGATION RESISTANCE OF SELF-CONSOLIDATING CONCRETE (SCC)
WAQTC TM 18

Scope

This procedure provides instruction for assessing the static segregation resistance of self-consolidating concrete (SCC) in accordance with ASTM C1712-17.

Segregation is the tendency for coarse aggregate to separate from the sand-cement mortar. Segregation resistance is a critical requirement in self-consolidating concrete.

Static segregation is affected by fluid (paste) rheology and by the size, density, volume fraction, shape, and gradation properties of suspended particles (aggregates).

Static segregation may occur after the SCC has been placed until it has hardened.

This method is a quick and easy assessment of the likelihood that static segregation of an SCC concrete will occur. A mass (penetration head) is placed on a sample of static (motionless) SCC in a mold for a specified time and the distance that the mass penetrates the SCC is measured.

Warning—Fresh hydraulic cementitious mixtures are caustic and may cause chemical burns to skin and tissue upon prolonged exposure.

Apparatus

- Mold: meeting the requirements of the FOP for AASHTO T 119.
- Penetration apparatus, meeting the requirements of ASTM C1712, consisting of:
  - Support frame
  - Metal sleeve
  - Set screw
  - Penetration head comprised of a hollow cylinder with a metal rod bolted vertically to the top.
  - Reading scale with 1 mm increments mounted on the support frame next to the metal rod
- Base plate (optional): flat, rigid, non-absorbent moistened surface on which to set the mold
- Strike-off bar: a straight steel bar or other suitable metal.
- Pouring vessel or scoop: a water-tight container large enough so each amount of concrete obtained from the sampling receptacle is representative and small enough, so it is not spilled during placement in the mold.

Procedure

Testing may be performed in conjunction with the FOP for AASHTO T 347/T 351 providing the mold is filled and removed within 2 ½ minutes.

1. Prepare the penetration apparatus.
    a. Dampen the hollow cylinder.
    b. Hold the device horizontally and release the set screw.
    c. Spin the hollow cylinder to ensure free movement of the rod in the sleeve.
    d. Ensure the bottom of the hollow cylinder does not protrude past the bottom of the frame.
    e. Tighten the set screws to hold the rod in the sleeve.
2. Obtain the sample according to the FOP for WAQTC TM 2.
3. Dampen the inside of the mold.
4. Invert the mold and place on the dampened base plate or a dampened, rigid, nonabsorbent surface that is level and firm. Hold down firmly.
5. Use the pouring vessel or scoop to slightly overfill the mold. Do not rod or tamp the SCC. Do not tap or vibrate the mold.
6. Use the strike-off bar to strike off the SCC level with the top of the mold.

Note 2: When performing in conjunction with the FOP for AASHTO T 347/T 351, clean off all SCC from around the base of the mold to prevent interference with the flowing SCC.

7. Allow SCC to stabilize for 80 ±5 sec.
8. Position the penetration apparatus while the SCC is stabilizing.
    a. Place the device on the top of the inverted mold with the penetration head aligned with the center of the inverted mold.
    b. Hold the metal rod while releasing the set screw.
    c. Lower the penetration head carefully so that it just touches the surface of the SCC.
    d. Tighten the set screw to hold the metal rod in place.
    e. Read the mark on the scale that is in line with the top of the metal rod. Designate as d_i.
9. At the end of 80 ±5 sec., release the set screw so that the hollow cylinder penetrates the SCC.
10. After 30 ±2 sec, read the mark on the scale that is in line with the top of the metal rod. Designate as d_f.

Note 3: Continue with Step 8 of the FOP for AASHTO T 347/T 351 if performing them together.

11. Calculate the penetration depth (P_d), by subtracting d_i from d_f.

Calculation

Calculate the penetration depth.

$$P_d = d_f - d_i$$

Where:

P_d = penetration depth, mm

d_f = final reading, mm

d_i = initial reading, mm

Example:

$$P_d = 17\ mm - 5\ mm = 12\ mm$$

Given:

d_f = 17 mm

d_i = 5 mm

Report

- On forms approved by the agency
- Sample ID
- Penetration depth (P_d) to the nearest 1 mm