

FRESHLY MIX CONCRETE TESTINGS

Quality Control Technician
Training Module
For Internal In-house Training Purposes Only

FRESHLY MIX CONCRETE TESTINGS

What is “FRESHLY MIX CONCRETE TESTINGS”?

Freshly mixed concrete testing refers to verification of concrete properties and characteristics of the concrete mixture to ensure it meets the desired specifications and requirements for the intended application.

WHAT ARE THE CONCRETE TESTING ASSOCIATED ON FRESHLY MIX CONCRETE?

1. Slump Test
2. Temperature Test
3. Air Content Test
4. Density Test

Slump Test

ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete
BS EN 12350-2:2019 - Testing fresh concrete. Slump-test

This test measures the consistency and workability of concrete by determining the "slump" or the amount of settlement that occurs when a conical mold is filled with fresh concrete and then removed. It is widely used for assessing the consistency of concrete in the field.

Common apparatus for fresh concrete testing

1. Slump cone.
2. Compacting rod.
3. Funnel (optional).
4. Ruler / Measuring tape
5. Base plate/surface.
6. Remixing container or tray.
7. Shovel.
8. Moist cloth.
9. Scoop.
10. Timer.
11. Sealed container (when slump retention is to be measured).
12. Trowel or float



Slump Test Procedures

1. Dampen the mold and place it on a flat, moist, non-absorbent (rigid) surface.
2. Rod each layer with 25 strokes of the tamping rod. Uniformly distribute the strokes over the cross section of each layer. For the bottom layer, this will necessitate inclining the rod slightly and making approximately half of the strokes near the perimeter, and then progressing with vertical strokes spirally toward the center. Rod the bottom layer throughout its depth. Rod the second layer and the top layer each throughout its depth, so that the strokes just penetrate into the underlying layer.
3. In filling and rodding the top layer, heap the concrete above the mold before rodding is started. If the rodding operation results in subsidence of the concrete below the top edge of the mold, add additional concrete to keep an excess of concrete above the top of the mold at all times. After the top layer has been rodded, strike off the surface of the concrete by means of a screeding and rolling motion of the tamping rod. Continue to hold the mold down firmly and remove concrete from the area surrounding the base of the mold to preclude interference with the movement of slumping concrete. Remove the mold immediately from the concrete by raising it carefully in a vertical direction. Raise the mold a distance of 12 in. [300 mm] in 5 to 2 s by a steady upward lift with no lateral or torsional motion. Complete the entire test from the start of the filling through removal of the mold without interruption and complete it within an elapsed time of 2 and 1/2 min.
4. Immediately measure the slump by determining the vertical difference between the top of the mold and the displaced original center of the top surface of the specimen. If a decided falling away or shearing off of concrete from one side or portion of the mass occurs, disregard the test and make a new test on another portion of the sample.

Temperature Test

ASTM C1064/C1064M - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete

Monitoring the temperature of fresh concrete is essential, especially in hot or cold weather conditions, as it can affect the setting time and strength development.

Common apparatus for fresh concrete Temperature Test

1. Digital Thermometer
2. thermocouples
3. infrared thermometers



Temperature Test Procedure

1. Obtain a representative sample of freshly mixed concrete from the batch being used for construction.
2. Take care to sample from different portions of the batch to account for any temperature variations.
3. Decide on the locations where temperature measurements will be taken. Typically, measurements are made at the surface, mid-depth, and near the center of the concrete mass.
4. Place the thermocouples or thermometer probes at the predetermined measurement locations.
5. If using a digital thermometer or infrared thermometer, point the sensor towards the surface of the concrete at the designated measurement locations.
6. Ensure good contact between the sensor and the concrete surface to obtain an accurate reading.
7. Record the temperature readings at each measurement location.
8. Take readings at regular intervals to capture any temperature changes over time.
9. Document the temperature measurements, including the locations, times, and readings obtained.
10. Maintain records for quality control purposes and future reference.

Air Content Test

ASTM C231/231M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C138/C138M - Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
BS EN 12350-7:2019 - Testing fresh concrete Air content Pressure methods
BS EN 12350-6:2019 - Testing fresh concrete Density
BS EN 12350-8:2019 - Testing fresh concrete Air content Volumetric method

Air entrainment in concrete is crucial for durability, especially in freeze-thaw environments. The air content test measures the volume of air voids in freshly mixed concrete. Methods include pressure methods (such as the pressure meter method) and volumetric methods (such as the volumetric method with a graduated cylinder).

Common apparatus for Air Content Test

Pressure Meter
Tamping Rod
Measuring Ruler
Graduated Cylinder



Air Content Test Procedure

Equipment Preparation:

- Ensure that the pressure meter apparatus is clean and in good working condition.
- Check that the pressure gauge is calibrated and functioning properly.
- Prepare the concrete sample by obtaining a representative portion of the freshly mixed concrete.

Sample Preparation:

- Fill the pressure meter bowl or base with a known volume of water.
- Place the lid or top plate on the pressure meter base.
- Lubricate the rim of the lid or top plate to ensure a watertight seal.
- Insert the correct amount of concrete into the pressure meter bowl or base in layers, compacting each layer with a tamping rod or mechanical vibrator.
- Ensure thorough compaction to remove any air voids.

Sealing and Pressurizing:

- Once the concrete sample is in place, ensure that the lid or top plate is securely fastened to the pressure meter base.
- Connect the pressure meter to a source of compressed air.
- Gradually apply pressure to the concrete sample by pressurizing the pressure meter.
- Monitor the pressure gauge readings until a stable pressure is achieved, typically around 30 psi (200 kPa) for standard testing.

Reading the Air Content:

- Once the pressure is stable, record the pressure gauge reading.
- Release the pressure slowly while observing the water level in the pressure meter.
- Note the change in water level as air is released from the concrete sample.
- Record the final water level after the pressure is fully released.

Calculating the Air Content:

Calculate the air content of the concrete using the following formula:

$$\text{Air Content (\%)} = V_c / V_a \times 100$$

Where:

V_a = volume of air voids in the concrete sample (determined from the change in water level).

V_c = total volume of the concrete sample.

Reporting and Interpretation:

Report the air content of the concrete sample as a percentage.

Compare the measured air content with project specifications or relevant standards to ensure compliance.

Cleaning and Maintenance:

Clean the pressure meter apparatus thoroughly after each use to prevent contamination.

Store the equipment properly in a clean and dry environment to maintain its integrity and accuracy.

Concrete Density Test Procedure

BS EN 12350-6:2019 - Testing fresh concrete. Density
ASTM C138/C138M - Standard Test Method for Density (Unit Weight), Yield, and Air Content

This test is important for verifying the yield of concrete delivered to the construction site.

Common apparatus for Air Content Test

Density Cylinder
Balance Scale
Water Container
Straight Edge or Trowel
Graduated Cylinder
Caliper or Measuring Ruler



Equipment Preparation:

Gather the necessary equipment, including a density basket or volumetric flask, a scale capable of measuring to the required precision, and a container for water.

Sampling:

Obtain a representative sample of freshly mixed concrete from the batch being used for construction. Take care to sample from different portions of the batch to ensure representativeness.

Preparation of the Density Basket or Volumetric Flask:

Fill the density basket or volumetric flask with water and record the mass of the container and water (M_w). Ensure the container is clean and free of any debris.

Weighing the Empty Density Basket or Volumetric Flask:

Record the mass of the empty density basket or volumetric flask (M_b).

Filling the Density Basket or Volumetric Flask with Concrete:

Place the freshly mixed concrete into the density basket or volumetric flask, ensuring it is filled completely and compacted thoroughly to remove any air voids.

Level the surface of the concrete with a straight edge.

Weighing the Concrete-filled Density Basket or Volumetric Flask:

Record the mass of the density basket or volumetric flask filled with concrete (M_c).

Determining the Volume of Concrete:

Calculate the volume of the concrete by subtracting the volume of water displaced by the concrete from the total volume of the density basket or volumetric flask.

Calculate the volume of water displaced using the formula: $\text{Volume of water displaced} = M_b + M_c - M_w$.

Calculating the Density of Concrete:

Calculate the density of the concrete using the formula: $\text{Density} = \text{Mass of concrete (Mc)} / \text{Volume of concrete}$.
The density is typically expressed in units such as kilograms per cubic meter (kg/m^3) or pounds per cubic foot (lb/ft^3).

Reporting and Interpretation:

Record the density of the concrete sample and compare it with project specifications or relevant standards to ensure compliance.

Note any deviations from the specified density and investigate potential causes.

Cleaning and Maintenance:

Clean the equipment thoroughly after each use to prevent contamination.

Store the equipment properly in a clean and dry environment to maintain its integrity and accuracy.

QUESTIONS:

1. What can affect the setting time and strength development of a concrete?
 - A. Adding water to concrete.
 - B. Adding concrete admixture.
 - c. mixing concrete.
 - D. Concrete Temperature.
2. What is the concrete testing for consistency and workability of a concrete?
 - A. Concrete Moisture
 - B. Concrete Slump
 - C. Concrete Cube Sample
 - D. Concrete Density
3. How many strokes of tamping rod for each layer of the slump?
 - A. 45 Strokes
 - B. 25 Stokes
 - C. 35 Stokes
 - D. 55 Strokes

4. Before to start slump test what you should do with the slump cone and where to place it?
 - A. Dampen the mold and place it on a Slope, non-moist, non-absorbent (rigid) surface
 - B. Dampen the mold and place it on a flat, moist, non-absorbent (rigid) surface
 - C. Dampen the mold and place it on a Slope, moist, non-absorbent (rigid) surface
 - D. Dampen the mold and place it on a Slope, moist, absorbent (rigid) surface

5. To measure the slump where you should measure to determine the slump reading?
 - A. Measure the slump by determining the Horizontal difference between the top of the mold and the displaced original center of the top surface of the specimen.
 - B. Measure the slump by determining the Vertical difference between the top of the mold and the displaced original center of the top surface of the specimen.
 - C. Measure the slump by thermometer
 - D. Measure the slump by making concrete cube samples

6. If a decided falling away or shearing off of concrete from one side or portion of the mass occurs what you should do?
 - A. Disregard the test and make a new test on another portion of the sample
 - B. Disregard the test and Reject the concrete.
 - C. Disregard the test and make a new test on the same portion of the sample
 - D. Disregard the test and make concrete cube sample

7. What is the test method to determine volume of air voids in freshly mixed concrete?

- A. Air Content / Air entrainment
- B. Slump Test
- C. Density Test
- D. Water Content

8. What kind of concrete test to determine the yield of concrete?

- A. Water Content
- B. Slump Test
- C. Air Content / Air entrainment
- D. Density Test

9. What are the two types of Methods used in Air entrainment?

Answer:

10. As Quality Control Technician what you should do after each and every test you perform?

Answer: