TESTS ON FRESH CONCRETE
6.1 SLUMP TEST

STANDARD

• IS: 1199 –1959.
OBJECTIVE

- To determine the workability of concrete

APPARATUS

- Mould for the test shall be in the form of the frustum of a cone having the following internal dimensions bottom diameter-20 cms, top diameter-10 cms, height-30 cms.

- The mould shall be made of metal (Brass or Aluminum shall not be used) of at least 1.6 mm thickness and the top and bottom shall be open and at right angles to the axis of the cone.

- The mould shall have a smooth surface.

- It shall be provided with suitable foot pieces and also handles to facilitate lifting it during the test in a vertical direction as required.

- Tamping rod shall be of steel or other suitable material, 16mm diameter, 0.6 m long rounded at one end with graduations of least count 1mm.

Sampling in the Field

- If the test is to be conducted in the field collect the true representative sample of the batch not less than 0.02 m$^3$ in volume.

- Mix the sample on a non-absorbent base either with a trowel or by other suitable implements to ensure uniformity.

- Use the sample immediately for the purpose of carrying out the test.

- In the case of concrete containing aggregate of maximum size more than 38 mm wet sieve the concrete through 1½ inch screen to exclude aggregate particles bigger than 38 mm.

Sampling from Laboratory Mix

- If the slump is to be checked in the laboratory mix the sample homogeneously and take the representative sample.

Preparation of the Mould

- Thoroughly clean the internal surface of the mould free from superfluous moisture and any set concrete.

- Place the mould on a smooth, horizontal rigid and non-absorbent surface such as a carefully leveled metal plate and held the mould firmly in the place while it is being filled.

PROCEDURE

- Fill the mould in four layers each approximately one quarter of the height of the mould.

- Prod each layer with twenty five strokes of the rounded end of the tamping rod.

- Distribute the strokes uniformly over the cross section of the mould such that the second and subsequent layers shall penetrate into underlying layer.

- Prod the bottom layer through out its depth.

- After the top layer has been prodded, struck off the concrete in level with the slump cone with a trowel or with the tamping rod, so that the mould is exactly filled.
• Clean the mortar if any, which has been leaked out between the mould and base plate.
• Remove the mould from concrete immediately by raising it slowly and carefully in a vertical direction.

Fig: 6.1.1 True slump                         Fig: 6.1.2 Shear                            Fig: 6.1.3 Collapse

• Measure the slump immediately by determining the difference between the height of the mould and that of the highest point of the specimen
• Complete the whole process within a period of 2 minutes after sampling.

REPORT
• Record the slump measured in terms of millimeters of subsidence of the specimen during the test.
• Any slump specimen, which collapses or shears off laterally gives incorrect result and if this occurs repeat the test with another sample
• If in the repeated test also the specimen collapses or shears off laterally measure the slump and record the fact.

PRECAUTION
• Carry out the slump test at a place free from vibration or shock and within a period of 2 minutes after sampling.

6.2 DETERMINATION OF COMPACTION FACTOR
STANDARD
- IS: 1199 -1959 (5.2).

DEFINITION
- Compaction factor is defined as the ratio of the weight of partially compacted concrete to the weight of fully compacted concrete.

APPARTUS
- Compaction factor apparatus
- Platform scale100kg capacity and sensitivity10 grams
- Hand Scoop
- Vibrating Table

PROCEDURE
- Determine the initial weight ($W_1$) of the cylinder.
- Place the sample of concrete gently in the upper hopper, using the hand scoop
- Fill the hopper in level with its brim.
- Open the trap door so that the concrete falls in to the lower hopper.
- Certain mixes have a tendency to stick in one or both the hoppers.
- If this occurs, help the concrete through by passing the rod gently in to the concrete from the top.

Fig: 6.2.1 Checking of mould for C.F.          Fig: 6.2.2 Compacting mix in to cylinder.
- During the process cover the cylinder by the trowels.
- Uncover the cylinder immediately after the concrete has come to rest.
- Open the trap door of the lower hopper and allow the concrete to fall in to the cylinder
- Remove the excess concrete above the level of the cylinder by holding a trowel in each hand with the plane of the blades horizontal, and moving them simultaneously one from each side
across the top of the cylinder, at the same time keeping them pressed on the edge of the cylinder.

- Wipe the outside of the cylinder and weigh ($W_2$).
- Determine the net weight of the concrete in the cylinder ($W_2 - W_1$).
- This weight is known as the weight of partially compacted concrete.
- Refill the cylinder with the concrete from the same sample in layers approximately 5cms deep, ram heavily or preferably vibrate so as to obtain full compaction.
- Carefully level the top surface.
- Wipe the outside of the cylinder and weigh to the nearest 10gms ($W_3$).
- Determine the net weight of the concrete in the cylinder ($W_3 - W_1$).
- This weight is known as the weight of fully compacted concrete.

**CALCULATIONS**

\[
\text{Compaction Factor} = \frac{(W_3 - W_1)}{(W_2 - W_1)}
\]

**REPORT**

- Report the result obtained to the nearest second decimal.

**PRECAUTIONS**

- This test is sufficiently sensitive to enable differences in workability from the initial process in the hydration of the cement to be measured.
- Therefore each test shall be carried out at a constant time interval after mixing is completed.
- A convenient time for releasing the concrete from the upper hopper has been found two minutes after the completion of mixing.
STANDARD
- IS: 516 – 1959

OBJECTIVE
- To determine the compressive strength of cement concrete cubes

APPARATUS
- Batch mixer
- Vibrating table
- Cube moulds
- Tamping road 16mm diameter, 6m long and with bullet point at lower end
- Standard compression testing machine
- Steel scale with an accuracy of 1mm
- Balance of capacity 10kgs and sensitivity 1gram

PROCEDURE
- Test specimens shall be either from Laboratory mix or from mix produced by Batching plant.

Preparation of Mix in the Laboratory
- Collect representative samples of the materials for use in the particular concrete design by careful sampling.
- Bring all the materials to room temperature, preferably 27 ± 3°C before the mixing.
- Store the cement in a dry place, preferably in airtight metal containers.
- Samples of aggregates for each batch of concrete shall be of the desired grading and in air dried condition.
- Weigh the portion of materials including water as required for specified mix design to an accuracy of 0.1% of the total weight of the batch.
- Each batch of concrete shall be of such a quantity as to give about 10% excess after casting the described no of test specimens.
- When mixing is done by machine introduce all the mixing water in to the drum before the solid materials.
- Load the drum with one half of the coarse aggregate, then with the fine aggregate, then with the cement and finally with the remaining coarse aggregates.
- The period of mixing shall not be less than 2 minutes after all the materials are placed in the drum and shall continue till the resulting concreting is uniform in appearance.
• After thoroughly mixing pour the concrete on a watertight non-absorbent plat form and fill in to the moulds before segregation occurs.

**Casting of Specimens**
• Fill the concrete in to the mould in layers approximately 5cm deep.
• When compacting by hand use standard tamping rod and each layer is subjected to 35 strokes uniformly distributed.
• When compacting by means of table vibrator each layer shall be vibrated until the specified vibration is obtained.
• In both the cases after the top layer has been compacted finish the surface of the concrete in level with the top of the mould using a trowel and cover with a glass or metal plate to prevent evaporation.
• Store the test specimens in a place free from vibration, in moist air of at least 90 percent relative humidity and at a temperature of $27 \pm 2^\circ C$ for $24 \pm 1/2$ hours from the addition of water to the dry ingredients.
• After this period, mark the specimens and remove from the moulds and unless required for test within 24 hours

**Curing**
• Immediately submerge the cubes in a clean, fresh water or saturated lime solution and keep there until taken out just prior to test.
• Renew the water or solution in which the specimens are submerged for every seven days, and the temperature of water is maintained with the specified limits.
• Conduct testing at recognized ages of the specimens, the most usual being 7 and 28 days.
• When it may be necessary to obtain the early strength, conduct tests at the ages of $24 \pm 1/2$ hours and $72 \pm 2$ hours.
• Calculate the ages from the addition of water to the dry ingredients.
• Test at least three specimens preferably from different batches at each selected age.

**Testing**
• Test the specimens stored in water immediately on removal from water and while they are still in wet condition.
• Wipe off surface water, grit and any projecting fins removed.
• Record the weight and dimensions of the specimens to the nearest 0.20mm.
• Wipe the bearing surface of the testing machine clean and dry.
• Place the cube specimens in the machine in such a manner that the load is applied to opposite sides of the cubes as cast, that is, not to the top and bottom.
• Carefully align the axis of specimen carefully with the center of the thrust of the spherically seated platen.
• Do not use any packing between the faces of the test specimen and the platens of the testing machine.
• Apply the load with out shock and increase continuously at a rate of approximately 140 kg/cm$^2$/min or 340KN/min until the resistance of the specimen of the increasing load breaks down and no further load can be sustained.

![Fig: 6.3.1 Testing of concrete cubes.](image)

• The maximum load applied to the specimen shall then be recorded and the appearance of the concrete and any unusual features shall be noted.

**CALCULATIONS**

Load

$$\text{Compressive strength} = \text{Load} \div \text{Cross sectional area} \, \text{N/mm}^2$$

**REPORT**

• Report the individual and average of three values to the nearest second decimal.
• The individual variation of the specimens shall not be more than $\pm$ 15 percent of the average.
3.1.3 VEE-BEE

AIM

To determine the workability of fresh concrete by using a Vee-Bee consistometer as per IS: 1199 - 1959.

APPARATUS

![VEE-BEE CONSISTOMETER](image)

**FIG. 10 : VEE-BEE CONSISTOMETER**

i) Vee-Bee consistometer

PROCEDURE

i) A conventional slump test is performed, placing the slump cone inside the cylindrical part of the consistometer.

ii) The glass disc attached to the swivel arm is turned and placed on the top of the concrete in the pot.
iii) The electrical vibrator is switched on and a stop-watch is started, simultaneously.

iv) Vibration is continued till the conical shape of the concrete disappears and the concrete assumes a cylindrical shape.

v) When the concrete fully assumes a cylindrical shape, the stop-watch is switched off immediately. The time is noted.

REPORTING OF RESULTS

The consistency of the concrete should be expressed in VB-degrees, which is equal to the time in seconds, recorded in Para v), above.