Ready Mix Concrete

Concrete mixed in a stationary mixer in a central batching and mixing plant or in a truck-mixer and supplied in the fresh condition to the purchaser either at the site or into the purchaser's vehicles

PRODUCTION AND DELIVERY

- Material Storage and Handling
- Batching Plants and Batching Equipment
- Mixing
    - Stationary or central mixers
    - Truck mixers

Material Storage and Handling

Cement

- Separate storage for different types and grades of cement shall be provided
- Containers may be used to store cements of different types
- Bins or silos shall be weatherproof
- Cement shall be stored and stacked in bags
- Bags are kept free from dampness or moisture

Aggregates (Coarse and Fine)

- Stockpiles shall be free draining
- Provision shall be made for separate storage for each nominal size and type of aggregate
- Method of loading of storage bins shall be such as to prevent intermingling of different sizes and types

Batching Plants and Batching Equipment

- Hoppers for weighing cement, mineral admixtures, aggregates and water and chemical admixture shall consist of suitable load measuring device and equipped with a suitable discharging mechanism

- The method of control of the loading mechanism shall be such that, as the quantity required in the weighing hopper is approached, the material may be added at a controllable rate and shut off precisely

- When more than one type or grade of cement is being used, the weighing device and discharge screw or other parts of the transfer system shall be empty before changing from one type of cement to another

Mixing

Stationary or central mixers

- Plants include a stationary mixer that blends the concrete materials prior to discharge into the truck mixer. The truck mixer is used primarily as an agitator when the concrete is centrally mixed.
- Non-agitating haul units such as dump trucks may be also used to deliver concrete (usually relatively short distances) from a central mix plant. The main advantages of central mixing include faster batching and reduced wear of the truck mixer drums. However, central mix plants can be more expensive to purchase and maintain than transit mix plants.

Truck mixers

- When a truck mixer is used for the partial or complete mixing of concrete, mixing shall be considered to commence from the moment when all the materials required for the batch, including water, are in the rotating drum of the mixer.
- Mixing shall continue for not less than 60 revolutions of the truck mixer drum at a rate of not less than 7 revolutions/min
- When a truck mixer or agitator is used for transporting concrete which has been mixed before leaving the plant, the concrete shall be agitated during transit and re-mixed at the site for at least 2 min so that the concrete is of the required uniformity

Fresh Concrete

- Fresh concrete is that stage of concrete in which concrete can be moulded and it is in plastic state

Properties of Fresh concrete

- Workability
- Consistency
- Segregation
- Bleeding

Workability

- Workability is often referred to as the ease with which a concrete can be transported, placed and consolidated without excessive bleeding or segregation
- ***Slump Test*** can be used to find out the workability of concrete

Factors Affecting Workability

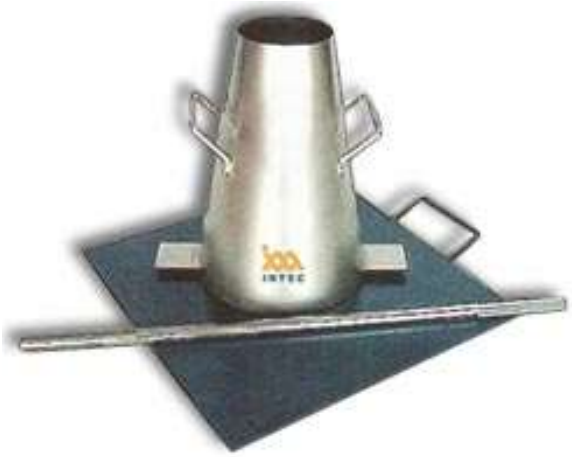
- Workable concrete is the one which exhibits very little internal friction between particle
- The factors helping concrete to have more lubricating effect to reduce internal friction for helping easy compaction are given below:
    - Water Content
    - Mix Proportions
    - Size of Aggregates
    - Shape of Aggregates
    - Surface Texture of Aggregate
    - Grading of Aggregate
    - Use of Admixtures

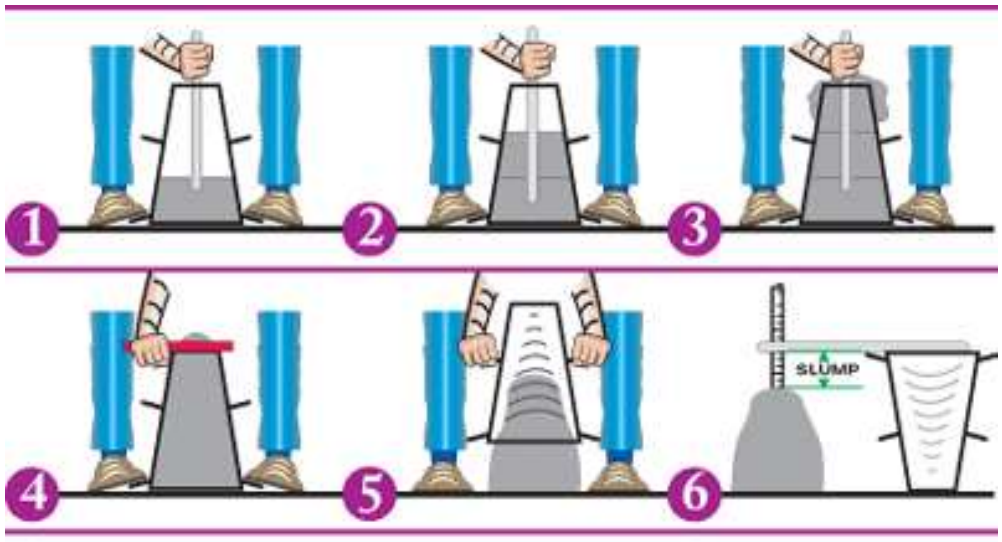
Consistency

- Ease of flow of concrete
- Consistency is the aspect of workability related to the flow characteristics of fresh concrete
- It is an indication of the fluidity or wetness of a mix and is measured by the slump test

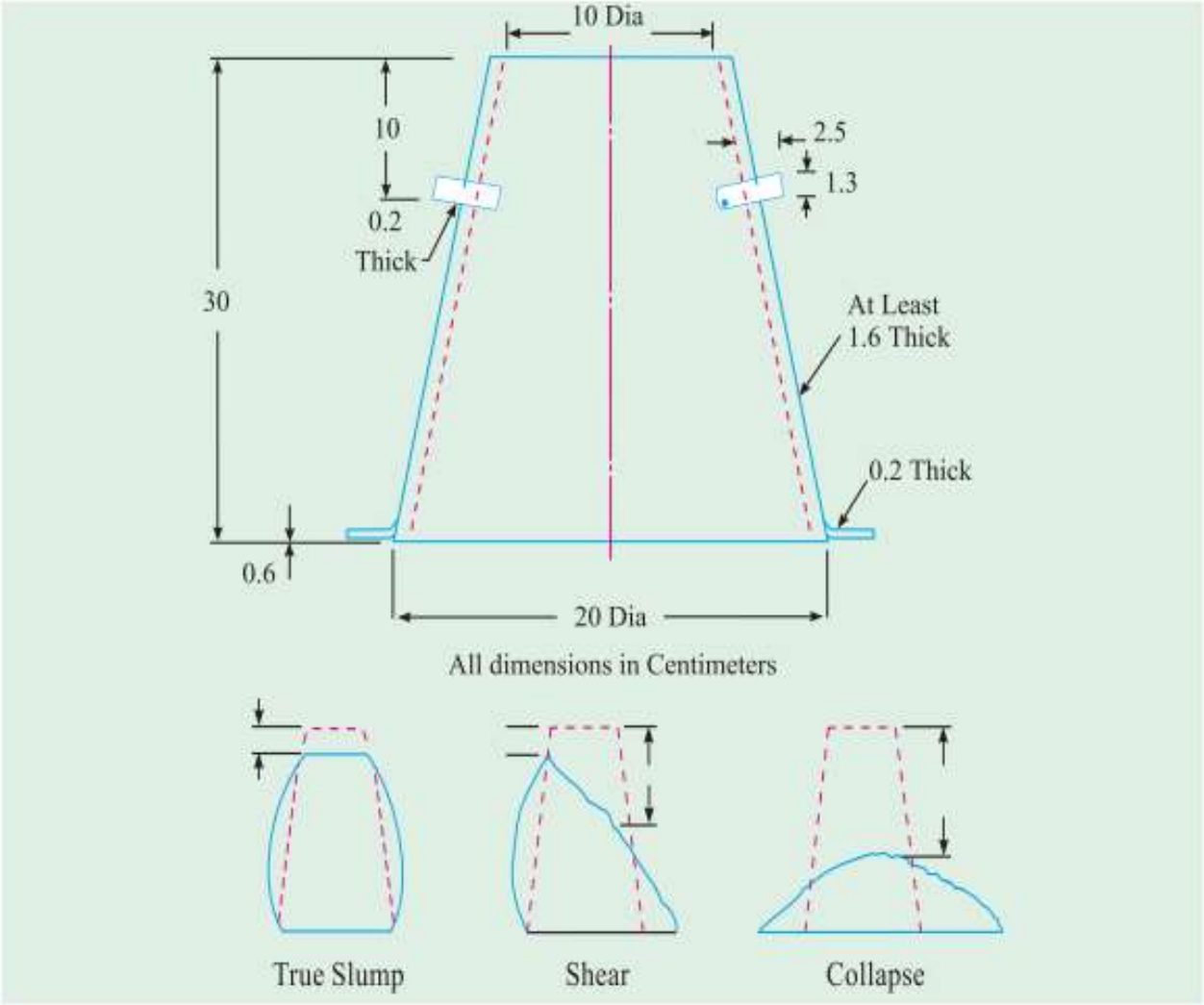
Slump Test

- Slump test is the most commonly used method of measuring consistency of concrete It is not a suitable method for very wet or very dry concrete.
- However, it is used conveniently as a control test and gives an indication of the uniformity of concrete from batch to batch.





Slump test

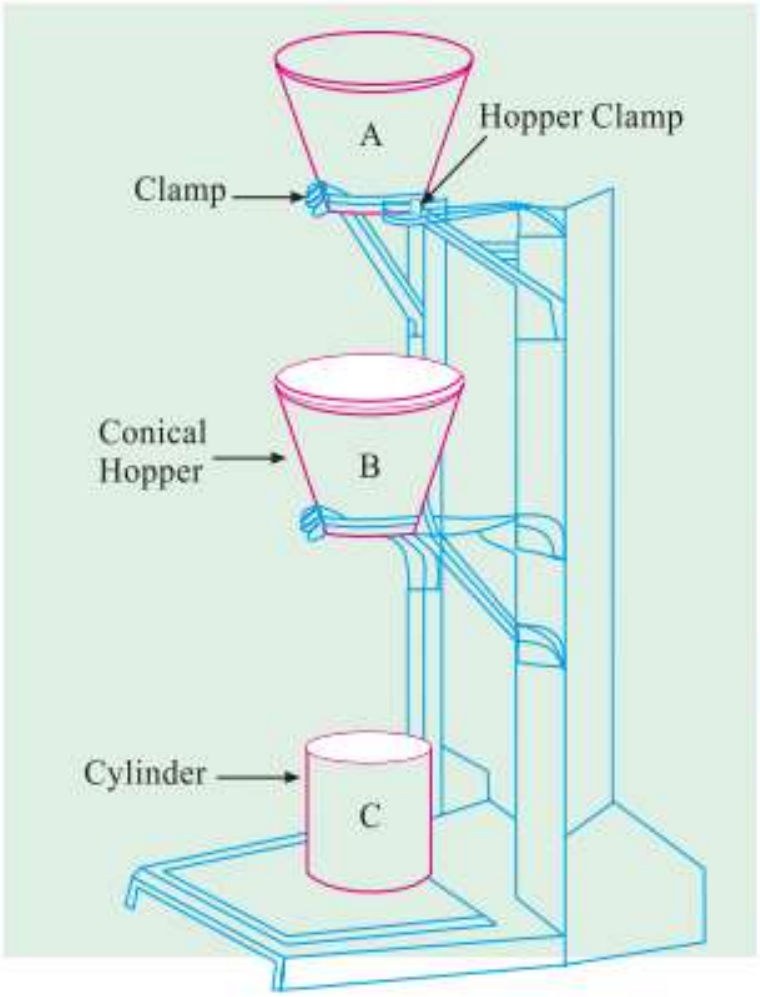

10 Dia
10
2.5
1.3
0.2
Thick
30
At Least
1.6 Thick
0.2 Thick
0.6
20 Dia
All dimensions in Centimeters
True Slump
Shear
Collapse

Compacting Factor Test

- It is more precise and sensitive than the slump test
- It is particularly useful for concrete mixes of very low workability as are normally used when concrete is to be compacted by vibration
- Such dry concrete are insensitive to slump test
- The degree of compaction, called the compacting factor is measured by the density ratio i.e., the ratio of the density actually achieved in the test to density of same concrete fully compacted

$$\text{The Compacting Factor} = \frac{\text{Weight of partially compacted concrete}}{\text{Weight of fully compacted concrete}}$$

Compacting Factor Test



Compacting Factor Apparatus

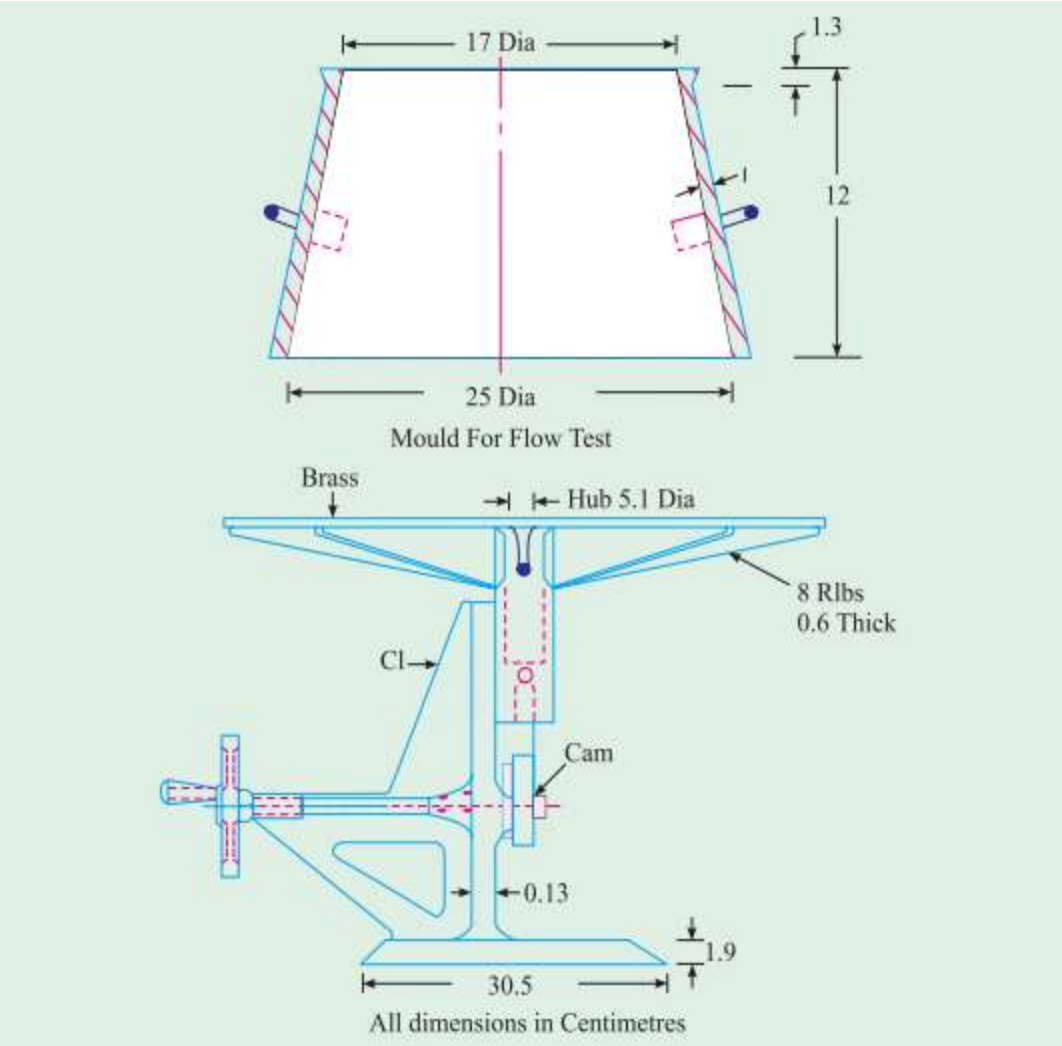
Essential Dimension of the Compacting Factor Apparatus for use with Aggregate not exceeding 40 mm Nominal Max. Size

Upper Hopper, A	Dimension cm
Top internal diameter	25.4
Bottom internal diameter	12.7
Internal height	27.9
Lower hopper, B	
Top internal diameter	22.9
Bottom internal diameter	12.7
Internal height	22.9
Cylinder, C	
Internal diameter	15.2
Internal height	30.5
Distance between bottom of upper hopper and top of lower hopper	20.3
Distance between bottom of lower hopper and top of cylinder	20.3

Flow Test

- This test gives an indication of the quality of concrete with respect to consistency, cohesiveness and the proneness to segregation
- In this test, a standard mass of concrete is subjected to jolting
- The spread or the flow of the concrete is measured and this flow is related to workability.
- The apparatus consists of flow table, about 76 cm. in diameter over which concentric circles are marked.
- A mould made from smooth metal casting in the form of a frustum of a cone is used with the following internal dimension
- The base is 25 cm. in diameter, upper surface 17 cm. in diameter, and height of the cone is 12 cm

Flow Table Apparatus



Flow Table Apparatus

- Each layer is rodded 25 times with a tamping rod 1.6 cm in diameter and 61 cm long rounded at the lower tamping end.
- After the top layer is rodded evenly, the excess of concrete which has overflowed the mould is removed.
- The mould is lifted vertically upward and the concrete stands on its own without support.
- The table is then raised and dropped 12.5 mm 15 times in about 15 seconds.
- The diameter of the spread concrete is measured in about 6 directions to the nearest 5 mm and the average spread is noted.
- The flow of concrete is the percentage increase in the average diameter of the spread concrete over the base diameter of the mould

$$\text{Flow, per cent} = \frac{\text{Spread diameter in cm} - 25}{25} \times 100$$

Segregation

- Segregation can be defined as the separation of the constituent materials of concrete
- A good concrete is one in which all the ingredients are properly distributed to make a homogeneous mixture
- Segregation may be of three types
    - Firstly, the coarse aggregate separating out or settling down from the rest of the matrix
    - Secondly, the paste or matrix separating away from coarse aggregate and
    - Thirdly, water separating out from the rest of the material being a material of lowest specific gravity
- A well made concrete, taking into consideration various parameters such as grading, size, shape and surface texture of aggregate with optimum quantity of waters makes a cohesive mix. Such concrete will not exhibit any tendency for segregation.

Bleeding

- Bleeding is sometimes referred as water gain
- It is a particular form of segregation, in which some of the water from the concrete comes out to the surface of the concrete, being of the lowest specific gravity among all the ingredients of concrete
- Bleeding is predominantly observed in a highly wet mix, badly proportioned and insufficiently mixed concrete
- In thin members like roof slab or road slabs and when concrete is placed in sunny weather show excessive bleeding.
- Due to bleeding, water comes up and accumulates at the surface
- Sometimes, along with this water, certain quantity of cement also comes to the surface.
- When the surface is worked up with the trowel and floats, the aggregate goes down and the cement and water come up to the top surface.
- This formation of cement paste at the surface is known as “Laitance”