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DEPARTMENT OF CIVIL ENGINEERING

FACULTY OF ENGINEERING & TECHNOLOGY

Topics to be covered:

- Testing of concrete
- Workability of Concrete and Factors affecting it
- Testing for Workability of Concrete
- Compressive Strength of Concrete and Factors affecting it
- Characteristic Strength of Concrete
- Green Density and Dry Density Tests
- Problems Related to the Topics Discussed

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WORKABILITY OF CONCRETE AND FACTORS AFFECTING IT :

Quality tests on concrete are performed as a part of quality control of concrete structures. Different quality tests on concrete such as compressive strength tests, slump tests, permeability tests etc. are used to assure the quality of the concrete that is supplied for a given specification.

These quality tests on concrete give an idea about the properties of concrete such as strength, durability, air content, permeability etc.

Each quality test conducted on concrete determines their respective quality result of concrete. Hence, it is not possible to conduct all the test to determine the quality of concrete. We have to choose the best tests that can give good judgment of the concrete quality. The primary quality test determines the variation of the concrete specification from the required and standard concrete specification. The quality tests ensure that the best quality concrete is placed at the site so that concrete structural members of desired strength are obtained. Below mentioned are the quality tests conducted on fresh and hardened concretes.

QUALITY TESTS ON FRESH CONCRETE

Most Common Quality Tests on Fresh concrete are:

1. WORKABILITY TESTS

Workability of concrete mixture is measured by, Vee-bee Consistometer test, Compaction factor Test, and Slump test.

2. AIR CONTENT

Air content measures the total air content in a sample of fresh concrete but does not indicate what the final in-place air content is, because a certain amount of air is lost in transportation Consolidating, placement, and finishing.

3. SETTING TIME

The action of changing mixed cement from a fluid state to a solid state is called “Setting of Cement”.

INITIAL SETTING TIME is defined as the period elapsing between the time when water is added to the cement and the time at which the needle of 1 mm square section fails to pierce the test block to a depth of about 5 mm from the bottom of the mold.

WORKABILITY OF CONCRETE AND FACTORS AFFECTING IT :

Final Setting Time is defined as the period elapsing between the time when water is added to cement and the time at which the needle of 1 mm square section with 5 mm diameter attachment makes an impression on the test block.

OTHER TESTS CONDUCTED ON FRESH CONCRETE ARE:

a) Segregation resistance

b) Unit weight

c) Wet analysis

d) Temperature

e) Heat generation

f) Bleeding

TESTS ON HARDENED CONCRETE :

Most Common Quality Tests on hardened concrete are:

1. COMPRESSIVE STRENGTH

The compressive strength of concrete cube test provides an idea about all the characteristics of concrete.

2. TENSILE STRENGTH

The tensile strength of concrete is one of the basic and important properties which greatly affect the extent and size of cracking in structures. Moreover, the concrete is very weak in tension due to its brittle nature. Hence. it is not expected to resist the direct tension. So, concrete develops cracks when tensile forces exceed its tensile strength. Therefore, it is necessary to determine the tensile strength of concrete to determine the load at which the concrete members may crack.

3. MODULUS OF ELASTICITY

Modulus of elasticity of concrete is the ratio of stress to the strain of the concrete under the application of loads.

WORKABILITY OF CONCRETE AND FACTORS AFFECTING IT :

4. PERMEABILITY TESTS ON CONCRETE

When concrete is permeable it can cause corrosion in reinforcement in presence of oxygen, moisture, CO^2, SO^{3-} and Cl^- etc. This formation of rust due to corrosion becomes nearly 6 times the volume of steel oxide layer, due to which cracking develops in reinforced concrete and spalling of concrete starts.

5. IN SITU TEST ON CONCRETE

There are various in-situ test conducted on hardened concrete, both destructive and non-destructive. Some of them are concrete pull out tests, Break off tests, Schmidt Hammer test.

Other quality tests are conducted to test the following :

a) MODULUS OF RUPTURE

b) DENSITY

c) SHRINKAGE

d) CREEP

e) FREEZE/THAW RESISTANCE

f) RESISTANCE TO AGGRESSIVE CHEMICALS

g) RESISTANCE TO ABRASION

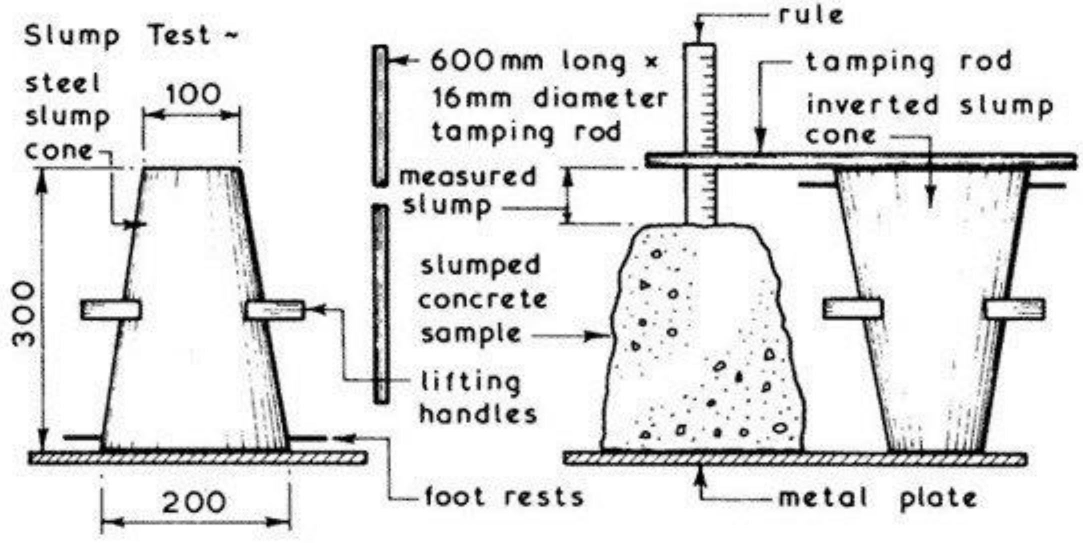
h) BOND TO REINFORCEMENT

i) ABSORPTION

WORKABILITY OF CONCRETE AND FACTORS AFFECTING IT :

COMPRESSION TEST AND SLUMP TEST FOR QUALITY TESTS :

Among the tests mentioned above, the two major tests mainly considered as quality tests are the compression tests and slump tests. If necessary, it is desired to conduct fresh concrete temperature and hardened concrete density determination tests.



THE REASONS FOR THE SELECTION OF COMPRESSIVE STRENGTH TEST AND SLUMP TEST IN PRACTICE FOR QUALITY CONTROL TESTING OF CONCRETE ARE:

a) Most of the concrete properties are related to the compressive strength that is obtained by compressive strength test.
b) Compressive strength test is the easiest, most economical or most accurately determinable test.
c) The variability of concrete is best studied by means of compressive strength tests.
d) The quality of the mix is judged by the slump test. This studies the variation of construction materials in the mix. These tests focus on the water-cement ratio of the concrete mix.

WORKABILITY OF CONCRETE AND FACTORS AFFECTING IT :

e) The slump test is easy to conduct. It determines the quality of concrete very fastly before its placement. The placement standards are as recommended by the respective concrete practice codes.

f) Slump test is conducted at the site which does not require any lab arrangement or expensive testing machines. Hence this test is economical.

f) We conduct the slump test before pouring into the formwork. Hence if there is an issue with the concrete quality, the tested batch can be rejected. This would help in bringing up a defective structural member and avoiding future dismantling and repair.

WORKABILITY :

A theoretical water/cement ratio calculated from the considerations discussed above is not going to give an ideal situation for maximum strength. Hundred per cent compaction of concrete is an important parameter for contributing to the maximum strength. Lack of compaction will result in air voids whose damaging effect on strength and durability is equally or more predominant than the presence of capillary cavities. To enable the concrete to be fully compacted with given efforts, normally a higher water/ cement ratio than that calculated by theoretical considerations may be required.

That is to say the function of water is also to lubricate the concrete so that the concrete can be compacted with specified effort forthcoming at the site of work. The lubrication required for handling concrete without segregation, for placing without loss of homogeneity, for compacting with the amount of efforts forth-coming and to finish it sufficiently easily, the presence of a certain quantity of water is of vital importance.

For a concrete technologist, a comprehensive knowledge of workability is required to design a mix. Workability is a parameter, a mix designer is required to specify in the mix design process, with full understanding of the type of work, distance of transport, loss of slump, method of placing, and many other parameters involved. Assumption of right workability with proper understanding backed by experience will make the concreting operation economical and durable.

WORKABILITY OF CONCRETE AND FACTORS AFFECTING IT :

FACTORS AFFECTING WORKABILITY : Workable concrete is the one which exhibits very little internal friction between particle and particle or which overcomes the frictional resistance offered by the formwork surface or reinforcement contained in the concrete with just the amount of compacting efforts forthcoming. The factors helping concrete to have more lubricating effect to reduce internal friction for helping easy compaction are given below:

(a) Water Content (b) Mix Proportions

(c) Size of Aggregates (d) Shape of Aggregates

(e) Surface Texture of Aggregate (f) Grading of Aggregate

(g) Use of Admixtures.

(A) WATER CONTENT: Water content in a given volume of concrete, will have significant influences on the workability. The higher the water content per cubic meter of concrete, the higher will be the fluidity of concrete, which is one of the important factors affecting workability. At the work site, supervisors who are not well versed with the practice of making good concrete, resort to adding more water for increasing workability. This practice is often resorted to because this is one of the easiest corrective measures that can be taken at site. It should be noted that from the desirability point of view, increase of water content is the last recourse to be taken for improving the workability even in the case of uncontrolled concrete. For controlled concrete one cannot arbitrarily increase the water content. In case, all other steps to improve workability fail, only as last recourse the addition of more water can be considered. More water can be added, provided a correspondingly higher quantity of cement is also added to keep the water/cement ratio constant, so that the strength remains the same.

(B) MIX PROPORTIONS: Aggregate/cement ratio is an important factor influencing workability. The higher the aggregate/cement ratio, the leaner is the concrete. In lean concrete, less quantity of paste is available for providing lubrication, per unit surface area of aggregate and hence the mobility of aggregate is restrained. On the other hand, in case of rich concrete with lower aggregate/cement ratio, more paste is available to make the mix cohesive and fatty to give better workability.

WORKABILITY OF CONCRETE AND FACTORS AFFECTING IT :

(C) SIZE OF AGGREGATE: The bigger the size of the aggregate, the less is the surface area and hence less amount of water is required for wetting the surface and less matrix or paste is required for lubricating the surface to reduce internal friction. For a given quantity of water and paste, bigger size of aggregates will give higher workability. The above, of course will be true within certain limits.

(D) SHAPE OF AGGREGATES: The shape of aggregates influences workability in good measure. Angular, elongated or flaky aggregate makes the concrete very harsh when compared to rounded aggregates or cubical shaped aggregates. Contribution to better workability of rounded aggregate will come from the fact that for the given volume or weight it will have less surface area and less voids than angular or flaky aggregate. Not only that, being round in shape, the frictional resistance is also greatly reduced. This explains the reason why river sand and gravel provide greater workability to concrete than crushed sand and aggregate.

The importance of shape of the aggregate will be of great significance in the case of present day high strength and high performance concrete when we use very low w/c in the order of about 0.25. We have already talked about that in the years to come natural sand will be exhausted or costly. One has to go for manufactured sand. Shape of crushed sand as available today is unsuitable but the modern crushers are designed to yield well shaped and well graded aggregates.

(E) SURFACE TEXTURE: The influence of surface texture on workability is again due to the fact that the total surface area of rough textured aggregate is more than the surface area of smooth rounded aggregate of same volume. From the earlier discussions it can be inferred that rough textured aggregate will show poor workability and smooth or glassy textured aggregate will give better workability. A reduction of inter particle frictional resistance offered by smooth aggregates also contributes to higher workability.

(F) GRADING OF AGGREGATES: This is one of the factors which will have maximum influence on workability. A well graded aggregate is the one which has least amount of voids in a given volume. Other factors being constant, when the total voids are less, excess paste is available to give better lubricating effect. With excess amount of paste, the mixture becomes cohesive and fatty which prevents segregation of particles. Aggregate particles will slide past each other with the least amount of compacting efforts.

TESTING FOR WORKABILITY OF CONCRETE :

The better the grading, the less is the void content and higher the workability. The above is true for the given amount of paste volume.

(G) USE OF ADMIXTURES: Of all the factors mentioned above, the most import factor which affects the workability is the use of admixtures. In Chapter 5, it is amply described that the plasticizers and super-plasticizers greatly improve the workability many folds. It is to be noted that initial slump of concrete mix or what is called the slump of reference mix should be about 2 to 3 cm to enhance the slump many fold at a minimum doze. One should manipulate other factors to obtain initial slump of 2 to 3 cm in the reference mix. Without initial slump of 2 – 3 cm, the workability can be increased to higher level but it requires higher dosage – hence uneconomical.

USE OF AIR-ENTRAINING AGENT being surface-active, reduces the internal friction between the particles. They also act as artificial fine aggregates of very smooth surface. It can be viewed that air bubbles act as a sort of ball bearing between the particles to slide past each other and give easy mobility to the particles. Similarly, the fine glassy pozzolanic materials, in spite of increasing the surface area, offer better lubricating effects for giving better workability.

MEASUREMENT OF WORKABILITY :

It is discussed earlier that workability of concrete is a complex property. Just as it eludes all precise definition, it also eludes precise measurements. Numerous attempts have been made by many research workers to quantitatively measure this important and vital property of concrete. But none of these methods are satisfactory for precisely measuring or expressing this property to bring out its full meaning. Some of the tests, measure the parameters very close to workability and provide useful information. The following tests are commonly employed to measure workability.

(A) SLUMP TEST

(B) COMPACTING FACTOR TEST

(C) FLOW TEST

(D) KELLY BALL TEST

(E) VEE BEE CONSISTOMETER TEST.

TESTING FOR WORKABILITY OF CONCRETE :

SLUMP TEST : Slump test is the most commonly used method of measuring consistency of concrete which can be employed either in laboratory or at site of work. It is not a suitable method for very wet or very dry concrete. It does not measure all factors contributing to workability, nor is it always representative of the placability of the concrete. However, it is used conveniently as a control test and gives an indication of the uniformity of concrete from batch to batch. Repeated batches of the same mix, brought to the same slump, will have the same water content and water cement ratio, provided the weights of aggregate, cement and admixtures are uniform and aggregate grading is within acceptable limits. Additional information on workability and quality of concrete can be obtained by observing the manner in which concrete slumps. Quality of concrete can also be further assessed by giving a few tappings or blows by tamping rod to the base plate. The deformation shows the characteristics of concrete with respect to tendency for segregation. The apparatus for conducting the slump test essentially consists of a metallic mould in the form of a frustum of a cone having the internal dimensions as under:

BOTTOM DIAMETER : 20 CM

TOP DIAMETER : 10 CM

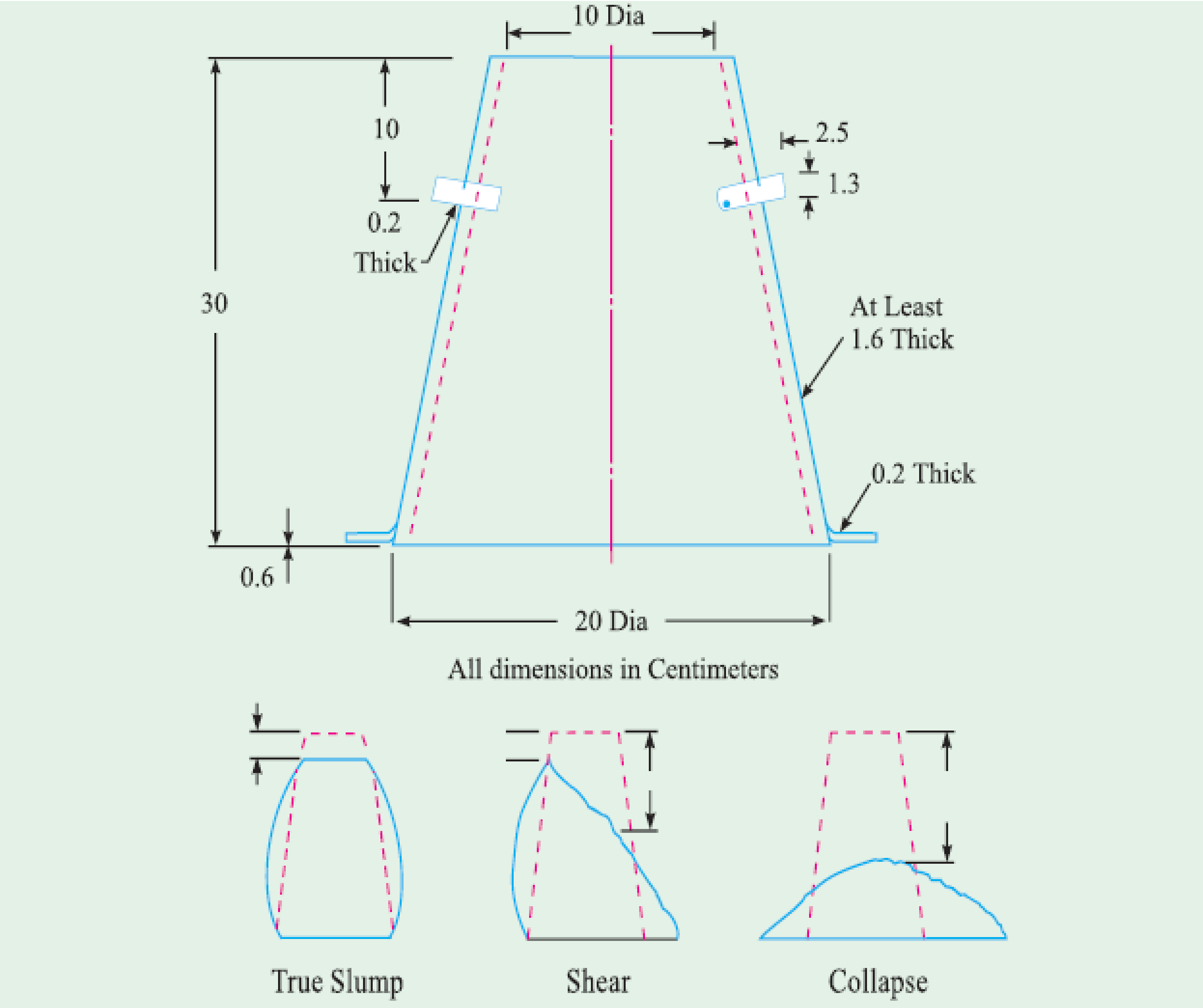
HEIGHT : 30 CM

The thickness of the metallic sheet for the mould should not be thinner than 1.6 mm. Sometimes the mould is provided with suitable guides for lifting vertically up. For tamping the concrete, a steel tamping rod 16 mm dia, 0.6 meter along with bullet end is used.

The internal surface of the mould is thoroughly cleaned and freed from superfluous moisture and adherence of any old set concrete before commencing the test. The mould is placed on a smooth, horizontal, rigid and non-absorbant surface The mould is then filled in four layers, each approximately 1/ 4 of the height of the mould. Each layer is tamped 25 times by the tamping rod taking care to distribute the strokes evenly over the cross section. After the top layer has been rodded, the concrete is struck off level with a trowel and tamping rod. The mould is removed from the concrete immediately by raising it slowly and carefully in a vertical direction. This allows the concrete to subside. This subsidence is referred as SLUMP of concrete.

TESTING FOR WORKABILITY OF CONCRETE :

The difference in level between the height of the mould and that of the highest point of the subsided concrete is measured. This difference in height in mm. is taken as Slump of Concrete.



TESTING FOR WORKABILITY OF CONCRETE :

The pattern of slump indicates the characteristic of concrete in addition to the slump value. If the concrete slumps evenly it is called true slump. If one half of the cone slides down, it is called shear slump. In case of a shear slump, the slump value is measured as the difference in height between the height of the mould and the average value of the subsidence. Shear slump also indicates that the concrete is non-cohesive and shows the characteristic of segregation.

It is seen that the slump test gives fairly good consistent results for a plastic-mix. This test is not sensitive for a stiff-mix. In case of dry-mix, no variation can be detected between mixes of different workability. In the case of rich mixes, the value is often satisfactory, their slump being sensitive to variations in workability. IS 456 of 2000 suggests that in the "very low" category of workability where strict control is necessary, for example, pavement quality concrete, (PQC) measurement of workability by determination of compacting factor will be more appropriate than slump and a value of 0.75 to 0.80 compacting factor is suggested.

The above IS also suggests that in the "very high" category of workability, measurement of workability by determination of "flow" by flow test will be more appropriate. However, in a lean-mix with a tendency of harshness a true slump can easily change to shear slump. In such case, the tests should be repeated.

K-SLUMP TESTER : Very recently a new apparatus called "K-Slump Tester" has been devised. It can be used to measure the slump directly in one minute after the tester is inserted in the fresh concrete to the level of the floater disc. This tester can also be used to measure the relative workability.

The apparatus comprises of the following four principal parts:-

PART 1 : A chrome plated steel tube with external and internal diameters of 1.9 and 1.6 cm respectively. The tube is 25 cm long and its lower part is used to make the test. The length of this part is 15.5 cm which includes the solid cone that facilitates inserting the tube into the concrete. Two types of openings are provided in this part: 4 rectangular slots 5.1 cm long and 0.8 cm wide and 22 round holes 0.64 cm in diameter; all these openings are distributed uniformly in the lower part.

TESTING FOR WORKABILITY OF CONCRETE :

PART 2. A disc floater 6 cm in diameter and 0.24 cm in thickness which divides the tube into two parts: the upper part serves as a handle and the lower one is for testing as already mentioned. The disc serves also to prevent the tester from sinking into the concrete beyond the preselected level.

PART 3. A hollow plastic rod 1.3 cm in diameter and 25 cm long which contains a graduated scale in centimeters. This rod can move freely inside the tube and can be used to measure the height of mortar that flows into the tube and stays there. The rod is plugged at each end with a plastic cap to prevent concrete or any other material from seeping inside.

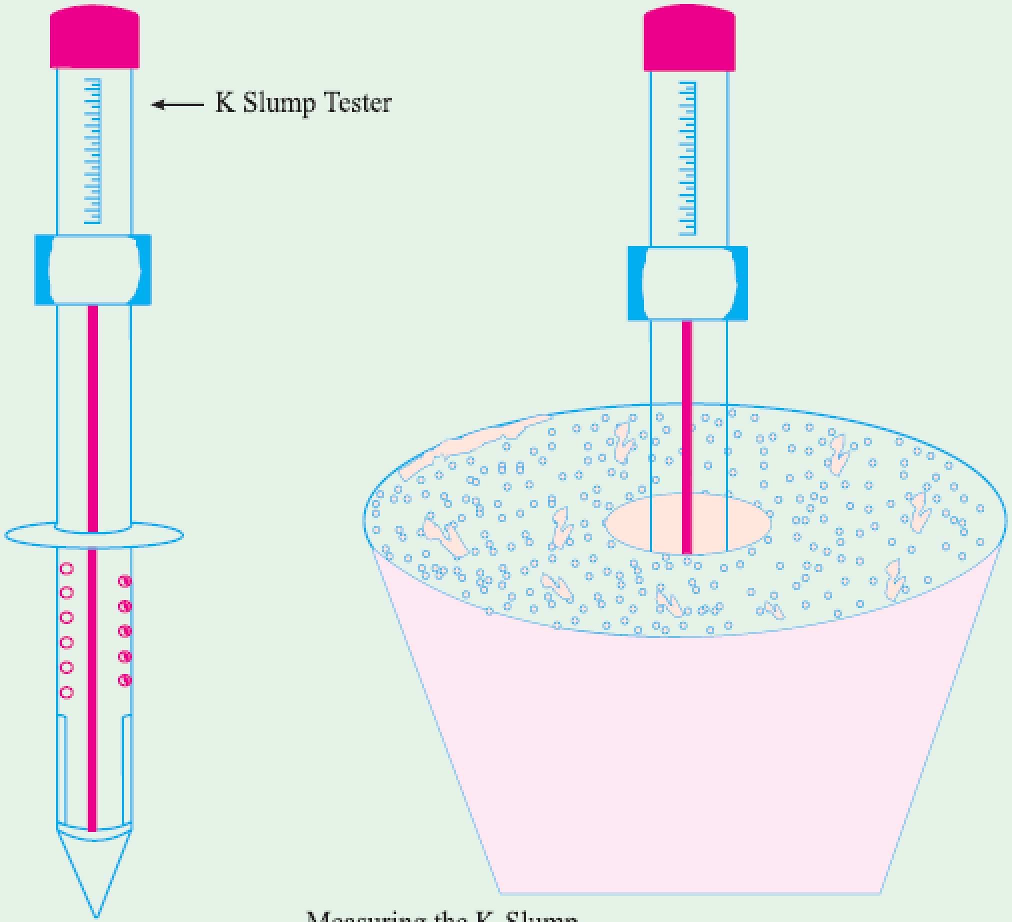
PART 4. An aluminum cap 3 cm diameter and 2.25 cm long which has a little hole and a screw that can be used to set and adjust the reference zero of the apparatus. There is also in the upper part of the tube, a small pin which is used to support the measuring rod at the beginning of the test. The total weight of the apparatus is 226 g.

The following procedure is used:

a) Wet the tester with water and shake off the excess.
b) Raise the measuring rod, tilt slightly and let it rest on the pin located inside the tester.
c) Insert the tester on the leveled surface of concrete vertically down until the disc floater rests at the surface of the concrete. Do not rotate while inserting or removing the tester.
d) After 60 seconds, lower the measuring rod slowly until it rests on the surface of the concrete that has entered the tube and read the K-Slump directly on the scale of the measuring rod.
e) Raise the measuring rod again and let it rest on its pin.
f) Remove the tester from the concrete vertically up and again lower the measuring rod slowly till it touches the surface of the concrete retained in the tube and read workability (W) directly on the scale of the measuring rod.

TESTING FOR WORKABILITY OF CONCRETE :

K-Slump Tester



Measuring the K-Slump

TESTING FOR WORKABILITY OF CONCRETE :

Table 6.1. Workability, Slump and Compacting Factor of Concretes with 20 mm or 40 mm Maximum Size of Aggregate

Degree of workability	*Slump mm*	*Compacting factor*		*Use for which concrete is suitable*
		Small appartus	*Large appartus*	
Very Low compacting factor is suitable	–	0.78	0.80	Roads vibrated by power-operated machines. At the more workable end of this group, concrete may be compacted in certain cases with hand-operated machines.
Low	25–75	0.85	0.87	Roads vibrated by hand-operated machines. At the more workable end of this group, concrete may be manually compacted in roads using aggregate of rounded or irregular shape. Mass concrete foundations without vibration or lightly reinforced sections with vibration.
Medium	50–100	0.92	0.935	At the less workable end of this group, manually compacted flat slabs using crushed aggregates. Normal reinforced concrete manually compacted and heavily reinforced sections with vibration
High	100–150	0.95	0.96	For sections with congested reinforcement. Not normally suitable for vibration. For pumping and tremie placing
Very High	–	–	–	Flow table test is more suitable.

TESTING FOR WORKABILITY OF CONCRETE :

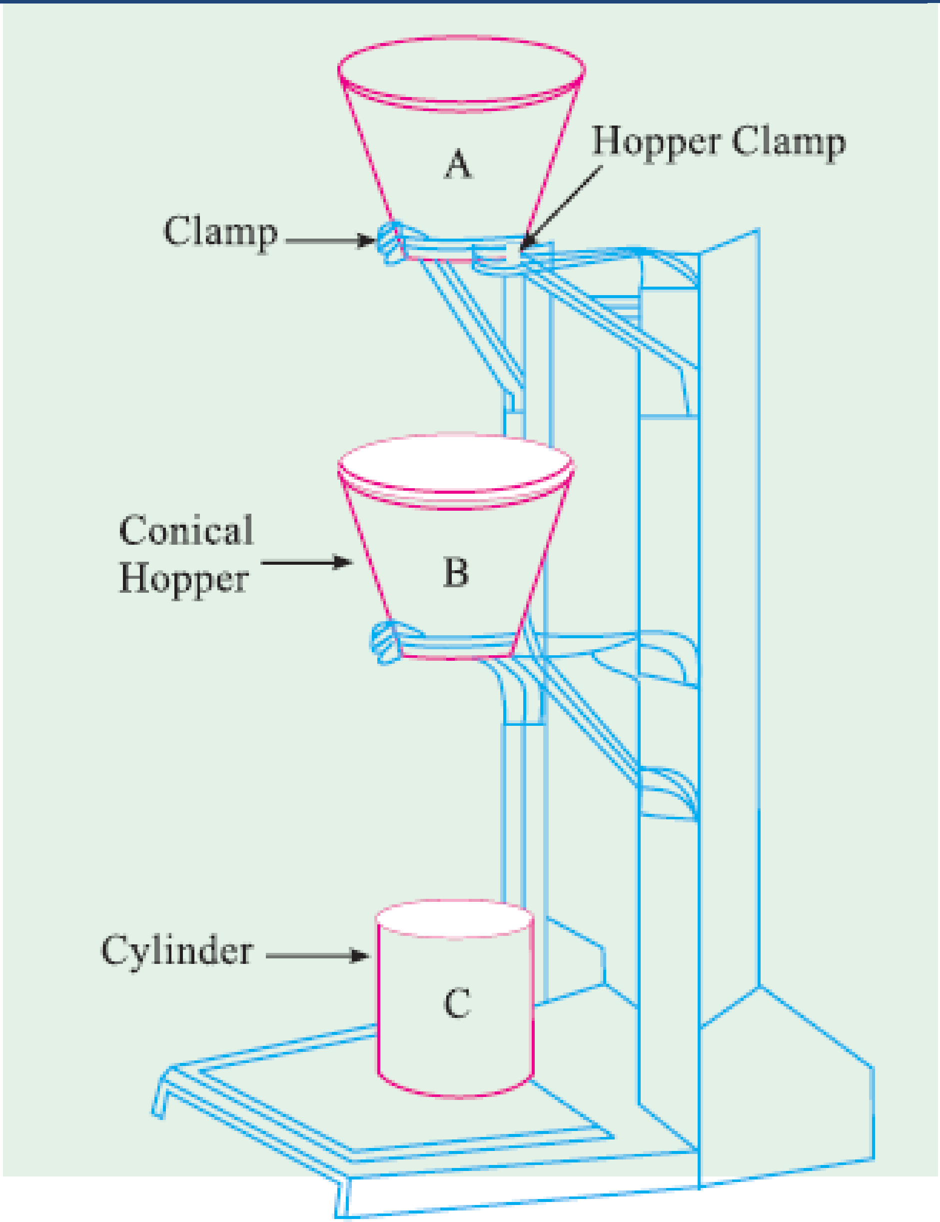
COMPACTING FACTOR TEST :

- The compacting factor test is designed primarily for use in the laboratory but it can also be used in the field.
- It is more precise and sensitive than the slump test and 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 essential dimensions of the hoppers and mould and the distance between them are shown in Table below.
- The compacting factor test has been developed at the Road Research Laboratory U.K. and it is claimed that it is one of the most efficient tests for measuring the workability of concrete.
- This test works on the principle of determining the degree of compaction achieved by a standard amount of work done by allowing the concrete to fall through a standard height.
- 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.

Table 6.2. Essential Dimension of the Compacting Factor Appartus 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

TESTING FOR WORKABILITY OF CONCRETE :



Compacting Factor Apparatus

TESTING FOR WORKABILITY OF CONCRETE :

The sample of concrete to be tested is placed in the upper hopper up to the brim. The trap-door is opened so that the concrete falls into the lower hopper. Then the trap-door of the lower hopper is opened and the concrete is allowed to fall into the cylinder. In the case of a dry-mix, it is likely that the concrete may not fall on opening the trap-door. In such a case, a slight poking by a rod may be required to set the concrete in motion. The excess concrete remaining above the top level of the cylinder is then cut off with the help of plane blades supplied with the apparatus. The outside of the cylinder is wiped clean. The concrete is filled up exactly upto the top level of the cylinder. It is weighed to the nearest 10 grams. This weight is known as “Weight of partially compacted concrete”. The cylinder is emptied and then refilled with the concrete from the same sample in layers approximately 5 cm deep. The layers are heavily rammed or preferably vibrated so as to obtain full compaction. The top surface of the fully compacted concrete is then carefully struck off level with the top of the cylinder and weighed to the nearest 10 gm. This weight is known as “Weight of fully compacted concrete”.

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

The weight of fully compacted concrete can also be calculated by knowing the proportion of materials, their respective specific gravities, and the volume of the cylinder. It is seen from experience, that it makes very little difference in compacting factor value, whether the weight of fully compacted concrete is calculated theoretically or found out actually after 100 per cent compaction. It can be realized that the compacting factor test measures the inherent characteristics of the concrete which relates very close to the workability requirements of concrete and as such it is one of the good tests to depict the workability of concrete.

TESTING FOR WORKABILITY OF CONCRETE :

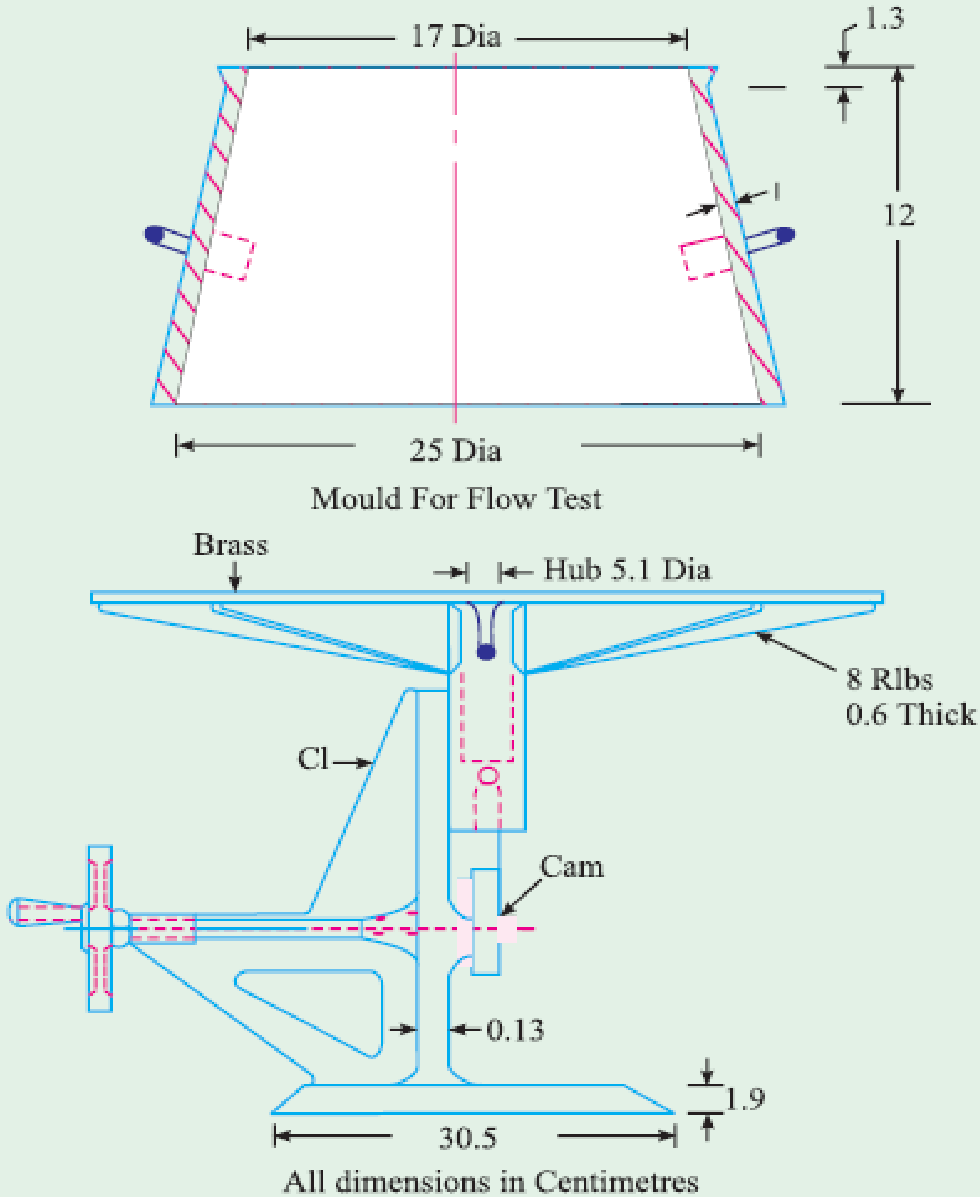
FLOW TEST :

- This is a laboratory test, which 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.
- It can be seen that 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 dimensions. The base is 25 cm. in diameter, upper surface 17 cm. in diameter, and height of the cone is 12 cm.
- The table top is cleaned of all gritty material and is wetted. The mould is kept on the centre of the table, firmly held and is filled in two layers. 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.

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

- The value could range anything from 0 to 150 per cent. A close look at the pattern of spread of concrete can also give a good indication of the characteristics of concrete such as tendency for segregation.

TESTING FOR WORKABILITY OF CONCRETE :



TESTING FOR WORKABILITY OF CONCRETE :

FLOW TABLE APPARATUS

The BIS has recently introduced another new equipment for measuring flow value of concrete. This new flow table test is in the line with BS 1881 part 105 of 1984 and DIN 1048 part I. The apparatus and method of testing is described below.

The flow table top is hinged to a base frame using externally mounted hinges in such a way that no aggregate can become trapped easily between the hinges or hinged surfaces. The front of the base frame shall extend a minimum 120 mm beyond the flow table top in order to provide a top board. An upper stop provided on each side of the table so that the lower front edge of the table can only be lifted 40 ± 1 mm.

The lower front edge of the flow table top is provided with two hard rigid stops which transfer the load to the base frame. The base frame is so constructed that this load is then transferred directly to the surface on which the flow table is placed so that there is minimal tendency for the flow table top to bounce when allowed to fall.

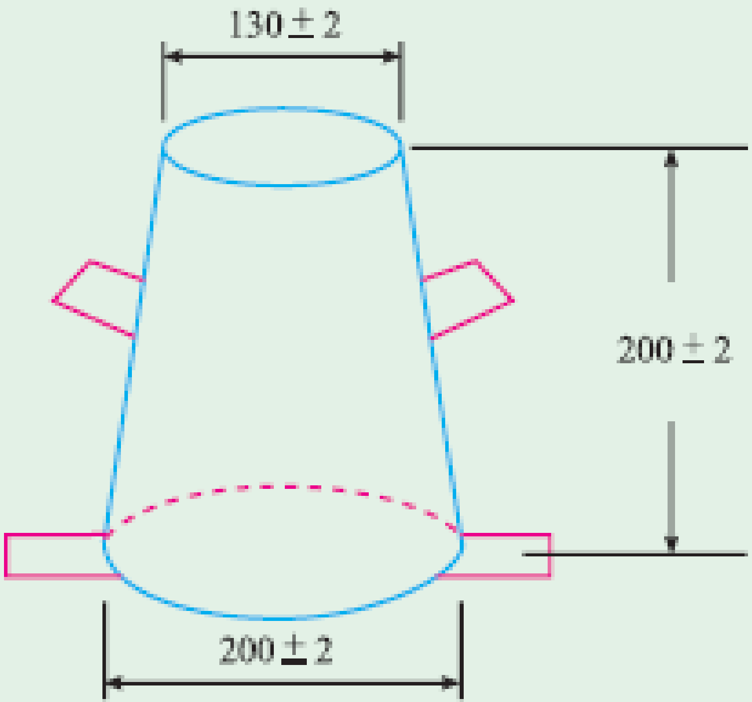
ACCESSORY APPARATUS

MOULD: The mould is made of metal readily not attacked by cement paste or liable to rust and of minimum thickness 1.5 mm. The interior of the mould is smooth and free from projections, such as protruding rivets, and is free from dents. The base and the top is open and parallel to each other and at right angles to the axis of the cone. The mould is provided with two metal foot pieces at the bottom and two handles above them.

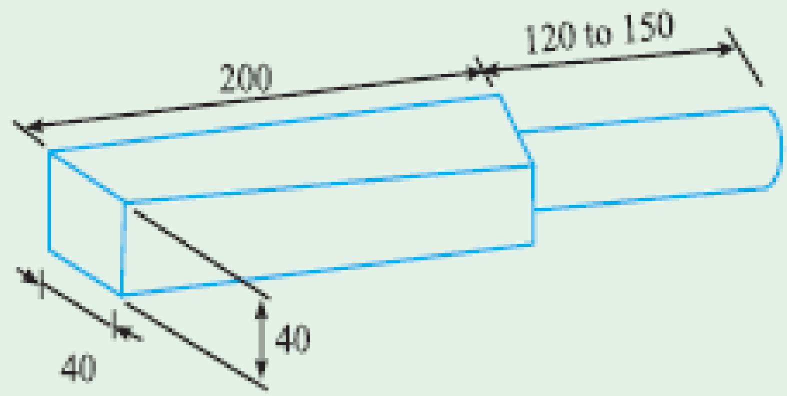
TAMPING BAR: The sample of freshly mixed concrete is obtained.

PROCEDURE: The table is made level and properly supported. Before commencing the test, the table-top and inner surface of the mould is wiped with a damp cloth. The slump cone is placed centrally on the table. The slump cone is filled with concrete in two equal layers, each layer tamped lightly 10 times with the wooden tamping bar. After filling the mould, the concrete is struck off flush with the upper edge of the slump cone and the free area of the tabletop cleaned off.

TESTING FOR WORKABILITY OF CONCRETE :



All dimensions in millimetres.



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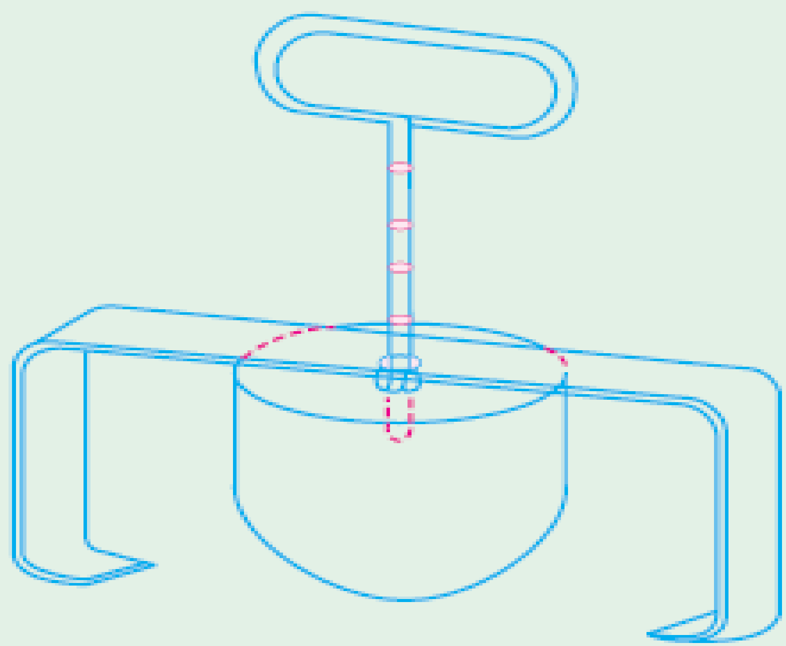

TESTING FOR WORKABILITY OF CONCRETE :

VEE BEE CONSISTOMETER TEST : This is a good laboratory test to measure indirectly the workability of concrete. This test consists of a vibrating table, a metal pot, a sheet metal cone, a standard iron rod. Slump test as described earlier is performed, placing the slump cone inside the sheet metal cylindrical pot of the consistometer. The glass disc attached to the swivel arm is turned and placed on the top of the concrete in the pot. The electrical vibrator is then switched on and simultaneously a stop watch started. The vibration is continued till such a time as the conical shape of the concrete disappears and the concrete assumes a cylindrical shape. This can be judged by observing the glass disc from the top for disappearance of transparency. Immediately when the concrete fully assumes a cylindrical shape, the stop watch is switched off. The time required for the shape of concrete to change from slump cone shape to cylindrical shape in seconds is known as Vee-Bee Degree. This method is very suitable for very dry concrete whose slump value cannot be measured by Slump Test, but the vibration is too vigorous for concrete with a slump greater than about 50 mm.

Vee-Bee Consistometer

PROBLEMS RELATED TO THE TOPICS DISCUSSED :

1. How many types of tests are there to find workability?
a) 3
b) 4
c) 5
d) 6
2. These test find workability ___________
a) Directly
b) Indirectly
c) 0
d) Equals to the weight of the cement
3. Workability of concrete is measured by ___________
a) Vicat apparatus test
b) Slump test
c) Minimum void method
d) Talbot Richard test
4. Which test gives good results for rich mixes?
a) Slump test
b) Compacting factor test
c) Flow table test
d) VeBe test
5. Which test used for low workable concretes?
a) Slump test
b) Compacting factor test
c) Flow table test
d) VeBe test
6. Which test Used for high workable concretes?
a) Slump test
b) Compacting factor test
c) Flow table test
d) VeBe test

7. Which test used for fiber reinforced concrete?
   a) Slump test
   b) Compacting factor test
   c) Flow table test
   d) VeBe test
8. ___________ is practical in field test.
   a) Slump test
   b) Compacting factor test
   c) Flow table test
   d) Kelly Ball Test
9. What is the compaction factor for medium degree of workability?
   a) .78
   b) .85
   c) .92
   d) .95
10. What is the Vee-Bee time for medium degree of workability?
   a) 10-20 sec
   b) 5-10 sec
   c) 2-5 sec
   d) 35 sec
11. The water–cement ratio is the ratio of _______________
   a) Weight of water to the weight of cement
   b) Volume of water to the volume of cement
   c) Density of water to the Density of cement
   d) Weight of water to the weight of aggregate
12. A lower ratio leads to ____________
   a) Higher strength and durability
   b) Higher strength but low durability
   c) Lower strength but high durability
   d) Lower strength and durability

"Thank you"

Have Any Query ?

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