Concrete Technology

Topic – Properties of Concrete

Concrete

- It is obtained by mixing cement, fine aggregate, coarse aggregate and water in required proportions.
- The hardening of concrete is caused by chemical action between water and the cement due to which concrete gain its strength.
- The strength, durability and other characteristics of concrete depend upon the properties of its ingredients, proportion of the mix, the method of compaction and other conditions during placing, compaction and curing.

Properties of concrete

Properties of concrete can be easily understood by classifying the properties of concrete as:

1. Properties of fresh concrete
2. Properties of harden concrete.

Properties of Fresh Concrete

- WORKABLILITY
- SAGGREGATION
- BLEEDING
- HARDNESS

WORKABLITY

- Workability of concrete can be define as the “ease of doing work with it”.
- It depends upon the type of work.
- A concrete which is workable for slab casting may not be workable for foundation work .
- “The property of concrete which determines the amount of useful internal work necessary to produce full compaction is known as WORKABLITY .”

Factors Affecting Workability

(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.

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.
- One should not add water to conctere to increase the workability of concrete since it can give advers effect to the other properties of concrete.
- It should be kept as the last option if in case all other options to increase workability is not working .

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.
- Rich concrete with lower aggregate/cement ratio, more paste is available to make the mix cohesive and fatty to give better workability.

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 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. (within limits)

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

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.

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.

Use of Admixtures

- Of all the factors mentioned above, the most import factor which affects the workability is the use of admixtures. The plasticizers and superplasticizers greatly improve the workability of concrete.

Measurement of Workability

(a) Slump Test

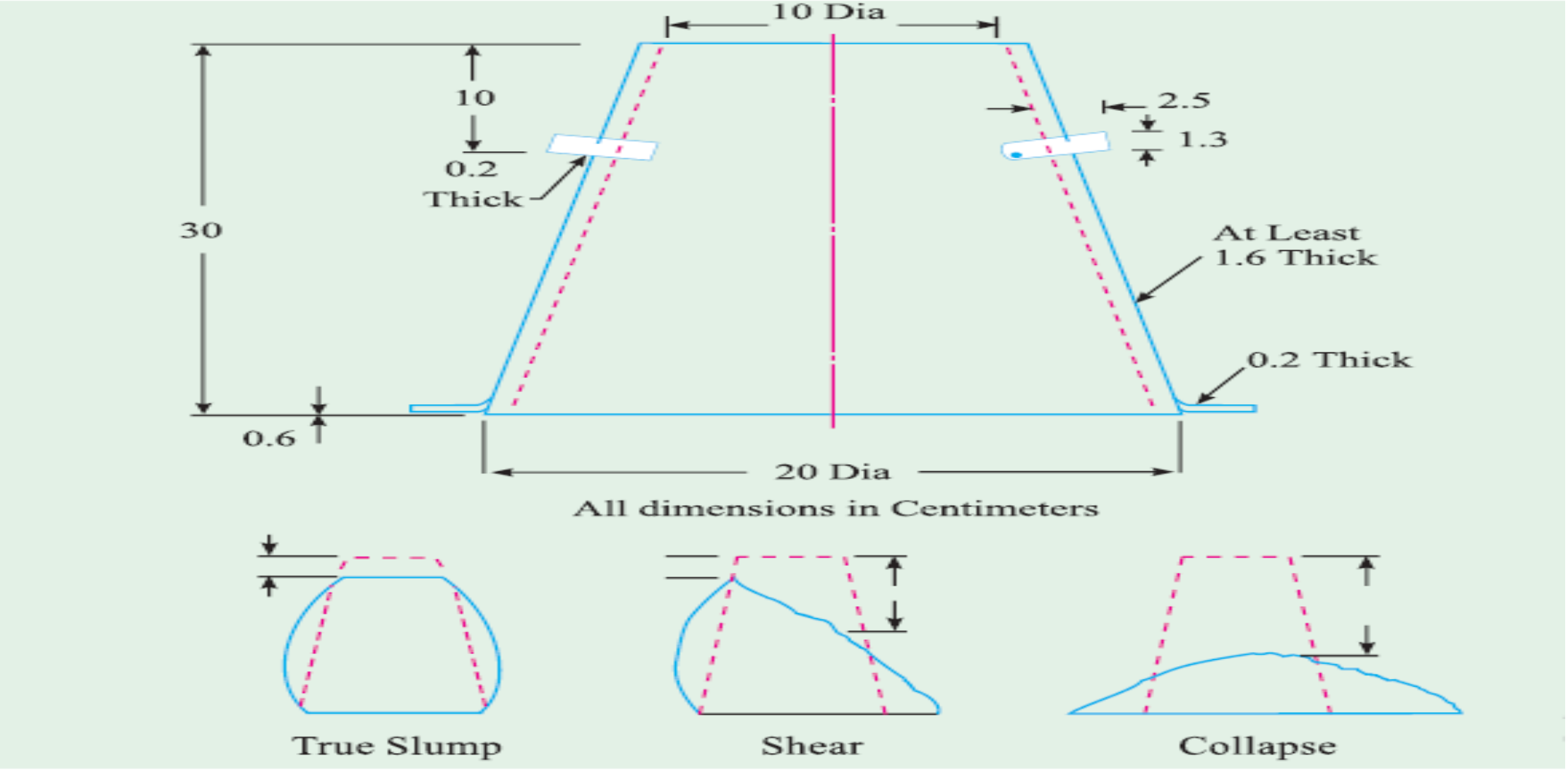
(b) Compacting Factor Test

(c) Flow Test

(d) Kelly Ball Test

(e) Vee Bee Consistometer Test.

Slump test


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

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 reinforce-ment. Not normally suitable for vibrat-ion. For pumping and tremie placing
Very High	–	–	–	Flow table test is more suitable.

Discussion for The Next Lecture

- Compaction Factor Test
- Vee-Bee Consistometer test
- Flow Test
- Kelly Ball Test
- Other properties of fresh concrete

Assignment

- What do you mean by fresh concrete? Write down the properties of fresh concrete ?
- Write down the procedure of Slump Test?
- Write down the factors affecting workability of concrete ?
- Name the various test used for the measuring workability of concrete?
- what effect w/c ratio will impose on concrete if we increase it ?

Thank you