AXIAL COMPRESSION TEST ON CUBE AND CYLINDRICAL MOULD

Exp. No:

Date :

AIM

To determine the compressive strength of concrete by testing cube and cylinder specimen.

EQUIPMENT

Universal testing machine, vernier calipers, scale, cube moulds and cylindrical moulds, tamping rod, trowels, Non-absorbent platform, hand scoop and compression testing machine

THEORY

The compressive strength of concrete is determined by testing 150 mm size concrete cubes under compression, 28 days after curing. The rate of loading is kept at 14/mm^2/min. the failure of the specimen is called as 'hour glass' type of failure. This happens because of lateral restraint provided by the plates to the cubes.

PROCEDURE

A) Preliminary

1. As per the given proportion, the quantities of cement, aggregate and water shall be determined by weight, to an accuracy of 0.1% of the total weight of the batch.
2. The quantity of concrete to be prepared shall be about 10 % excess of the volume of the desired number of test specimens to account for losses.
3. The interior surfaces of the properly assembled mould shall be thinly coated with mould oil to prevent adhesion of concrete.
4. The concrete shall be mixed by hand, or preferably, in a laboratory mixer machine, which are described below.

B) Mixing

1. Machine mixing

The sequence of materials to be fed into the hand-loaded concrete mixing machine is: it shall be charged with about one-half of the coarse aggregate, then with the fine aggregate, then with the cement, and finally with the remaining quantity of coarse aggregate on the top. The water shall be added immediately before start rotating the drum. The period of mixing shall not be less than two minutes and shall continue till the resulting concrete is uniform is appearance.

2. Hand mixing

i) The cement and fine aggregate shall be mixed dry until the mixture is thoroughly blended and is uniform in colour.

ii) The coarse aggregate shall then be added and mixed with the cement and fine aggregate until the coarse aggregate is uniformly distributed throughout.

iii) The water shall then be added and mixed until the concrete appears to be homogenous and has desired consistency.

C) Specimen preparation

1. Test specimens shall be made as soon as practicable after mixing. The concrete shall be filled in to the moulds in layers approximately 50 mm deep using hand scoop.
2. In placing each scoopful of concrete, the scoop shall be moved around the top edge of the mould as the concrete slides from it, in order to ensure a symmetrical distribution of the concrete within the mould.
3. Each layer of concrete can be compacted either by hand compaction or by vibration.
4. After the last layer has been compacted with overflowing concrete, the surface may be finished with trowel. By keep pressing the trowel, it may be moved forward and backward to give additional compaction to the top layer concrete and the surface is also finished simultaneously.

   Cylinder specimens shall be capped with a thin layer of stiff and neat cement paste after two to four hours of moulding.
5. After finishing the specimens, they shall be kept in moist air environment for 24 hours. After this period, the specimens shall be demoulded, marked and submerged in clean water. Specimens shall be kept in water till testing at the appropriate ages.

6. At the appropriate age the specimens are removed from water and surface water is wiped off. The dimensions are measured and their weight shall be noted.
7. Immediately after finding the weight the specimens have to be tested before they become dry. specimens shall not be tested in dry condition.
8. In the case of cubes, the specimen shall be placed in the Compression testing machine such that the load is applied through the sides of the cubes as cast and not through the top and bottom.
9. The maximum (crushing) load applied to the specimen shall be recorded and any unusual features noticed in the type of failure shall be reported.

FORMULA

$$\text{Compressive strength} = \frac{\text{Crushing load}}{\text{Cross sectional area}}$$

OBSERVATION

1) Cube

Length = Breadth = Depth =

2) Cylinder

Length = Diameter =

TABULATION

(a) Cube strength

Sl.No	Date of casting	Date of testing	Age of test	Weight	Density	Crushing Load	Compressive strength
Unit			Days	kg	kg/m^3	kN	N/mm^2
						Average	

(b) Cylinder strength

Sl.No	Date of casting	Date of testing	Age of test	Weight	Density	Crushing Load	Compressive strength
Unit			Days	kg	kg/m^3	kN	N/mm^2
						Average	

CALCULATION

(a) Cube compressive strength

(i) F_{cu1} =

(ii) F_{cu2} =

(iii) F_{cu3} =

SPECIFIC GRAVITY OF CEMENT

Exp. No.

Date :

AIM

To determine specific gravity of cement sample

EQUIPMENT AND MATERIAL REQUIRED

Specific gravity bottle, Kerosene fix from water, Weighing balance

THEORY

In concrete technology, specific gravity of cement is made use of in design calculations of concrete mixes, and it is also used to calculate its specific surface. The specific gravity is defined as the ratio between the weight of a given volume of cement and weight of an equal volume of water. The most popular method of determining, S.G. of cement is by the use of kerosene which doesn't react with cement

PROCEDURE

1. Weigh the specific gravity bottle dry (W_1)
2. Fill the bottle with distilled water and weigh the bottle(W_2)
3. Dry the specific gravity bottle and fill it with kerosene and weigh(W_3)
4. Pour some of the kerosene out and introduce a weighed quantity of cement (say about 60 gms) into the bottle. Roll the bottle gently in the inclined position until no further air bubble rise to the surface. Fill the bottle to the top with kerosene and weight it(W_4)

OBSERVATION

1. Weight of empty dry bottle (W_1) = gms
2. Weight of bottle + water (W_2) = gms
3. Weight of bottle + kerosene (W_3) = gms
4. Weight bottle + cement + kerosene(W_4) = gms

5. Weight of cement (W_5) = gms

CALCULATION

Specific gravity of kerosene $g = \frac{W3 - W1}{W2 - W1}$

Specific gravity of cement $G = \frac{W5\,(W3 - W2)}{(W5+W3-W4)\,(W2 - W1)}$

$G = \frac{W5}{(W5+W3-W4)} \times g$

RESULT

Specific gravity of cement=

SETTING TIME OF CEMENT

Exp No.

Date :

AIM

To find out the initial setting time cement.

EQUIPMENT AND MATERIAL REQUIRED

1. Vicat apparatus with all its accessories

THEORY

In actual construction dealing with cement paste, mortar , concrete , certain time is required for mixing, transporting and placing. During this time the cement mixture should be in plastic condition. The time interval for which the cement products remain in plastic condition is known as setting time. Normally a minimum of 30 minutes called initial setting time and maximum of 10 hours called final setting time for OPC

PROCEDURE

1. Before doing I.S.T , F.S.T , normal consistency , (p) of cement paste is required

NORMAL CONSISTENCY

1. Take 400gms cement and prepare a paste with a weighed quantity of water (say 24%)
2. Fill the paste in the mould with in 3 to 5 minutes
3. Shake the mould to expel air
4. A standard plunger 10mm dia , and 50 mm long is attached and brought down to touch the surface of the paste in the test block and quickly release it to sink in to the paste by its own weight
5. Note down the depth of penetration of the plunger
6. Conduct the second trail (25% of water) and find out the depth of penetration.
7. Conduct number of trails till the plunger penetrates for s depth of 33 – 35mm from top

8. The particular percentage of water which allows the plunger to penetrate to a depth of 33 – 35mm is known as the % of water required to procedure a cement paste of standard consistency

INITIAL SETTING TIME

1. Prepare a neat cement paste with 0.85 times the water required to give a standard consistency
2. Note down the time at which the water is added
3. Fill the vicat mould with the cement paste with in 3- 5 minutes
4. Smooth the surface of the paste , making it level with the top of the mould
5. Lower the needle gently into the surface of the paste and quickly released allowing it to sink into the paste by its own weight
6. Repeat the procedure until the needle fails to pierce the block for above 5mm – 7mm measure from the bottom and note down the time in stop watch
7. The difference between the two timings will give the initial setting time.

OBSERVATION

NORMAL CONSISTENCY

Needle used plunger size 10mm x 5mm

Sl. No	Weight of cement	Percentage of water	Amount of water	Reading of the pointer from bottom

INITIAL SETTING TIME

Needle used = Needle with 1 sq. mm
Amount of water = 0.85 P.

Sl. No	Time in minutes	Reading of the pointer

FINAL SETTING TIME

Needle used = Needle with a circular attachment

RESULT

Initial setting time of cement

COMPRESSIVE STRENGTH CEMENT

Exp No.

Date :

AIM

To determine the compressive strength of the given cement

EQUIPMENT AND MATERIAL REQUIRED

Mould of size 7.06 cm x 7.06cm , Wide base plate , C.T.M

THEORY

Strength of the hardened cement is most important for structural use . This strength depends upon the cohesion of the cement paste on its adhesion to the aggregate particles. Several forms of this test are direct tension , compression and flexure. This strength depends upon the temperature and humidity conditions of the room, curing chamber etc. It increases with age, strength retrogression might be a sign of unsoundness or other faults in cement

PROCEDURE

1. Find out the consistency of the given cement by using Vicat apparatus
2. take 555g of standard sand (Ennore sand) and 185 gms cement (ie) (C : m) in ratio 1:3
3. Mix them in a non – porous enamel tray for one minute
4. Then add water of quantity $\frac{P}{4}$ + 3 % of combined weight of sand and Cement . (where p-percentage water required for standard consistency)
5. Mix well to get a uniform colour.
6. Time of mixing should not be less than 3 minutes not more than 4 minutes
7. Then fill the mould of size 7.06cm
8. Compact the mortar by hand compaction in a standard manner
9. Keep the compacted cube in the mould at a temperature 27 $\pm$ 2° C for 24 hours

10. After 24 hours the cubes are removed from the mould and immersed in clean fresh water.
11. Then these cubes are tested for compressive strength at the periods mentioned below

(OPC) Ordinary Portland cement = 3 & 7 days
(RHC) Rapid Hardening cement = 1 & 3 days
(LHC) Low heat cement = 3, 7 & 28 days

This average compressive strength shall not be less than the values given in the table

Sl No	**Duration of time**	**OPC**	**RHC**	**LHC**
Unit		**kg/cm^2**	**kg/cm^2**	**kg/cm^2**
1.	1 day 24 hours	-	160	-
2.	3days (72 hrs)	160	275	100
3.	7days (178hrs)	220	-	160
4.	28days(672hrs)	-	-	350

OBSERVATION

Size of the mould =

Weight of cement =

Weight of sand =

Percentage of water for standard consistency =

Amount of water added $= \frac{P}{4} + 3\ \%$

Sl. No	Cast on	Tested on	Failure load	Compressive strength

CALCULATION

Area of the mould =

Compressive strength = $\frac{\text{Load at failure}}{\text{Area}}$

=

=

RESULT

Compressive strength of cement =

SOUNDNESS TEST

Exp No.

Date.

AIM

To detect unsoundness in cement

EQUIPMENT AND MATERIAL REQUIRED

Le-chatlier mould with all its accessories

THEORY

Un soundness in cement is due to the presence of excess of lime, magnesia or sulphates . Because of this it undergoes an appreciable change in volume after setting. The testing of soundness of cement to ensure that the cement does not show any appreciable subsequent expansion

PROCEDURE

1.Mix cement thoroughly with 0.78p (where p is the percentage of water required for standard consistency)
2.Fill the Le-chatlier mould kept on a glass plate.
3.Cover the mould on the top with another glass plate
4.Immerse the whole assembly in water at 27˚ – 32˚ C for 24 hours
5.Measure the distance between the indicator points
6.Submerge the mould again in water
7.Heat the water and bring to boiling point in 25-30 minutes and keep it boiling for 3 hours
8.Remove the mould from the water, allow it to cool and measure the distance between the indicator points.
9.This must not exceed 10 mm.

OBSERVATION

Weight of cement	=
Water required for standard consistency	=
Amount of water added	=
Distance between the indicator points	
Before boiling	=
After boiling	=

RESULT

Unsoundness in cement