St. Aloysius Institute of Technology

Jabalpur

FOURTH SEMESTER B.E. CIVIL

CONSTRUCTION MATERIAL AND TECNOLOGY-LAB

DEPARTMENT OF CIVIL ENGINEERING

SAIT JABALPUR

DEPARTEMENT OF CIVIL ENGINEERING

CE-404 CONSTRUCTION MATERIAL AND TECNOLOGY-LAB

LIST OF EXPERIMENT

1- To find out the crushing of compressive strength of a given sample of Bricks.

2- To determine the percentage of water absorption of bricks

3- To determine soundness test of cement by Le-Chatelier method as per IS: 4031 (Part 3) – 1988

4- To determine the workability of fresh concrete by compacting factor test as Per IS: 1199 – 1959.

5- To determine the workability of fresh concrete by using a Vee - Bee Consistometer.

6- To determine the crushing value of aggregate.

7- To determine the particle size distribution of the coarse and fine aggregates.

8- To determine the workability of fresh concrete of given proportions by slump Test.

9-To determine the normal consistency of given cement sample.

10-To determine initial and final setting time of cement

Developed by shailendra Singh Kourav

EXPRIMENT.NO.1

Object: - To find out the crushing of compressive strength of a given sample of Bricks.

Instruments Required:-

Compressive Strength Testing Machine, Support plates

Material Required: - Bricks 3no. Sand, a measuring scale,

Theory:- The maximum peneacible compressive load on per unit area of the brick is called compressive strength of the brick. Crushing strength of brick should not be less than 3.5N/mm² of the value is 7 to 14 N/mm² bricks are said to be glass A type and if crushing strength is more than 14N/mm² the bricks are considered to be class AA type.

DIAGRAM:-

Procedure:-

1- Take the sample of three bricks randomly from the slot and make the sample.
2- Measure the length and width of the bricks in mm.
3- Fill the frog of the sample by coast sand
4- Put the sand filled sample b/w two metal plates
5- Put the assembly on the anvil
6- Apply a uniform load at 13.72N/mm² on the surface of the bricks
7- Note the load at which sample is failed

Observation table:-

S.N.	Length in mm	Width in mm	Surface area (A) in mm	Max. Comp. Load (L)	Avg. Comp. Str.= N/mm²

Calculation:-

Avg. compressive strength of sample = (A1+A2+A3)/3

Result:- The average crushing or compressive strength of the given sample of the brick is ……

Precautions:-

1. Bricks should not be in dry condition.

2 .The frog should be filled completely and uniformly.

3. The sand should be coarst

4. Complete surface of the bricks should be covered by metal plate.

EXPRIMENT NO.2

OBJECT-To determine the percentage of water absorption of bricks

Apparatus Required:-

A sensitive balance capable of weighing within 0.1% of the mass of the specimen and ventilated oven.

Specimen

Three numbers of whole bricks from samples collected for testing should be taken.

DIAGRAM-

Procedure:-

1) Dry the specimen in a ventilated oven at a temperature of 105 °C to 115°C till it attains substantially constant mass.

2) Cool the specimen to room temperature and obtain its weight (M_1) specimen too warm to touch shall not be used for this purpose.

3) Immerse completely dried specimen in clean water at a temperature of 27+2°C for 24 hours.

4) Remove the specimen and wipe out any traces of water with damp cloth and weigh the specimen after it has been removed from water (M_2).

Observation table:-

S.N.	**Mass (M_1)**	**Mass (M_2)**
1.		
2.		
3.		

CALCULATIONS-

Water absorption, % by mass, after 24 hours immersion in cold water in given by the formula,

$$W = \frac{M_2 - M_1}{M_1} X\ 100$$

The average of result shall be reported.

Result

Water absorption of the given bricks = …….%

Specification

When tested as above, the average water absorption shall not be more than 20% by weight up to class 125 and 15% by weight for higher class.

EXPRIMENT.NO.3

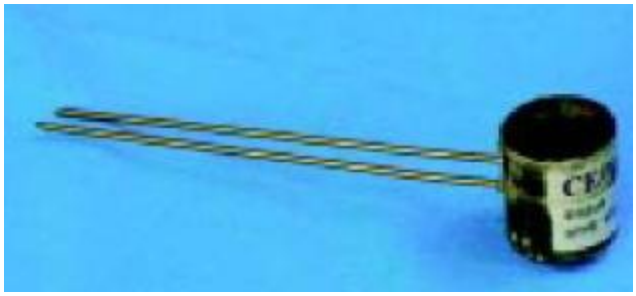
OBJECT- To determine soundness test of cement by Le-Chatelier method as per

IS: 4031 (Part 3) – 1988.

APPRATUS REQUIRED :– The apparatus for conducting the Le-Chatelier test

Should conform to IS: 5514 – 1969 Balance, whose permissible variation at a load of 1000g should be +1.0g and Water bath.

DIAGRAM:-



PROCEDURE:-

1) Place the mould on a glass sheet and fill it with the cement paste formed by gauging cement with 0.78 times the water required to give a paste of standard consistency.

2) Cover the mould with another piece of glass sheet, place a small weight on this covering glass sheet and immediately submerge the whole assembly in water at a temperature of 27 ± 2^{o}C and keep it there for 24hrs.

3) Measure the distance separating the indicator points to the nearest 0.5mm (say

d_1).

4) Submerge the mould again in water at the temperature prescribed above. Bring the water to boiling point in 25 to 30 minutes and keep it boiling for 3hrs.

5) Remove the mould from the water, allow it to cool and measure the distance between the indicator points (say d_2).

6) ($d_2 – d_1$) represents the expansion of cement.

OBSERVATION TABLE:-

S.N.	Weight of cement	Water content	Distance (d_1)	Distance (d_2)

CALCULATION:- Expansion of cement ($d_2 – d_1$)

RESULT:-

EXPRIMENT.NO.4

OBJECT:- To determine the workability of fresh concrete by compacting factor

Test as per IS: 1199 – 1959.

APPRATUS REQUIRED:- Compacting factor apparatus.

MATERIAL REQUIRED:- Aggregate, sand, Cement, Water.

DIAGRAM:-

SAILENT FEATURES

- The apparatus consists of two rigid conical hoppers and a cylinder installed on a rigid metal frame.
- Provided with a circular metal plate to cover the top of the cylinder.
- The lower opening of the hoppers are fitted with hinged trap-doors having quick release catches.
- The apparatus is supplied complete with one plaster's trowel and one tamping rod, whose one end is rounded.
- The inside surfaces of the apparatus are machined smooth.
- The whole apparatus is furnished in hammertone spray.

PROCEDURE:-

1) The sample of concrete is placed in the upper hopper up to the brim.

2) The trap-door is opened so that the concrete falls into the lower hopper.

3) The trap-door of the lower hopper is opened and the concrete is allowed to fall into the cylinder.

4) The excess concrete remaining above the top level of the cylinder is then cut off with the help of plane blades.

5) The concrete in the cylinder is weighed. This is known as weight of partially compacted concrete.

6) The cylinder is filled with a fresh sample of concrete and vibrated to obtain full compaction. The concrete in the cylinder is weighed again. This weight is known as the weight of fully compacted concrete.

OBSERVATION TABLE:-

Degree of workability	Slump mm	Compaction Factor		Applications
		Small Appts.	Large Appts.	
Very low	0-25			Vibrated concrete in roads or other large Sections.
Low	25-50			Mass concrete foundations without Vibration. Simple reinforced sections with Vibration.
Medium	50-100			Normal reinforced work without vibration and heavily reinforced sections with Vibration.
High	100-180			Sections with congested reinforcement. Not normally suitable for vibration.

CALCULATION-

Compacting factor = (Weight of partially compacted concrete)/(Weight of fully compacted concrete**).**

EXPRIMENT.NO.5

OBJECT:- performed to determine the workability of fresh concrete by using a Vee-Bee consistometer.

APPRATUS REQUIRED:- Vee-Bee consistometer

MATERIAL REQUIRED:- Aggregate, Sand, cement, water.

THEORY:-

A metal cylindrical container mounted on a Vibrating table, which produces a sinusoidal vibration. In the version of the test standardized in Europe as EN 12350-3, a slump cone is placed in the center of the cylinder and filled in the same Manner as in the standard slump test. After the slump cone is removed, a clear plastic disk is set atop the fresh concrete. The Vebe table is started and the time for the concrete to remold from the slump cone shape to the shape of the outer cylindrical container is recorded as a measure of consistency. The sliding clear plastic disk facilitates the determination of the end of the test.

Juvas (1994) has presented a modified Vebe test to more efficiently measure low slump Concretes that exhibit standard Vebe times greater than 30 seconds. In the modified Vebe test, a 20 kg surcharge is attached to the rod above the clear plastic disk. The remainder of the test Apparatus and procedure is unchanged. The modified Vebe test more closely represents the

Production of precast concrete elements that is both vibrated and pressed.

ADVANTAGES-

1) The Vebe consistometer is a dynamic test and can be used on concretes that are too dry for the slump test.

2) The test device is standardized in ASTM and identified by ACI Committee 211 (2002) in its guide for proportioning low slump concrete.

3) Test results are obtained directly.

DISADVANTAGES-

1) Due to the need to ensure that all vibration is kept within the test device, the size of the test device makes the Vee bee consistometer generally unsuitable for field use.

2) The test device only works for low slump concretes.

3) No analytical treatment of the test method has been developed. Such treatment would be Complex because the shear rate declines during the duration of the test as the concrete Specimen changes shape.

VEE BEE CONSISTOMETER

PROCEDURE: **-**

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

2) The glass disc attached to the swivel arm is turned and placed on the top of the concrete in the pot.

3) The electrical vibrator is switched on and a stop-watch is started, simultaneously.

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

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

OBSERVATION TABLE-

S.N.	Height of the Slump cone (a)	Subsided height of concrete (b)	Slump (a-b)	Vee-Bee seconds

RESULT:-

EXPRIMENT.NO.6

OBJECT- To determine the crushing value of aggregate.

APPRATUS REQUIRED:- Cylindrical measure and plunger, Compression testing machine, IS Sieves of sizes – 12.5mm, 10mm and 2.36mm

This test helps to determine the aggregate crushing value of coarse aggregates as per IS: 2386(Part IV) – 1963.

PROCEDURE:-

1) The aggregates passing through 12.5mm and retained on 10mm IS Sieve are oven-dried at a temperature of 100 to 110^{o}C for 3 to 4hrs.

2) The cylinder of the apparatus is filled in 3 layers, each layer tamped with 25 strokes of a tamping rod.

3) The weight of aggregates is measured (Weight 'A').

4) The surface of the aggregates is then leveled and the plunger inserted. The apparatus is then placed in the compression testing machine and loaded at a uniform rate so as to achieve 40t load in 10 minutes. After this, the load is released.

5) The sample is then sieved through a 2.36mm IS Sieve and the fraction passing through the sieve is weighed (Weight 'B').

6) Two tests should be conducted.

OBSERVATION TABLE-

S.N.	Weight (A)	Weight (B)

CALCULATION-

Aggregate crushing value = (B/A) x 100%.

RESULT:- The aggregate crushing value is ……..

EXPRIMENT.NO:-7

OBJECT:- To determine the particle size distribution of the coarse and fine aggregates.

APPRATUS REQUIRED:-

1) A set of IS Sieves of sizes – 80mm, 63mm, 50mm, 40mm,31.5mm, 25mm, 20mm, 16mm, 12.5mm, 10mm, 6.3mm,4.75mm, 3.35mm, 2.36mm, 1.18mm, 600µm, 300µm, 150µm and 75µm.

2) Balance or scale with an accuracy to measure 0.1 percent of the weight of the test sample.
The weight of sample available should not be less than the weight given below:-

Maximum size present in substantial proportions (mm)	Minimum weight of sample despatched for testing (kg)
63	100
50	100
40	50
25	50
20	25
16	25
12.5	12
10.0	6
6.3	3

The sample for sieving should be prepared from the larger sample either by quartering or by means of a sample divider.

PROCEDURE:-

1) The test sample is dried to a constant weight at a temperature of 110 + 5^{o}C and weighed.

2) The sample is sieved by using a set of IS Sieves.

3) On completion of sieving, the material on each sieve is weighed.

4) Cumulative weight passing through each sieve is calculated as a percentage of the total sample weight.

5) Fineness modulus is obtained by adding cumulative percentage of aggregates retained on each sieve and dividing the sum by 100.

Reporting of Results:-

The results should be calculated and reported as:

1) The cumulative percentage by weight of the total sample.

2) The percentage by weight of the total sample passing through one sieve and retained on the next smaller sieve, to the nearest 0.1 percent. The results of the sieve analysis may be recorded graphically on a semi-log graph with particle size as abscissa (log scale) and the percentage smaller than the specified diameter as ordinate.

EXPRIMENT.NO.9

OBJECT:- To determine the workability of fresh concrete of given proportions by slump test.

APPARATUS:- Slump cone, Tamping rod,

MATERIAL:- Cement, Sand Aggregate, Water, Scale.

THEORY:-

The concrete slump test is the most commonly used method of measuring consistency of concrete. The test is popular due to the simplicity of apparatus used and simple procedure. The slump test is used to ensure uniformity for different batches of similar concrete under field conditions, and to ascertain the effects of plasticizers on their introduction. Additional information on workability and quality of concrete can be obtained by observing the manner in which concrete slumps.

DESCRIPTION OF APPARATUS -

1) Following are some of the key features of slump cone test equipment :-

2) The apparatus comprises of a slump cone along with handles and foot pieces.

3) There is a octagonal shaped base plate having two clamps, to which is attached the foot pieces.

4) The base plate is provided with lifting handles for ease of transportation.

5) Provided with a chrome plated steel tamping rod, which is long and rounded off at one end. The rod is graduated in millimeters.

Slump cone consists of :- Upper diameter 10 cm. ,bottom diameter 20 cm and a height of 30 cm.

DIAGRAM:-

PROCEDURE:-

1) Fill the slump cone (1/3 full by volume) and rod 25 times with 5/8 inch diameter X 24 inch long hemispherical tip steel tamping rod. This specification requirement should be exactly followed for getting standard results from slump cone test. Distribute rodding evenly over the entire cross section of the sample.

2) Fill the slump cone with other layer (2/3 full by volume). Rod this layer 25 times with rod penetrating into but not so deep that it goes through the first layer. Distribute rodding evenly over the entire cross section of the layer.

3) Fill the slump cone with another layer that overflows. Rod this layer 25 times with rod penetrating into but not so deep that it goes through the second layer.

4) Now remove the excessive concrete from the top of the cone with the help of tamping rod. Also clean the concrete overflow from base of the slump cone.

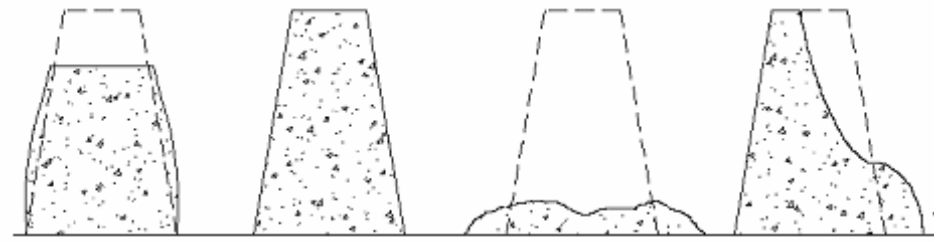
5) Now without wasting any time, immediately lift the slump cone with a slow and even motion. Avoid jarring the concrete or tilting the cone while doing this process. Invert the withdrawn cone and place it next to the slumped concrete. Take care so that it doesn't touch the concrete. This procedure should be complete within 5-10 seconds with no lateral and torsional motion.

6) Lay a straight across the top of the slump cone. Now measure the amount of slump in inches with the help of the ruler from the bottom of the straight edge to the top of the slumped concrete at a point over the original center of the base.

OBSERVATION TABLE:-

S.N.	Height of the Slump cone (a)	Subsided height of concrete (b)	Slump (a-b)

RESULT :-



True Zero Collapsed Shear

The slumped concrete takes various shapes, and according to the profile of slumped concrete, the slump is termed as true slump, shear slump or collapse slump. If a shear or collapse slump is achieved, a fresh sample should be taken and the test repeated. A collapse slump is an indication of too wet a mix. Only a true slump is of any use in the test.

EXPRIMENT.NO.9

OBJECT:- To determine the normal consistency of a given cement sample.

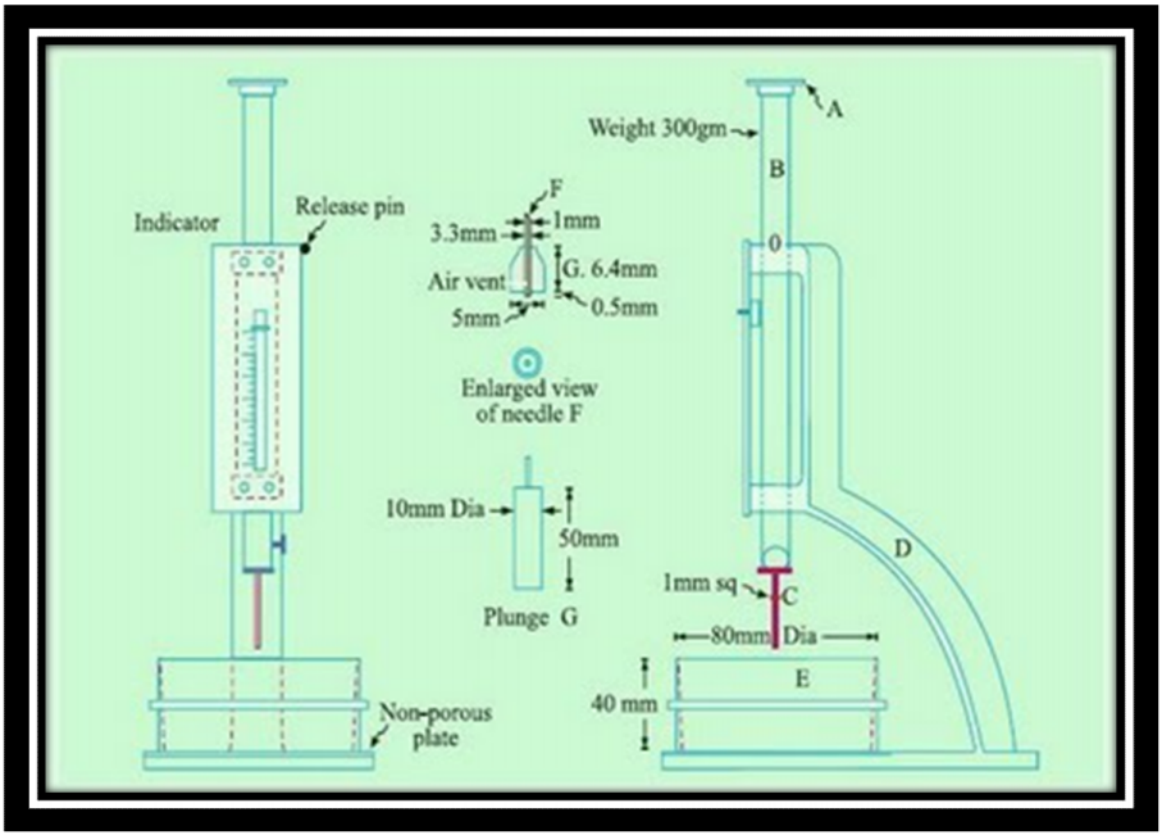
Instruments Required:- Vicat´s apparatus, Plunger, Mould, Glass plate, Weighing Machine, etc.

Material Required:-Cement, Water.

THEORY:- Consistency is the amount of water to make the cement paste

Workable. The normal consistency of cement is 30%.

DIAGRAM-



PROCEDURE:-

1) Take 300 gm cement specimen and add 30% of water by the weight of cement.
2) Mix the water and add cement on a non- porous surface mixing should be done thoroughly and fix the mould of Vicat's apparatus.
3) The interval between the addition of water to the common cement and fixing the mould is known as time of gauzing plunger is attached to the movable rod of vicat apparatus.
4) The plunger is gently lowered.
5) If the penetration of plunger into the cement paste is between 5 to 7 mm from the bottom of the mould.

Observation table:-

S.N.	Weight of cement	% of water	Quantity of water (300 × % of water)/100	Penetration from bottom	Remark

RESULT:- The penetration is found to be…….. from the bottom of the mould.

PRECAUTIONS:-

1) Cement should be taken out from gunny bag.
2) It should be stored in cool and dry place.
3) Before actual test in lab the quality of cement should be determined by physical inspection

EXPRIMENT.NO.10

OBJECT:- To determine initial and final setting time of cement.

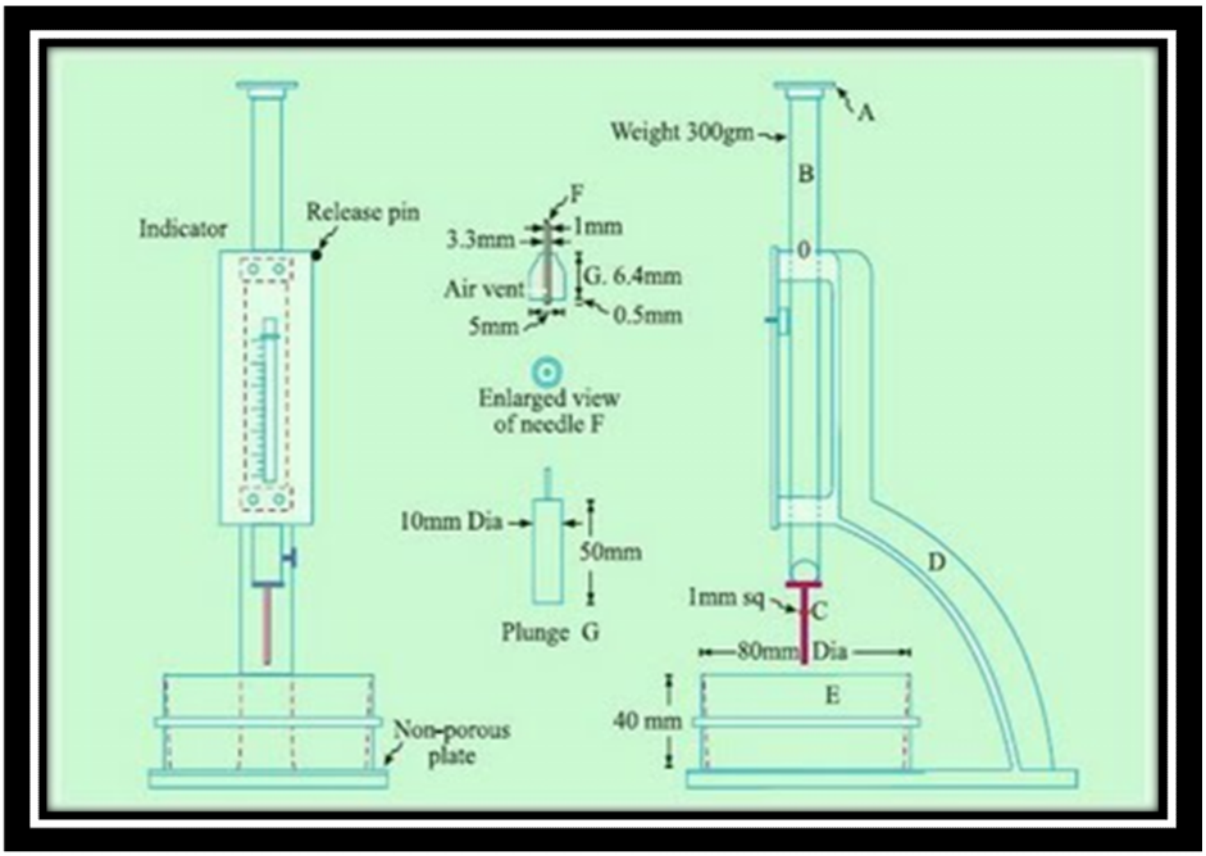
Instruments Required:- Vicat´s apparatus, Sharp needle, Mould, Glass plate, Weighing Machine, Stop watch etc.

Material Required:-Cement, Water etc.

THEORY:- This test is used to detect the deterioration of cement due to storage the initial setting time of cement is defined as the time taken from the moment when water is added to cement to the moment when the needle of 1mm square cross sectional area fails to penetrate beyond 33 to 35 mm from top.

The final setting time of cement is defined as the time taken from the moment when water is added to cement to the moment the collar fails to make impression on the surface of cement paste.

DIAGRAM-



PROCEDURE:- INITIAL SETTING TIME

1.The cement weighing 300 gm is taken & is mixed with the % of water as determined in consistency test.

2. The cement paste is filled in vicat mould.

3. The sq needle of cross section 1mm*1mm is attached to the moving rod of vicat apparatus.

4. The needle is quickly released & it is allowed to penetrate the cement paste. In the beginning, the needle penetrates completely. It is then taken out & dropped at a fresh place. The procedure is repeated at Regular intervals till the needle does not penetrate completely. The needle should penetrate up to about 5mm measured from bottom.

5. The initial setting time is the interval between the addition of water to cement

& the stage when needle ceases to penetrate completely. It should be 30 minutes for ordinary cement

FINAL SETTING TIME:-

1) The cement paste is prepared & is filled in the vicat mould
2) The needle with annular collar is attached to the moving rod of vicat apparatus. This needle has a sharp point projecting in the centre with annular collar.
3) The needle is gently released. The time at which the needle makes an Impression on test block & the collar fails to do so is noted
4) The final setting time is the difference between the time at which the water is added to cement & time as recorded in 3. This time should be about 10 hrs for ordinary cement.

Observation table:-

S.N.	Time Mixing Water (in minute)	Penetration from Bottom (in mm)	Remark

RESULT:- The Initial Setting of Cement is Found to be ……..

The Final Setting Time of Cement is Found to be…….

PRECAUTION:-

1) Cement should be taken out from Gunny Bag.
2) Penetration should apply gradually.
3) Time should be noted carefully.