Summer Training Report

Place of Training: Manglam Consultancy Services, Madri, Udaipur.

Period of Training: 20 July - 4 September, 2023

Submitted to

Department of Civil Engineering

Summer Training In-charge at TINJRIT: **Mr. Rakesh Yadav**

By

Pushpendra Gehlot

(Batch 2021-2025)

Branch: Civil Engineering

Roll No.: 21ETCCE006

Techno India NJR Institute of Technology

Plot-T, Bhamashah (RIICO) Industrial Area, Kaladwas,

Udaipur – 313001, Rajasthan

Certificate I

Manglam Consultancy Services
UDAIPUR

NABL Accredited & ISO 9001 Certified

• Civil Engineering Material Testing • Destructive & Non Destructive Testing • Pile & Load Test • Geotechnical Exploration • Geo Physical Survey • Resistivity • TPI • BI & BBD in Highway Testing

Date-06/09/2023

Reference No –MCSU/2023/Training/0002

To,

Mr. Pushpendra Gahlot

Techno India NJR Institute of Technology,

Kaladwas, Udaipur

Sub: - Training Completion Certificate for 45 days.

This is to certify that **Mr. Pushpendra Gahlot** S/o Mr. Jagdish Lal Gahlot from **Techno India NJR Institute of Technology,** from department of Civil Engineering has successfully completed the 45 days industrial training in Civil Engineering Lab from Date 20/07/2023 to 04/09/2023 his work found quite satisfactory during his entire tenure.

6/9/23

(Rahul Mathur)

DIRECTOR

Manglam Consultancy Service

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CertificateII

This is to certify that Mr. PUSHPENDRA GEHLOT, Bachelor of Civil Engineering has successfully completed his 45 days Industrial Training from Manglam Consultancy Services, Udaipur in Civil Engineering Lab from date 20/07/2023 to 04/09/2023. His work found quite satisfactory during his entire tenure.

Signature

Mr. Rakesh Yadav HOD CE

ACKNOWLEDGMENT's

I am very grateful that I was given the opportunity to do this training, which has enhanced my knowledge in so many aspects. It gives me the knowledge of the various test which are being done on the building materials. I would like to show my gratitude to the coordinator Mr. Rakesh Yadav Sir, my teachers Mr. Nishit Jain Sir, Mr. Jitendra Chaubisa Sir for giving me this opportunity and their guidance during this training period.

All would also grateful for the coordination of the director of the Manglam Consultancies Mr. Rahul Mathur Sir for the guidance in the training. Also the engineers Mr. Gaurav Sir, Mr. Saumya Sir, MR. Deepak Sir helped me a lot to learn the various tests and procedures. The whole staff and the workers helped me there to complete the training.

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Chapter 1 : About the Company

MANGLAM CONSULTANCY SERVICES: Geotechnical Solutions
Company **Headquarter:** Vadodara, Gujarat.
Established in: 2001

Manglam Consultancy Services, a renowned name for providing Geotechnical Solutions, was established in 2001 in the town of Vadodara, Gujarat. With a team of experienced and knowledgeable technocrats who are committed to exploring the boundaries of Geotechnical Engineering, we are the leaders of Geotechnical Solutions and testing of Civil Engineering Materials.

We provide services in the fields of Soil & Civil Engineering Materials: Investigation, Testing, and Surveying; Chemical Analysis, Non Destructive Testing of Structures, Load Testing, Highway Engineering & Road Testing, Pile Integrity Testing, Quality Assurance: Geophysical Investigation & Third Party Inspection.

Equipped with the latest technology equipments and machines for conducting the aforestated tests, these are duly calibrated and maintained through NABL approved Laboratories. We have grown and spread out to network our Laboratories across India. We have Laboratories in Vadodara, Ahmedabad, Gandhinagar, Valsad, Rajpipla, Godhra, Anand, Bharuch, Surat, New Delhi, Indore, Goa, Udaipur and Pune. These Laboratories are also ISO 9001:2008 Certified, with approvals from Central Govt., all major State Govt., and other Private Sector approvals.

"Geotechnical Solutions equals Manglam Consultancy Services."

Chapter 2 : About the lab

Manglam Consultancy Services offers a wide range of laboratory services, including:

1. Soil investigation and testing: This includes collecting and analyzing soil samples to determine their properties, such as bearing capacity, compressibility, and permeability.
2. Foundation design and analysis: This involves designing foundations that are safe and economical for a particular soil condition.
3. Earthworks and slope stability analysis: This includes designing and monitoring earthworks projects, such as dams, embankments, and retaining walls, to ensure their stability.
4. Pile testing and analysis: This involves testing piles to determine their load-carrying capacity and to ensure that they are safe to support a structure.
5. Tunneling and underground construction: This includes providing geotechnical advice for tunneling and underground construction projects. • Groundwater studies: This includes investigating the occurrence and movement of groundwater, and designing groundwater control measures.
6. Environmental geotechnics: This includes providing advice on the impact of geotechnical works on the environment.
7. Construction materials testing: This includes testing the properties of construction materials, such as concrete, steel, and asphalt, to ensure that they meet the required standards.

Chapter 3 : Gradation of Coarse Aggregate

AIM:

To determine the size of particle distribution

Apparatus:

1. IS sieves used for gradation of coarse aggregate40mm,25mm,20mm,16mm,12.5mm,10mm,6.3mm, 4.75mm,2.36mm,1.18mm.
2. Pan
3. Brush

Procedure:

1. The sample should be oven dried at temperature 100^0C to 110^0C before weighing and sieving.
2. The dried sample of coarse aggregate is weighed.
3. The sieve is arranged according to sizes.
4. The sieve with biggest opening is kept on top while the sieve with smallest opening is kept at bottom.
5. Below the sieve of smallest opening, pan is kept in order to collect the remaining samples which does not conform to the sieve sizes above.
6. A brush is used to clean the additional particles or impurities remaining on the sieve shaker.
7. After making all the arrangement the sieve shaker is turned on and it is operated continuously for around 10 – 15 minutes in order to obtain correct results.
8. After operating the shaker is turned off and the sieves are taken out for weighing the remaining samples on each of the respective sieves.
9. Cumulative weight passing through each sieve sizes are calculated as a percentage of the total sample weighed.

Fig.1 IS Sieve

Chapter 4 : Impact test of Aggregate

AIM:

To find the impact value of aggregate

Apparatus:

1. Impact testing machine
2. A cylindrical steel cup having internal diameter 102 mm, depth 50 mm, and minimum thickness 6.3 mm.
3. A metal hammer having weight of 13.5 to 14.0 kg the lower end is cylindrical in shape, 50 mm long, 100 mm in diamete. The hammer is arranged in such a way that it should slide freely between vertical guides and be concentric with the cup. It is arranged that the free fall of the hammer should be within 380±5 mm
4. A cylindrical metal measure has an internal diameter of 75 mm and a depth of 50 mm for measuring aggregates.
5. One end rounded tamping rod having 10 mm diameter and 230 mm length.
6. A balance of capacity not less than 500 g.

Procedure:

1. Sieve the material through 12.5mm and 10.0 mm IS sieves. The aggregates passing through the 12.5 mm sieve comprise the test material.
2. Then, just 1/3 rd depth of the measuring cylinder is filled with aggregate by pouring.
3. Compact the material by giving 25 gentle blows with the rounded end of the tamping rod in the cylinder.
4. Two more layers are added in a similar manner, to make the cylinder full.
5. Strike off the surplus aggregates.
6. Determine the net weight of the aggregates to the nearest gram (W1).
7. Bring the impact machine to rest without wedging or packing upon the level plate, block, or floor, so that it is rigid and hammer guide columns are vertical.
8. 25 gentle strokes with a tamping rod are used to compact the test sample by fixing the cup firmly in position on the base of the machine with placing the whole of the test sample in it.

9. After that raise the hammer until its lower face is 380 mm above the surface of the aggregate in the cup and allow it to fall freely on the aggregate sample. 15 such blows at an interval of not less than one second between successive falls are acted on it.

10. Remove the crushed aggregate from the cup and sieve it through 2.36 mm IS sieves until no further significant amount passes in one minute. Weight the fraction passing the sieve to an accuracy of 1 gm (W2). The fraction retained in the sieve is weighed.

11. Note down the observations in the proforma and compute the aggregate impact value. The 'Aggregate Impact Value' is the mean of two observations, rounded to the nearest whole numbe

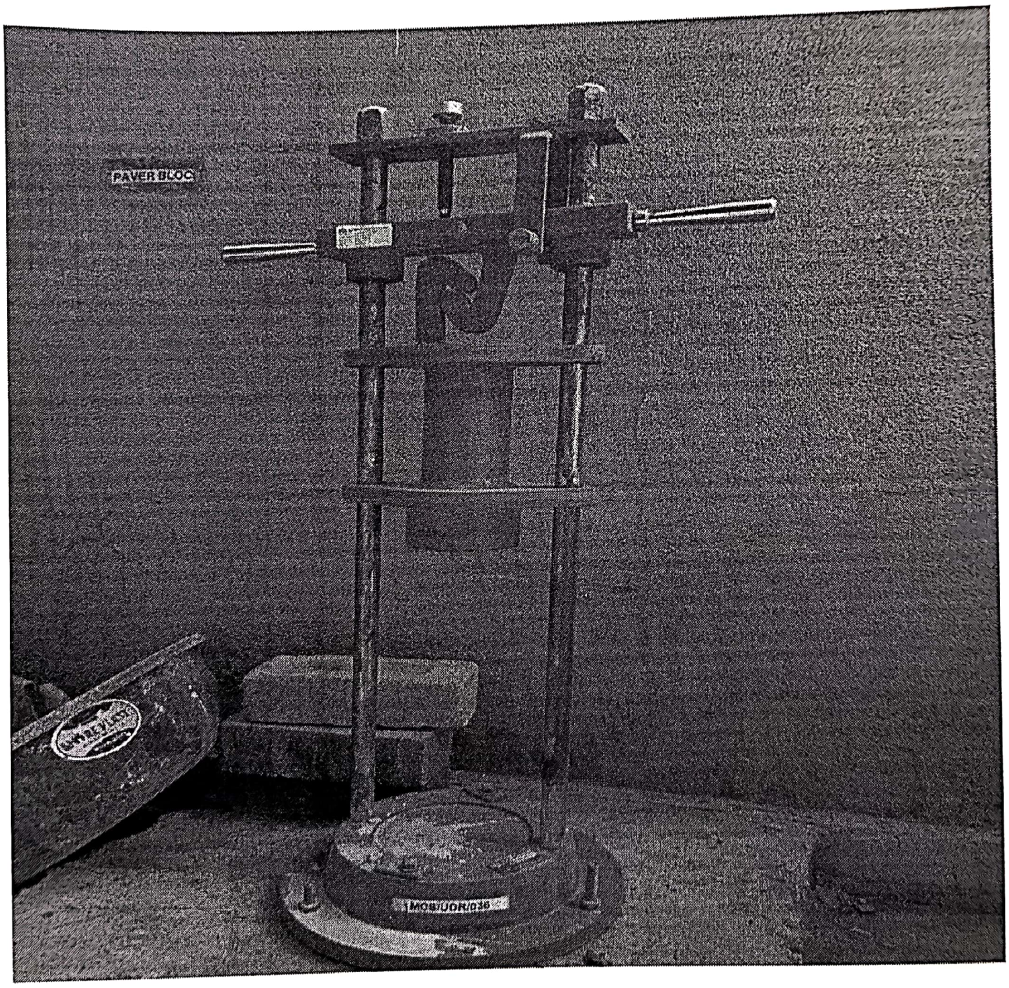

Fig.2 Impact Testing Machine

Chapter 5 : crushing value test of Aggregate

AIM:

To find the crushing value of aggregate when gradually load is applied.

Apparatus:

1. A steel cylinder having 15 cm diameter with plunger and base plate.
2. Tamping rod having 16mm diameter and 45 to 60cm long and rounded at one end.
3. A balance of capacity 3 kg readable and accurate to one gram.
4. IS sieves of sizes 12.5mm, 10mm and 2.36mm
5. A compression testing machine (CTM).
6. Cylindrical metal measure of sufficient rigidity to retain its from under rough usage and of 11.5cm diameter and 18cm height.

Procedure:

1. Coarse aggregate passing 12.5mm IS sieve and retained on a10mm IS sieve are selected and heated at 100 to 110°C for 4 hours and cooled to room temperature.
2. At first set the cylinder in position on the base plate and weigh it **(W)**.
3. Put the sample in 3 layers, with 25 strokes each layer using the tamping rod. Care being taken in the case of weak materials not to break the particles and weigh it **(W1)**.
4. Level the surface of aggregate carefully and insert the plunger so that it rests horizontally on the surface and ensure that the plunger does not jam in the cylinder.
5. Place the cylinder with plunger on the loading platform of the compression testing machine.
6. And applied the 400KN load at the pace value of 0.67KN/s.
7. Release the load and remove the material from the cylinder.

8. Now pass the crushed material from 2.36mm IS sieve, care being taken to avoid loss of fines.
9. Weigh the fraction passing through the IS sieve (W2).

Aggregate crushing value = **(W2 x 100) / (W1-W)**

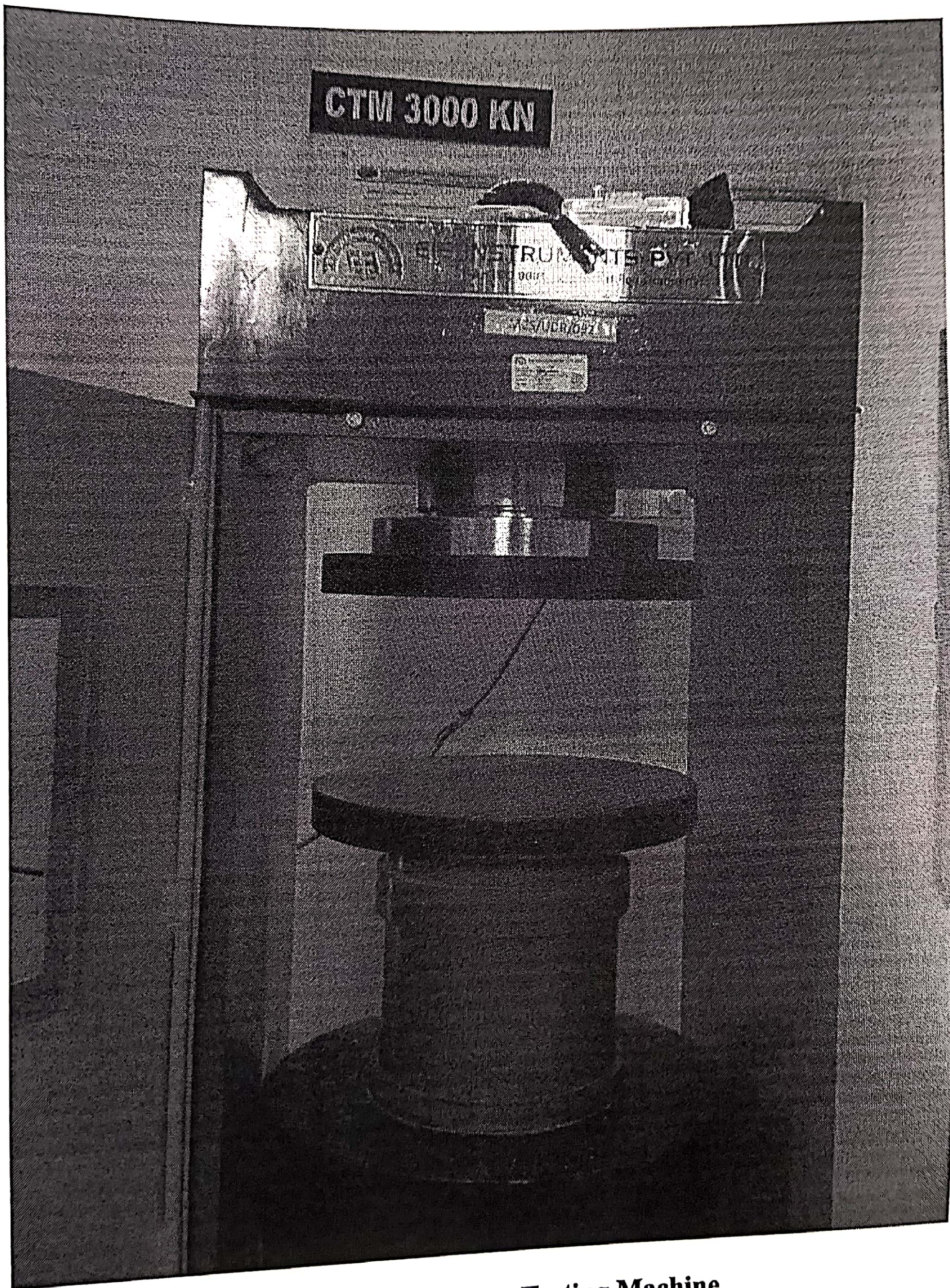

Fig.3 Compression Testing Machine

Chapter 6 : Flakiness and Elongation index test of coarse Aggregate

a. When the size of aggregate is less than 0.6 times of mean dimension is called flaky aggregate

b. When the longer size of aggregate is greater than 1.8 times of mean dimension is called elongated aggregate

AIM:

To find the flaky and elongated aggregate from the course aggregate

Apparatus:

1. IS sieve of 25mm,20mm,16mm,12.5mm,10mm,6.3mm,4.75mm,2.36mm,1.18mm.
2. Pan
3. Balance
4. Metal gauge – Flakiness gauge , Elongation gauge.

Procedure:

1. Take the 200 piece of aggregate from each that retained on 20mm,16mm,12.5mm and 10mm.
2. Firstly take 20mm retained aggregate and take the total weight of aggregate and passed it from flakiness gauge from 25mm to 20mm range space.
3. Then weight the flaky aggregate . And weight Non Flaky aggregate .
4. Now take the Non Flaky aggregate and passed it from elongation gauge.
5. Now take the weight of Elongated aggregate .
6. And repeat this process with all the retained aggregate pieces from different sieves.
7. At last total the all retained weight at different sieve W1.
8. Total the weight of flaky aggregate W2.
9. Total the weight of non flaky aggregate W3.
10. Total the weight of elongated aggregate W4.

Flaky aggregate = (W2 x 100)/W1

Elongated aggregate = (W4 x 100)/W3

Total of flaky and elongated aggregate should not more than 30%.

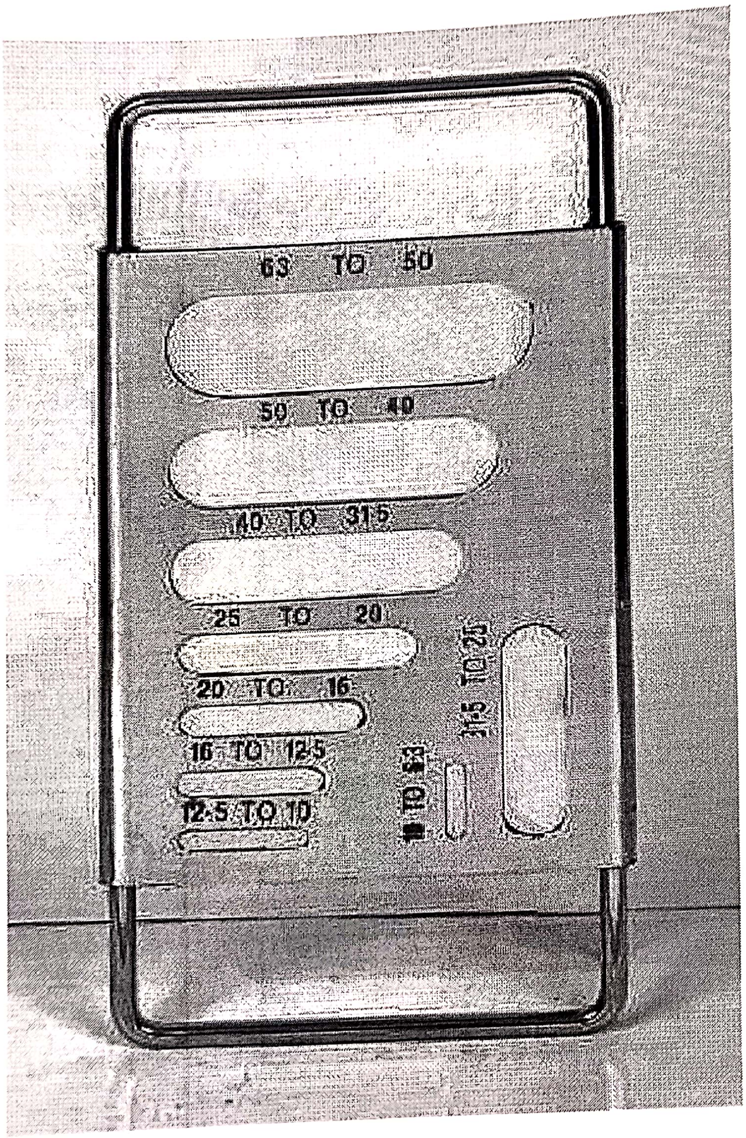

Fig.4 Flakiness Index Apparatus

Fig.5 Elongation Index Apparatus

Chapter 7 : consistency test of cement.

Consistency - The consistency of cement is the minimum water required for cement to just convert into liquid state

AIM:

To find the consistency of cement.

Apparatus:

1. Vicat apparatus – Vicat Apparatus consists of a plunger with a needle, which used to penetrate the cement specimen up to the depth of 5mm to 7mm and above.
2. Weighing balance – Up to measure 1000g with 1g accuracy
3. Stop Watch
4. Measuring Cylinder 200 ml
5. Glass Plate
6. Vicat Mould
7. Tray
8. Trowel

Procedure:

1. Fix and place the Vicat apparatus on a flat surface and make necessary adjustments.
2. Now take 400gm of cement specimen and add 28% of water by the weight of cement and mix it for up to 3 to 5 minutes.
3. Then fill the cement paste into the Vicat mould and remove the excess cement paste by the trowel.
4. Now place the Vicat mould on the Vicat apparatus and release the plunger by contacting the cement paste surface.

5. Then release the plunger and allow it to penetrate the cement paste and note down the reading from the gauge scale from the bottom of the Vicat mould.
6. Now again, add water with cement paste at a different water ratio until the reading lies between 5mm and 7mm.

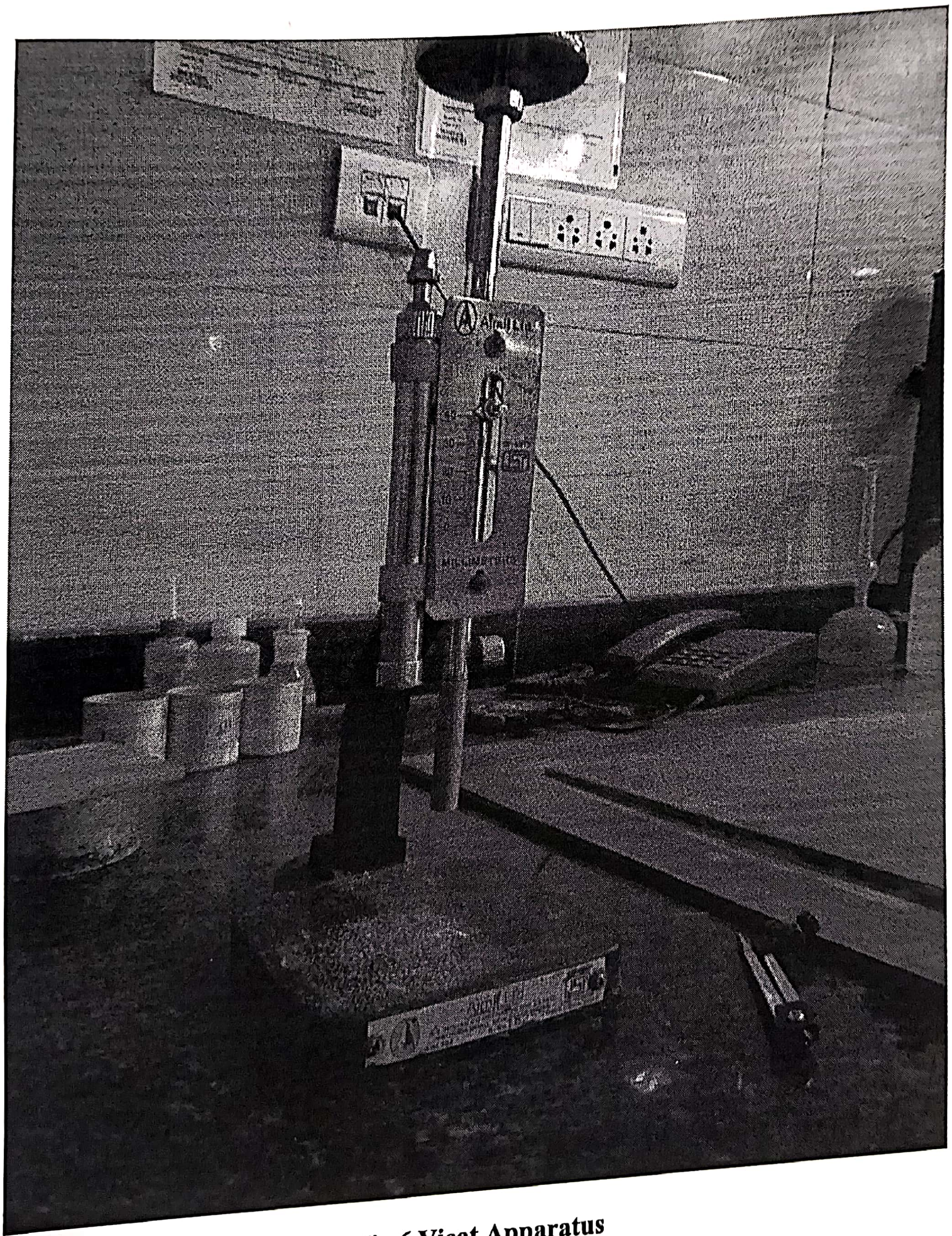

Fig.6 Vicat Apparatus

Chapter 8 : Density test of cement

Aim:

To Determine the Density and Specific Gravity of Cement

Apparatus:

1. Ordinary Portland Cement (OPC)
2. Le-Chatelier Flask of 250 ml or Specific Gravity Bottle / Pycnometer of 100 ml
3. Weighing Balance with 0.1g accuracy
4. Heavy Rubber Pad about 12 in. × 12 in.
5. Kerosene (free of water having a specific gravity not less than 0.731)
6. Glass Funnel
7. Constant Temperature Water Bath

Procedure:

1. Take the representative sample of the cement as per IS: 3535-1986 and thoroughly mix before testing.
2. Dry the Le-Chatelier flask and fill with kerosene oil or Naphtha to a point on the stem between the 0 and 1ml mark.
3. After pouring, dry the inside of the flask above the level of the kerosene oil or Naphtha if necessary.
4. Immerse the Le-Chatelier flask in a constant temperature water bath maintained at room temperature for a sufficient interval before making either of the readings so as to avoid variations greater than
5. 0.2°C in the temperature of the liquid (kerosene or naphtha) in the flask.
6. Record the level of the kerosene oil in the flask as initial height reading.
7. Introduce a weighed quantity of cement (about 64 g for Portland cement) into the flask at the same temperature as the liquid so that the level of kerosene rises to about say 22 ml mark.
8. Splashing should be avoided and cement should not be allowed to adhere to the insides of the flask above the liquid (kerosene or naphtha).

9. Use a vibrating apparatus to accelerate the introduction of the cement into the flask and to prevent the cement from sticking to the neck.
10. After all the cement has been introduced, insert the stopper into the flask and roll the flask gently in an inclined position to free the cement from air until no further air bubble rises to the surface of the liquid (kerosene or naphtha).
11. If a proper amount of cement has been added, the level of the liquid (kerosene or naphtha) will be in its final position at some point of the upper series of graduations.
12. Keep the Le-Chatelier flask again in constant temperature water bath maintained at room temperature for a sufficient interval before making either of the readings so as to avoid variations greater than
13. 0.2°C in the temperature of the liquid (kerosene or naphtha) in the flask.
14. Note down the new liquid (kerosene oil or naphtha) level in the flask as final height reading.

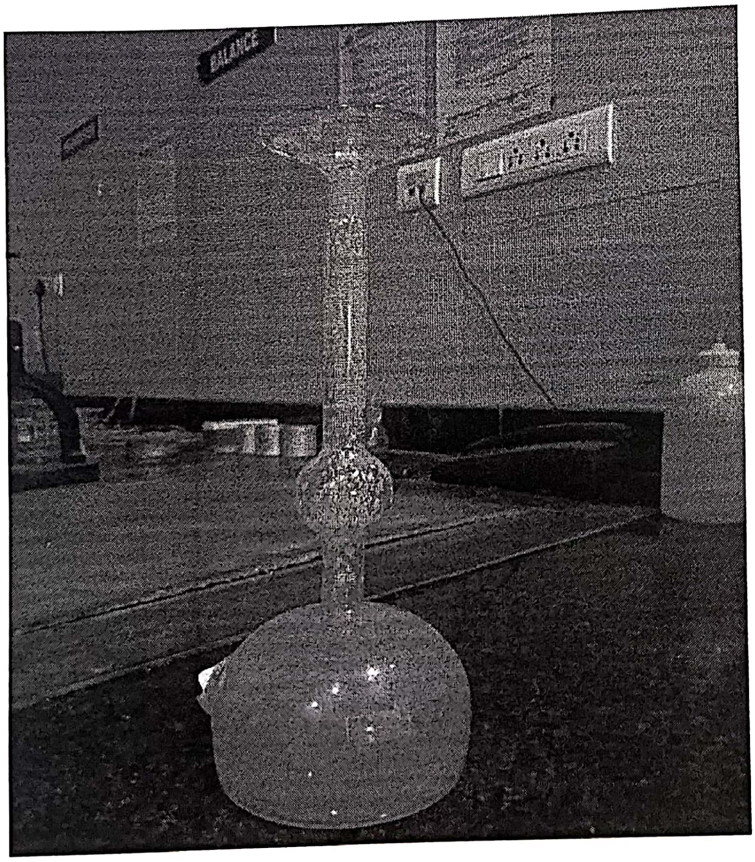

Fig.7 Le-Chatelier Flask

Chapter 9 : Initial and final setting time of cement

AIM:

To determine the initial and final setting time of cement, time take to set

Apparatus:

1. Vicat's apparatus
2. Balance
3. Measuring cylinder
4. Stop watch
5. Glass plate
6. Enamel tray
7. Trowel

Procedure:

1. Consistency test to be done before starting the test procedure to find out the water required to give the paste normal consistency (P).
2. Take 400 g of cement and prepare a neat cement paste with 0.85P of water by weight of cement.
3. Gauge time is kept between 3 to 5 minutes. Start the stop watch at the instant when the water is added to the cement. Record this time (T1).
4. Fill the Vicat mould, resting on a glass plate, with the cement paste gauged as above. Fill the mould completely and smooth off the surface of the paste making it level with the top of the mould. The cement block thus prepared is called test block.

a)Initial Setting Time

1. Place the test block confined in the mould and resting on the non-porous plate, under the rod bearing the needle.
2. Lower the needle gently until it comes in contact with the surface of test block and quick release, allowing it to penetrate into the test block.
3. In the beginning the needle completely pierces the test block. Repeat this procedure i.e. quickly releasing the needle after every 2 minutes till the needle fails to pierce the block for about 5 mm measured from the bottom of the mould. Note this time (T2).

b)Final Setting Time

1. For determining the final setting time, replace the needle of the Vicat's apparatus by the needle with an annular attachment.
2. The cement is considered finally set when upon applying the final setting needle gently to the surface of the test block; the needle makes an impression thereon, while the attachment fails to do so. Record this time (T3).

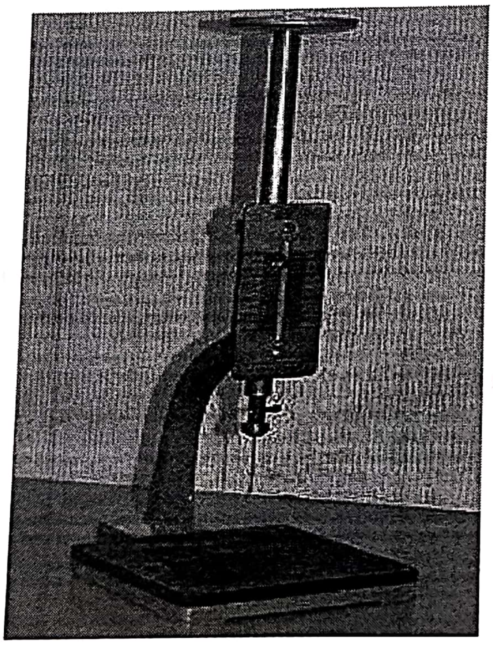

Fig.8 Vicat Apparatus for Initial Setting Time

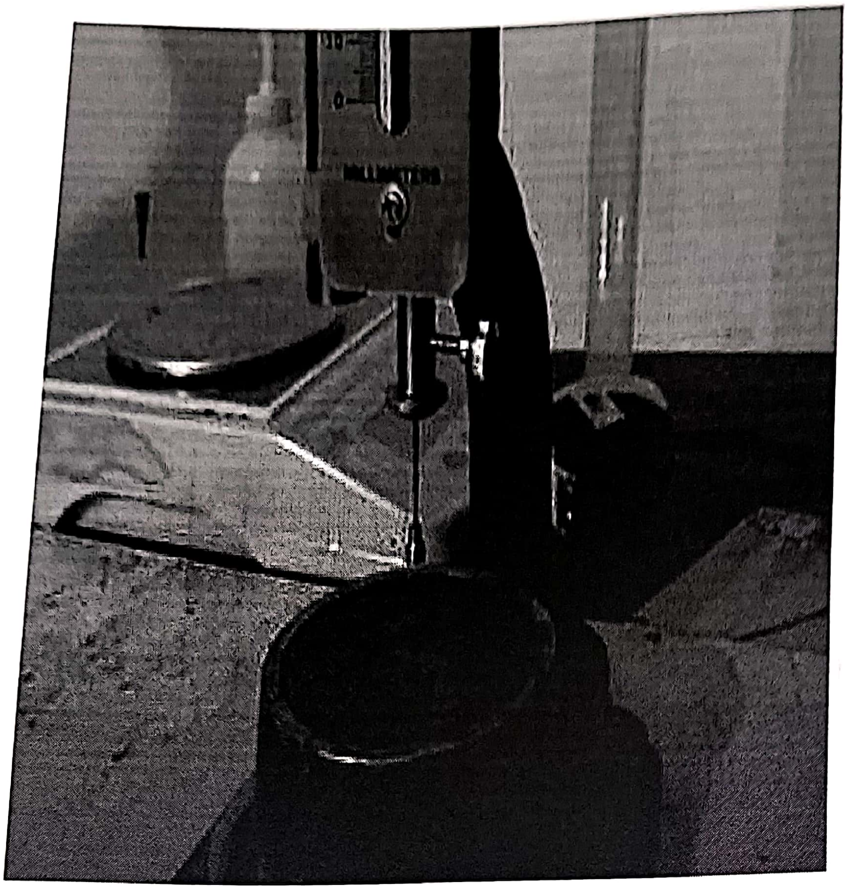

Fig.9 Vicat Apparatus for Final Setting Time

Chapter 10 : Marsh Cone Test for Viscosity

AIM:

To determine the viscosity and the optimum dosage of plasticizers and superplasticizers for various types of cement.

Apparatus:

1. A conical brass vessel is maintained on a wooden stand with a diameter of 50 cm or 80 cm at its base.
2. Stopwatch
3. The Mortar mixer to blend the cement paste with the preferred water-cement ratio

Procedure:

1. First make a cement paste of 1L with a preferred water-cement ratio by keeping 2 kg of cement to it.
2. While making the cement paste, the blending should be done in the mortar mixer. The mortar mixer is utilized to neglect the formation of a lump at the base of the vessel.
3. You can carry a water-cement ratio ranging from 0.3 to 0.5.
4. 70 % of water is kept at the start of mixing in the first stage and the remaining water is kept in the second stage with superplasticizers. The dosage of the superplasticizer will be 0.1 %.of the weight of cement.
5. Take 1L slurry and flow it into the marsh cone by completing the aperture with a finger.
6. Begin the stop and release the finger. Note the time required measure it in seconds for the entire flow out of cement paste. This time measured in seconds is called marsh cone time.
7. Repeat the previous stages with various quantities of plasticizers with the desired water-cement ratio. The Saturation point is the dose at which marsh cone time is minimum. This dose is the optimum dose of superplasticizer of plasticizer for that brand or type of cement.

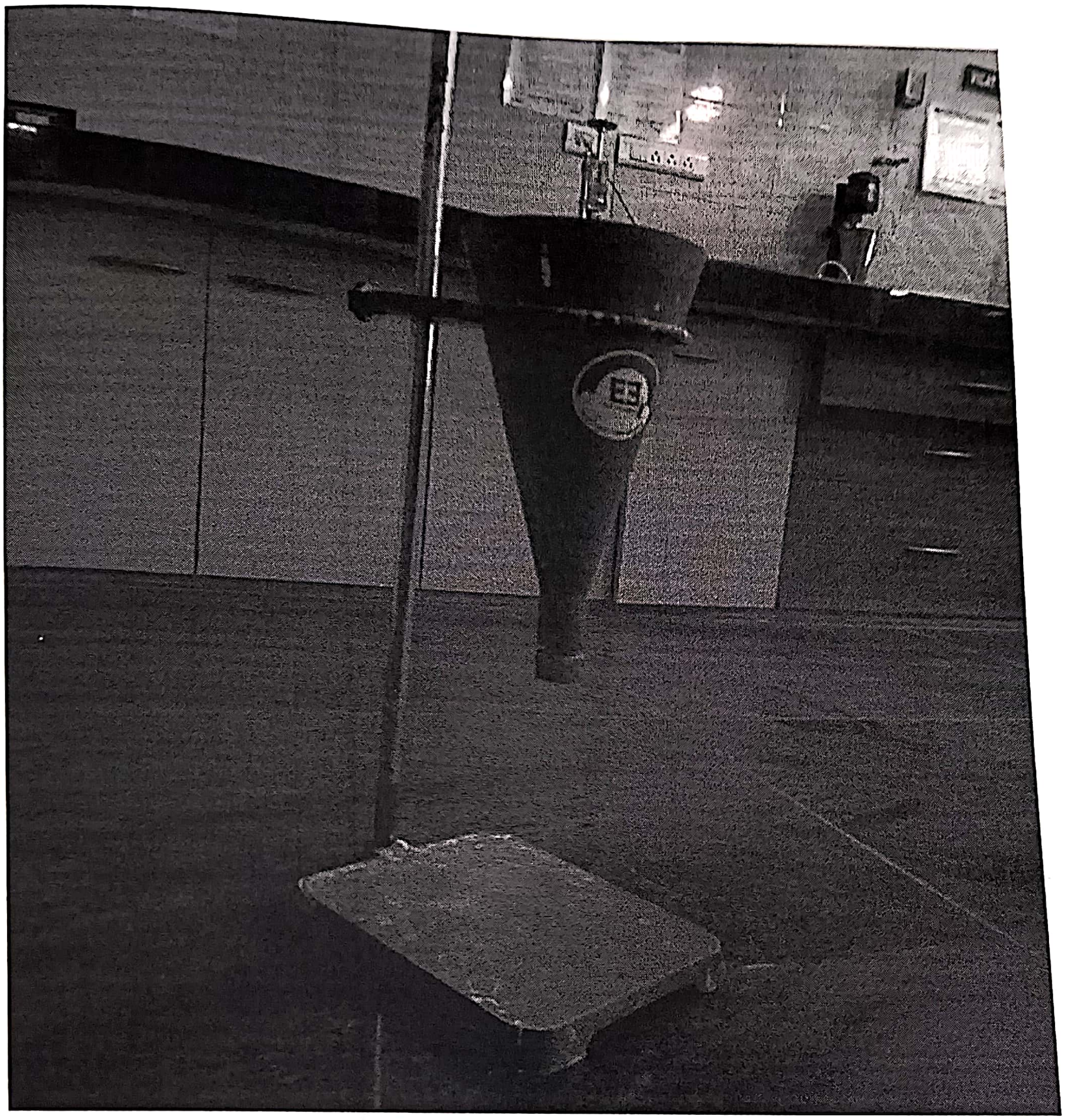

Fig.10 Marsh Cone

Chapter 11 : Density test of rock pieces

AIM:

The objective of the test is to measure the dry density of samples of cylindrical or of the regular form.

Apparatus:

1. Oven (24 hr at 105 0C +/-5°C)
2. Desiccator
3. Caliper with accuracy of 0.1 mm
4. Balance with accuracy of 0.01 9 and range of 100 g
5. Sample container (not-corrodible) with airtight lid.

Procedure:

1. The specimen mass should be at least 50 g (cube of 3 x 3 x 3 cm3, or cylinder with diameter of 2.5 cm and length 5 cm.)
2. The minimum specimen dimension should be at least ten times the maximum grain size of the rock.
3. The specimen volume (V) is calculated from the average value of several caliper readings (3 at least, with an accuracy of 0.1 mm) for each dimension of the specimens.
4. The specimen is located in a container (to avoid loss of mass during subsequent specimen handling), but without the lid, and dried in an oven to constant mass (generally 24 hours is enough) at a temperature of 105.0C. After replacing the lid, the specimen is cooled in a desiccator for 30 minutes.
5. The mass(C) of the container (and lid) with the specimen is determined with an accuracy of 0.1 g.
6. The container with the lid are cleaned and dried and its mass (A)is determined.

Fig.11 Rock Density Test Apparatus

Chapter 12 : Water absorption test of rock piece

AIM:

To find the water absorption capacity of Rock.

Apparatus:

1. Balance accurate to 0.1 g
2. A wire basket
3. A container of water
4. A desiccator
5. A clean, dry clot

Procedure:

1. Weigh a clean, dry sample of rock. This is the initial weight of the rock, W1.
2. Place the rock sample in the wire basket and suspend it in the container of water.
3. Allow the rock sample to soak in the water for 24 hours.
4. Remove the rock sample from the water and wipe off any excess water with the clean, dry cloth.
5. Weigh the rock sample again. This is the final weight of the rock, W2.

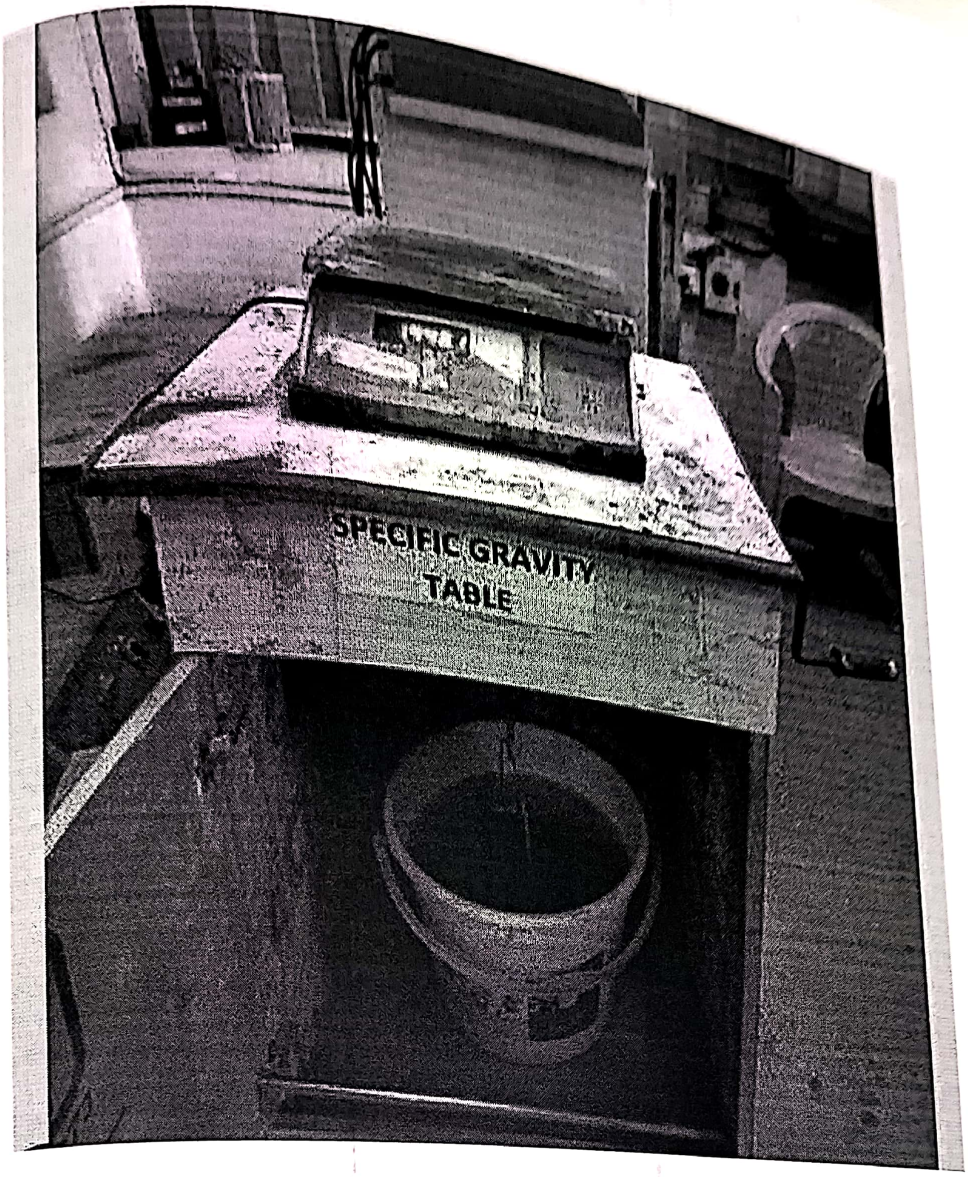

Fig.12 Water Absorption of Rock

Chapter 13 : Point load test of Rock

AIM:

To determine rock strength indexes in geotechnical practice.

Apparatus:

1. A point load testing machine
2. A cylindrical rock sample with a diameter of 50 mm and a height of 100 mm
3. A pair of conical indenters with a radius of 5 mm
4. A load cell
5. A data logger

Procedure:

1. Mount the rock sample in the point load testing machine:
2. Carefully align the rock sample so that the conical indenters are in contact with the same plane.
3. Secure the rock sample in place using the machine's clamps.
4. Start by applying a small load to the indenters.
5. Slowly and evenly increase the load until the rock sample fails.
6. Record the load at failure.
7. It is important to repeat the test for several rock samples to get an accurate measure of the point load strength index of the rock.
8. The point load strength index can be used to compare the strength of different rocks. It can also be used to assess the suitability of rocks for various applications.

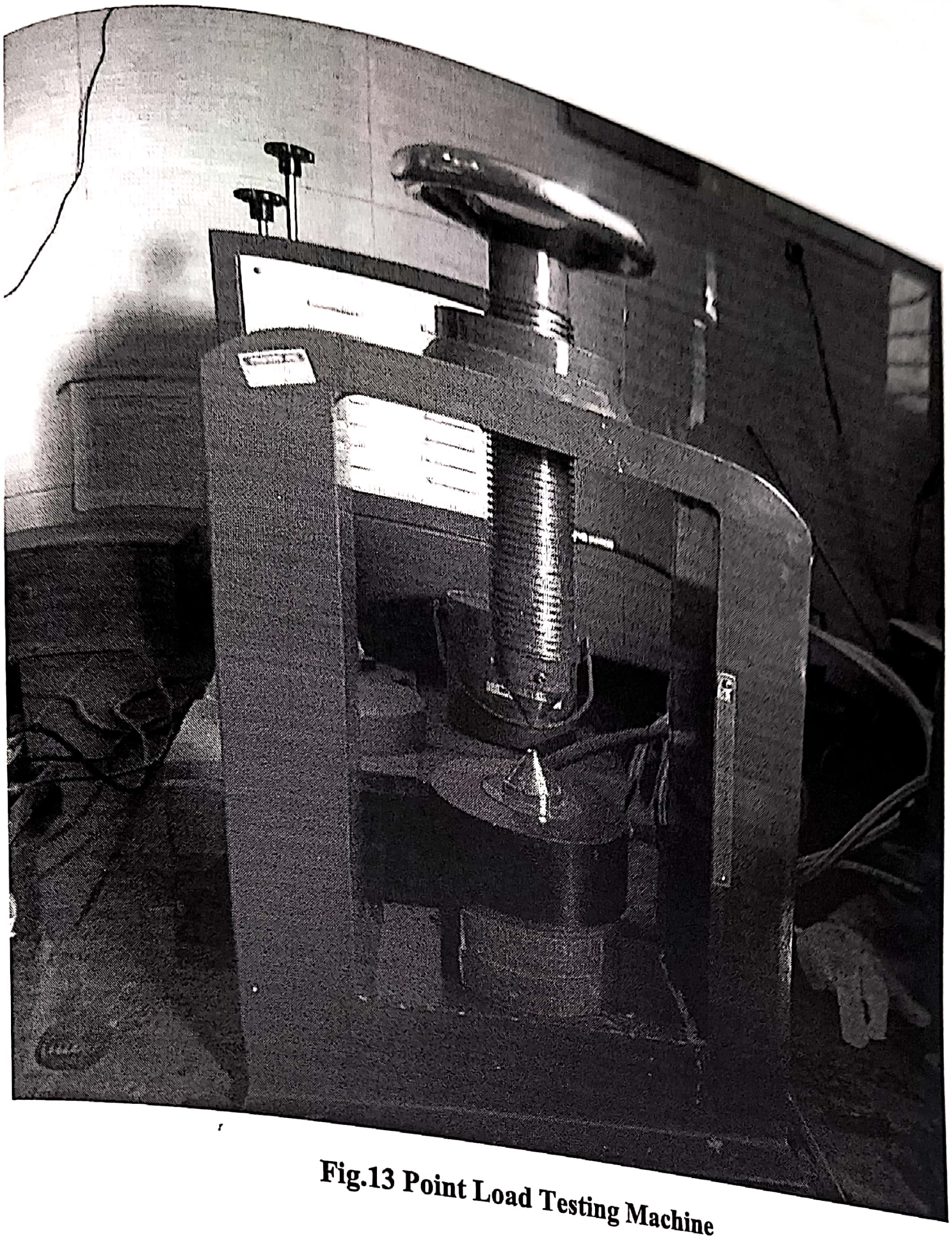

Fig.13 Point Load Testing Machine

Chapter 14 : Slump test of concrete mix

AIM:

To determine the workability of concrete mix prepared at the laboratory or the construction site during the progress of the work.

Apparatus:

1. Slump cone,
2. Scale for measurement,
3. Temping rod (steel)

Procedure:

1. The mold for the concrete slump test is a frustum of a cone, 300 mm (12 in) of height. The base is 200 mm (8in) in diameter and it has a smaller opening at the top of 100 mm (4 in).
2. The base is placed on a smooth surface and the container is filled with concrete in three layers, whose workability is to be tested .
3. Each layer is temped 25 times with a standard 16 mm (5/8 in) diameter steel rod, rounded at the end.
4. When the mold is completely filled with concrete, the top surface is struck off (leveled with mould top opening) by means of screening and rolling motion of the temping rod.
5. The mould must be firmly held against its base during the entire operation so that it could not move due to the pouring of concrete and this can be done by means of handles or foot - rests brazed to the mold.
6. Immediately after filling is completed and the concrete is leveled, the cone is slowly and carefully lifted vertically, an unsupported concrete will now slump.
7. The decrease in the height of the center of the slumped concrete is called slump.

8. The slump is measured by placing the cone just besides the slump concrete and the temping rod is placed over the cone so that it should also come over the area of slumped concrete.

9. The decrease in height of concrete to that of mold is noted with scale. (usually measured to the nearest 5 mm (1/4 in).

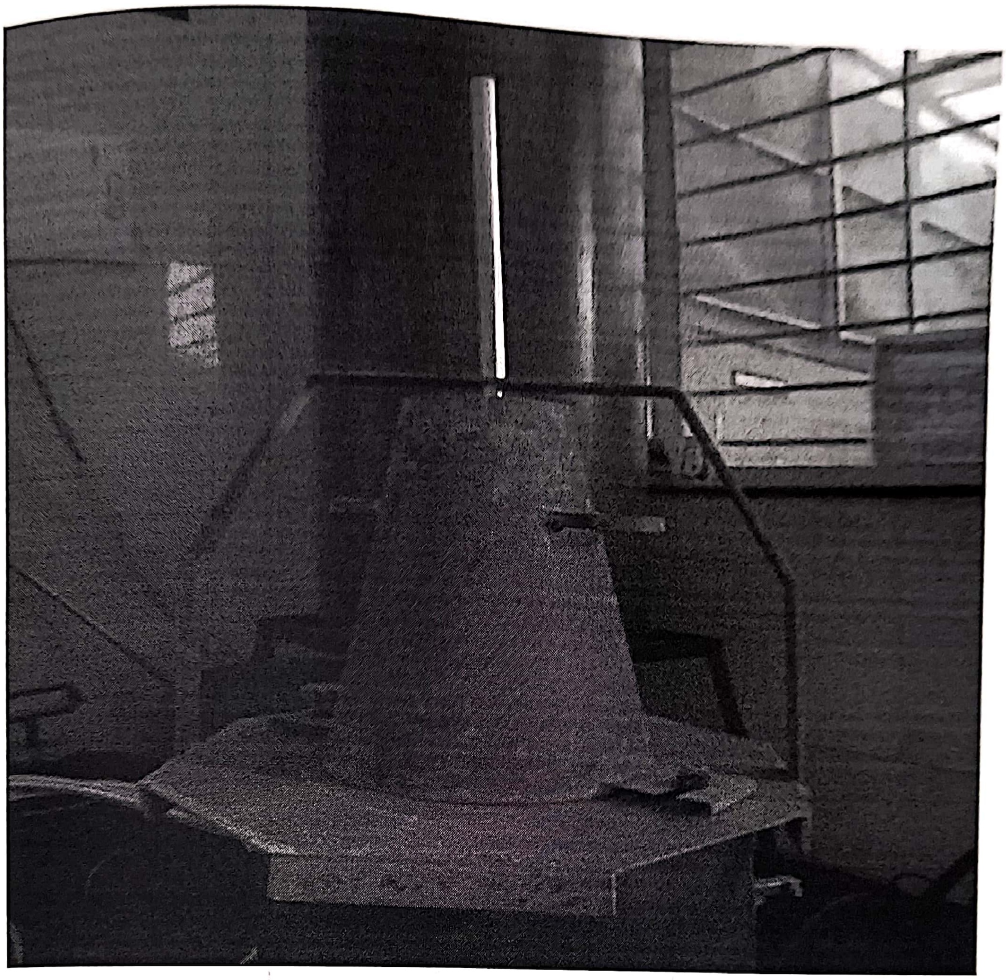

Fig.14 Slump Cone Test Apparatus

Chapter 15 : Moisture content of Soil

AIM:

Determination of Moisture Content in Soil.

Apparatus:

1. Soil Sample,
2. Balance,
3. Oven
4. Trays.

Procedure:

1. Weigh both of the aluminum dishes.
2. Aliquot approximately 50 g of moist soil into each aluminum dish and reweigh the dishes. Hence, the moist weight of the soil sample is now known.
3. Dry the soil overnight at 105 °C in the oven.
4. Remove the dishes from the oven and allow them to cool.
5. Reweigh the dishes plus the oven dry soil. Now the weight of the dry soil is known.

Fig.15 Moisture Content Apparatus