6.5 MIXING THE COMPOSITE SAMPLE

The composite sample obtained by either of the methods mentioned above shall be mixed on a non-absorbent base either with a shovel or trowel to ensure uniformity. These samples can then be used for conducting :

(a) slump test,

(b) compacting factor test,

(c) analysis of freshly mixed concrete,

(d) preparation of cube for strength test.

6.6 CURING OF FIELD SAMPLE FOR WORKS-CUBE TEST

The concrete from the composite sample mentioned above is cast in the cube or beam or cylinder mould in a way prescribed by the Indian Standard Institution and then should be stored and cured properly.

The specimen should be stored on site at a place free from vibration, under damp matting or sacks for 24 hours $\pm$ ½ hour from the time of adding water. The temperature should be between 22°C to 32°C. After 24 hours they shall be *marked for identification*, removed from the mould and kept in clean cool water till they are transported to laboratory for testing. Transporting should be done by packing them well in damp sand or damp sacks. After the arrival in laboratory, they should be kept in water till the time of test.

SAMPLING OF MATERIALS FOR CONCRETE FOR PRELIMINARY TESTING IN LABORATORY

6.7 SAMPLING OF CEMENT

Test samples made up of small portions should be taken from each of a number of bags on site. Further details may be seen in Chapter 4 - "Methods of Sampling Cement".

6.8 AGGREGATE

About 600 kg of aggregate should be collected from the site as per the procedure mentioned under 'Sampling of Aggregate'. Out of this lot, collect suitable quantity of riffling or quartering.

6.9 PREPARATION OF MATERIALS

(a) All material should be brought to the room temperature preferably 27°C $\pm$ 3°C before commencing tests.

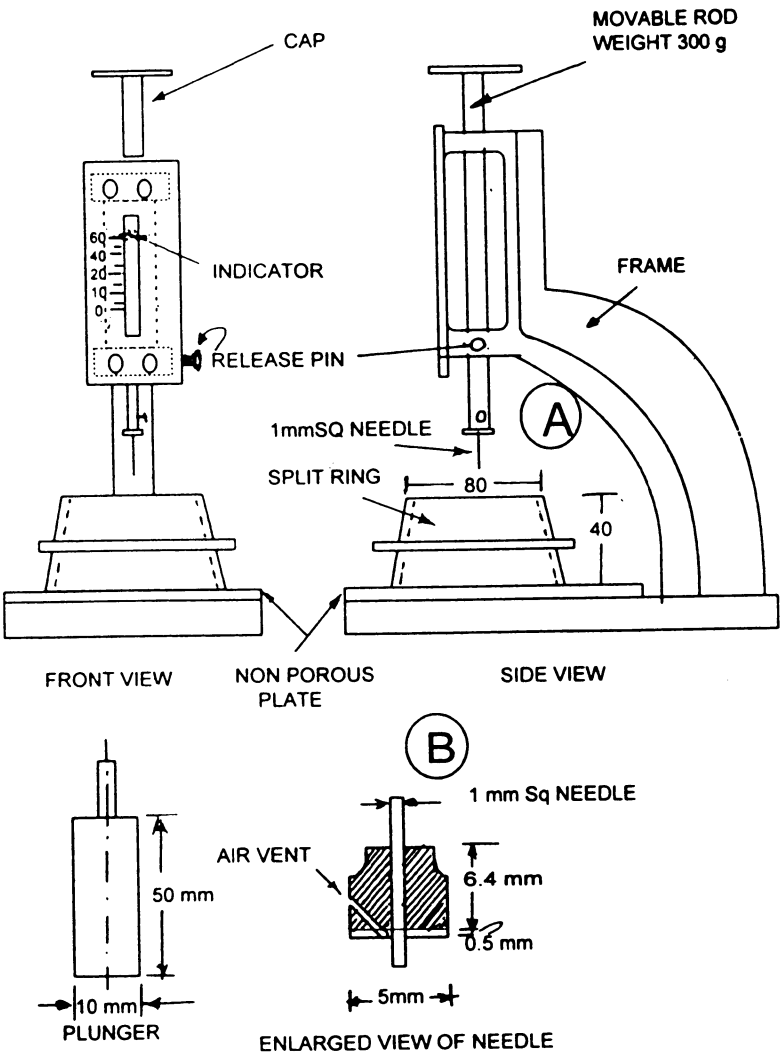
(b) Cement on arrival at the laboratory, shall be thoroughly mixed to ensure uniformity in material. Cement shall be stored in a dry place, preferably in air-tight metal container.

(c) Aggregate should be in air-dry condition and should be separated in fine and coarse fractions. 4.75 mm sieve should normally be used for such separation. These may be recombined in specified proportions according to test specifications. Where special grading is mentioned, the coarse and fine fractions should be separated into different sizes.

(iii) Quantity of water for compressive strength on 1 : 3 cement and standard sand mortar expressed as percentage of weight of dry cement and aggregate = P/4 + 3.0 where P is the percentage of water for standard consistency.

Apparatus (Fig. 8.1)

- Vicat's needle apparatus with plunger of 10 mm dia and 50 mm length, weighing 300 g and Vicat's mould.



VICAT'S MOULD

(All dimensions in mm)

Fig. 8.1. Vicat's mould

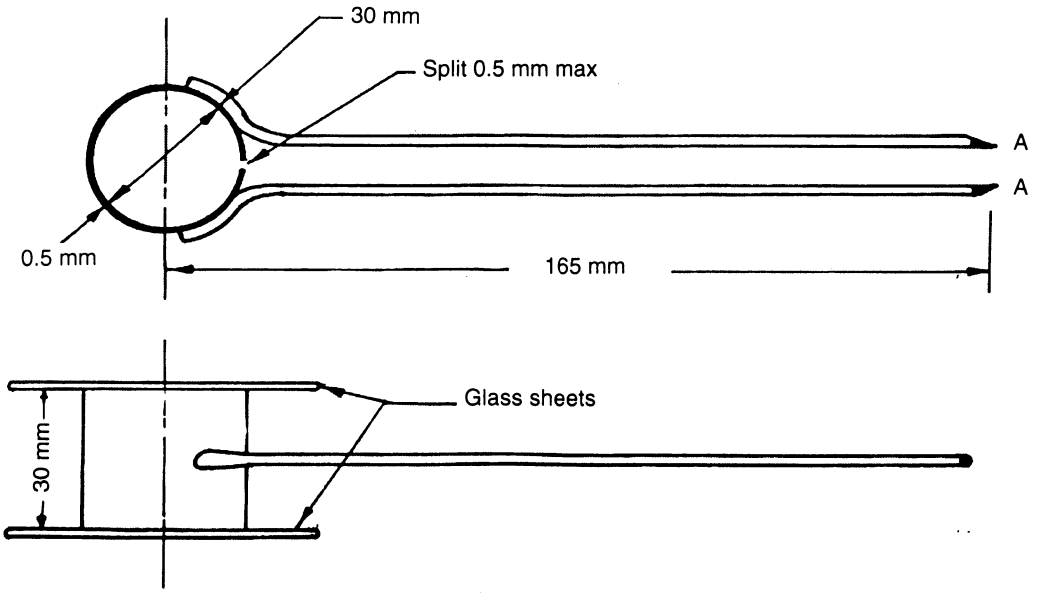


Fig. 8.2. Le-Chatelier's mould.

(d) Measure the distance separating the indicating points to an accuracy of a mm after 24 hours.
(e) Submerge the mould again in water at a temperature prescribed above.
(f) Bring the water to boiling, with the mould kept submerged in 25 to 30 minutes, and keep it boiling for three hours.
(g) Remove the mould from the water, allow it to cool and measure the distance between the indicator points.
(h) The difference between these two measurements represent the expansion of the cement.

Precautions

(a) All the measurements of quantity of cement and water should be done accurately by weight.
(b) The edges of the split mould should be kept together gently while filling the mould with the paste. Even a fine thread can be wound very gently so as to avoid the splitting up of the brass mould due to filling of the paste.
(c) Water should be brought to boiling point gradually in the specified time.
(d) Le-Chatelier apparatus should be handled by pressing indicator arms.

Observation table

		Before aeration			After aeration		
		I	II	III	I	II	III
(a) Weight of cement sample (C)	gm =						
(b) Water required for standard consistency	(P) =						
(c) Water added to the sample (0.78 P × C)	=						

Contd.

EXPERIMENT 5

TO DETERMINE THE COMPRESSIVE STRENGTH OF CEMENT

Statement of problem

For the given sample of cement, determine the compressive strength of cement.

Theory

The compressive strength test is the final check on the quality of cement. The compressive strength is measured by determining the compressive strength of cement mortar cubes of 1 : 3 proportions. The fine aggregate used is the standard sand specified by IS 650. The compression test enables also to distinguish rapid hardening cement from low heat and ordinary cement. The O.P.C. is now being classified as 33 Gr. O.P.C., 43 Gr. O.P.C. and 53 Gr. O.P.C. depending on the strength of cement. C.R.R.I. has developed curves for concrete compressive strength v/s water cement ratio corresponding to the 7 and 28 days compressive strengths of cement. The compressive strength of cement enables us to distinguish cements of different strength and maximum use can be made of high strength cement.

Apparatus

- Cube vibration machine
- Cube moulds 7.06 cm
- Trowel
- Enamel trough
- Measuring cylinder 1000 cc
- Balance
- Thermometer
- Non-Porous plate

Procedure

(a) The material for each cube shall be mixed separately and quantities of cement, standard sand and water are as follows :
Cement 185 gm; Standard sand 555 gm.
Water P/4 + 3.0 per cent of combined weight of cement and sand.

(b) Place on a non-porous plate a mixture of cement and standard sand in the proportion of 1 : 3 by weight as given above.

(c) Mix it dry with a trowel for one minute and then add water until the mix is of uniform colour.

(d) Gauging time should not be less than 3 minutes and should not exceed 4 minutes. If it exceeds, mixture is rejected and operation is repeated.

(e) Oil the interior faces of the mould.

(f) Place the assembled mould on the table of the vibration machine and firmly hold it in position by means of suitable clamps.

Apparatus

- Stove
- Enamelled trays
- Test tube
- Glass tumbler
- Measuring steel rule

Procedure

A. Setting and hardening action

(a) Prepare three small pats, each 75 mm × 75 mm × 25 mm in size from the sample given with 28 per cent water by weight.
(b) Prepare similar number of pats with good quality cement.
(c) Cover the pats with moist cloth for 24 hours.
(d) Try to make thumb nail impression. Good quality cement will resist this impression.
(e) If the cement does not resist this impression, then continue curing up to 48 hours, after which try to break it with pressure of thumb. Bad quality cement will easily break under the pressure. Such cement should be tested in the laboratory.
(f) If 48 hour-test show improvement in hardening, but does not attain hardness comparable with genuine cement, further trial should be made after 72 hours of curing. If the only defect in the cement under test is its slow-setting quality, it will become as strong as the genuine cement in this third test.

B. Detection of adulteration

(a) Take a small sample of doubtful cement on a steel plate and heat it thoroughly to 20 minutes on a stove. Adulterated cement will change its colour on heating. In genuine variety there will be no change in colour.
(b) To detect adulteration with coal ash take a small quantity of doubtful cement in test-tube or a glass tumbler and add water till the glass container is half full.
(c) Shake the container thoroughly and allow it to settle for a few minutes.
(d) Cement particles will settle down and ash particles will either be found floating on the surface or held in suspension, because of their lightness than cement particles.

C. Ascertaining soundness of cement

(a) Make a pat of cement 75 mm in diameter and 15 mm thick and cure it with moist cloth for 24 hours and then boil in water for a period of 6 hours.
(b) Observe the surface of the pat. If the cement is sound, the surface will not develop a pattern of cracks as shown in Fig. 8.4(c). These cracks are thin and uniformly distributed all over the surface.

Precautions

(a) In a test for soundness of cement, the cracking of unsound cement should not be confused with contraction cracks.