

CHAPTER 3 MATERIALS, SAMPLE PREPARATION AND METHODOLOGY

3.1 GENERAL

This chapter outlines the experimental methodology used to investigate the effects of admixing fly ash (FA), ground granulated blast furnace slag (GGBS), and micro silica (MS) on the properties of various cementitious systems. The study aims to partially replace cement with these materials and evaluate their impact on the properties of cement paste, mortar, and concrete.

The chapter provides a detailed description of the materials used in the study and the preparation of samples for testing. Various approaches were adopted to study the effects of FA, GGBS, and MS on the different properties of cement paste, mortar, and concrete, and these are described in detail.

The experimental methodology used in the study includes tests such as normal consistency, setting times, Marsh cone test, compressive strength, flexural strength, and split tensile strength. The properties of cement paste, mortar, and concrete are evaluated at different replacement levels of FA, GGBS, and MS, and the results are compared with those of the control samples.

In addition to the properties mentioned earlier, this chapter also considers the effects of partial cement replacement with FA, GGBS, and MS on the durability properties of concrete. The study evaluates the resistance of concrete to water permeability, carbonation, corrosion, and acid attack.

The methodology adopted in this research is shown in Figure 3.1

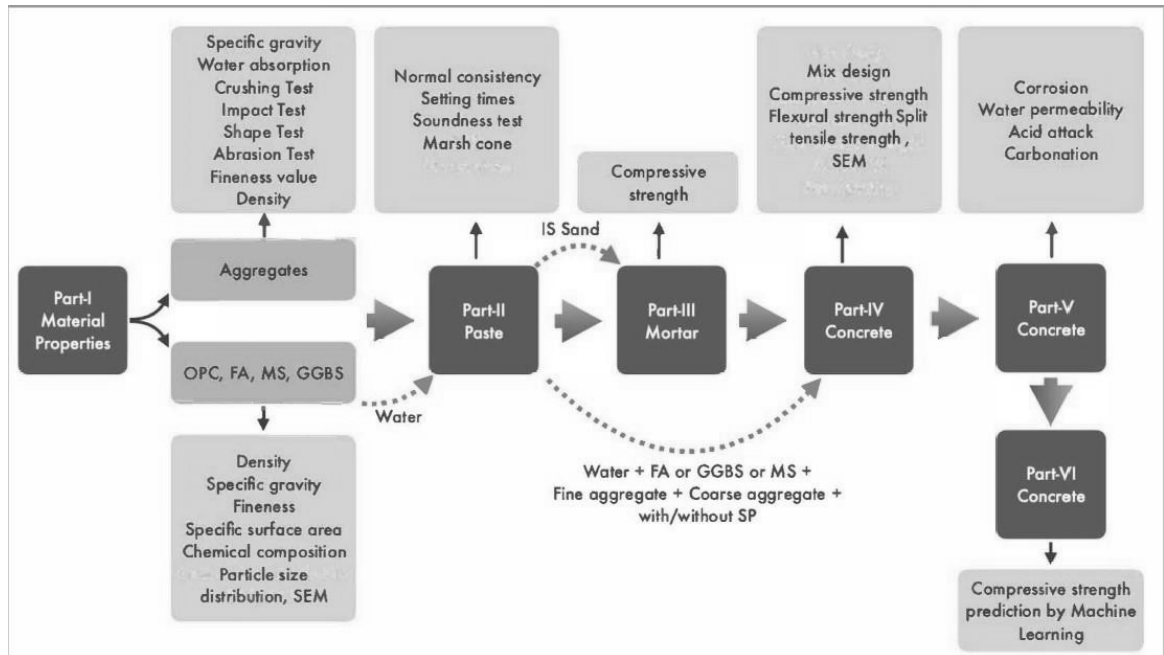


Figure 3.1 Flowchart of the Research

3.2 MATERIAL SELECTION

The materials used in the tests and the process employed to analyze their characteristics are described below.

3.2.1 Binding Material

3.2.1.1 Normal Consistency

The normal consistency of cement was determined in accordance with the procedure described in reference [243], utilizing Vicat's apparatus as per the specifications of IS 513. The apparatus consisted of a plunger with a diameter of 10 mm, as shown in Figure 3.2. Consistency, in this context, refers to the degree of mobility or flowability of freshly mixed cement paste or mortar. This test is crucial for determining the water content required for other tests such as initial and final setting time, as well as compressive strength. To determine the water content required for standard consistency, a paste was created by mixing 400 grams of cement with 30% of its weight in portable water using a spatula and hand mixing for approximately two to three minutes. The paste was then

placed in a mold and levelled before placing a metal plate under the plunger. The plunger was lowered to touch the surface of the paste before being released to sink into the paste.



Figure 3.2 Vicat apparatus for setting time and standard consistency

The penetration of the plunger with a diameter of 10 mm was recorded. For a cement to be considered of normal consistency, the plunger should penetrate the paste by 33 to 35 mm from the top (5 to 7 mm from the bottom).

Trial pastes were created with varying percentages of water to determine the percentage required to achieve the desired penetration. The resulting water content, expressed as a percentage by weight of the dry cement, is known as the normal consistency (P).

3.2.1.2 Initial and Final Setting Time

To ensure the quality of concrete, the constituents and fineness of cement must be maintained to keep the mixture in a plastic condition for a minimum amount of time necessary for mixing, transporting, placing, compacting, and finishing. This time interval is known as the initial setting time and should be at least 30 minutes to allow for handling operations. Once the concrete is in its final position, it should lose its plasticity as soon

as possible to reduce vulnerability to damage from external factors, and this time should not exceed 10 hours, known as the final setting time. To evaluate the quality of cement, a 400g dry cement paste is mixed with 0.85P percent of water by weight of dry cement paste, and the Vicat's needle is used to measure the initial and final setting times as per IS 4031 (Part 4) [244] and IS 4031 (Part 5) [245], respectively. According to IS 269, the initial setting time of cement should not be less than 30 minutes.

3.2.1.3 Soundness Test

The soundness of cement refers to its ability to retain its volume after setting without undergoing any significant expansion or contraction. The expansion test with Le-Chatelier moulds is a commonly used method to determine the soundness of cement.

The test procedure as per Indian standard specification, IS: 4031(Part 3) [246], involves preparing a cement paste and filling it in a Le-Chatelier mould, which is a small cylindrical mould with an inverted T-shaped glass rod placed at the center. The mould is initially kept on a non-porous plate and filled with cement paste until it is completely full. The glass rod is then placed at the center of the paste, and the mould is covered with another non-porous plate. The assembly is then kept in a moist room at a temperature of $27 \pm 2^{\circ}\text{C}$ for 24 hours.

After 24 hours, the distance between the indicator arms of the Le-Chatelier mould is measured using a scale or a gauge to the nearest 0.5 mm. This distance is recorded as the initial length of the cement paste. The assembly is then immersed in water at room temperature and boiled for 3 hours. After boiling, the mould is removed from the water and allowed to cool at room temperature for 30 minutes. The distance between the indicator arms is then again measured, and this is recorded as the final length of the cement paste.

The difference between the initial and final length of the cement paste is calculated, and if it exceeds the permissible limit specified in the standard, the cement is considered unsound. As per [246], the permissible limit for the expansion of cement is 10 mm.

3.2.1.4 Fineness

The fineness by dry sieving of cement/FA/MS/GGBS was measured as per IS 4031 (I) [243]. 100 gm of the material was sieved through a 90 µm sieve. The percentage mass of the material retained on the 90 µm sieve w.r.t total mass of material sieved was considered a fineness value. The minimum fineness requirement for cement as per IS 1489 (Part 1) [238] is that the percentage of material retained on the 90 µm sieve should not exceed 10%.

3.2.1.5 Specific Surface Area

The specific surface area of cement, FA (fly ash), GGBS (ground granulated blast furnace slag), and MS (microsilica) can be determined by the Blaine air permeability method as per Indian Standard IS 4031 (Part 2) [247]

The procedure for determining the specific surface area using the Blaine air permeability method is similar for all these materials. A known mass of the material is compacted into a cylindrical shape with a standard diameter and height. The compacted specimen is then placed on a permeability cell and subjected to a constant pressure of 2 kN/m². Air is allowed to pass through the specimen for a specified duration of time, and the volume of air passing through the specimen is measured using a calibrated flow meter.

The Blaine air permeability value is then calculated using the same formula as for cement:

$$\text{Blaine value} = \frac{kV}{At}$$

where k is a constant, V is the volume of air passing through the specimen, A is the surface area of the specimen, and t is the time taken for the air to pass through the specimen.

The specific surface area of the material can be calculated using the Blaine air permeability value and the relationship between the air permeability and specific surface area specified in the standard. The specific surface area of cement, FA, GGBS, and MS is typically reported in units of m^2/kg .

The Blaine air permeability method is a widely used method for determining the specific surface area of these materials due to its simplicity, speed, and accuracy. It provides an important measure of the surface area of these materials, which can affect their reactivity and pozzolanic activity when used in concrete.

3.2.1.6 Chemical Composition

The chemical composition of cement, FA, GGBS and MS were determined by X-Ray Fluorescence (XRF) test.

3.2.1.7 Specific Gravity and Unit Weight of Cement/FA/GGBS/MS

Specific gravity and unit weight of cement was found according to the method mentioned in [102]. In this test, kerosene oil was filled in Le-Chatelier's Flask up to 0 to 1 ml marks. Image of Le-Chatelier's Flask is shown in Figure 3.3. First reading was recorded after immersing it in water bath at $27^{\circ}C \pm 2^{\circ}C$. 64 gms of cement was slowly and carefully added in the flask. Second reading of displaced level of kerosene was then recorded. Displaced volume by cement was then calculated by subtracting second and first level reading.

$$\text{Specific Gravity} = (\text{Weight of cement in gms})/(\text{Displaced volume in ml})$$

Also, find unit weight of cement by loosely filling a container (Figure 3.4) of known volume and finding weight of cement. Unit Weight= (Weight of cement)/(Volume of cement)



Figure 3.3 Le-Chatelier's Flask



Figure 3.4 Cylinder for unit weight calculation

3.2.1.8 Compressive Strength of Binding Material

The compressive strength of hardened cement paste is the most important of all the properties. Thus, cement is always tested for its compressive strength in the laboratory before it is used in important works. Strength tests are not made on neat cement paste because of difficulties of excessive shrinkage and subsequent cracking of neat cement. Strength of cement is indirectly found on cement sand mortar in specific proportions. This test is necessary to understand the grade specification of cement as defined by the manufacturer. Cubes of size 70.6×70.06×70.06 mm are prepared using ingredients like cement (200 gm), standard sand (600 gm) and water (p%) using Equation 3.1 of combined mass of cement and sand, where P is the percentage of water required to produce a paste of standard consistency determined as described in IS 4031 (Part 4) [244]. The Nine filled

moulds after vibration are kept for 24 hours at a temperature of $27^{\circ} \pm 2^{\circ}\text{C}$ and are then cured for 3, 7 and 28 days. Casting of mortar cubes are shown in Figure 3.5 and the process of testing on compression testing machine is shown in Figure 3.6

The compressive strength of the cubes is calculated by dividing the maximum load applied at failure to the cross-sectional area of the specimen. Three specimens were tested for evaluating the compressive strength of cement at 3, 7, and 28 days respectively. Compressive strength of cement was found according to the method mentioned in [103].

$$p\% = \frac{P}{4} + 3 \quad \text{Equation 3.1}$$

where, P is the amount of water required for normal consistency.

3.3 MARSH CONE TEST

The Marsh cone test was performed to determine the optimum dosages of SP for cement mortar with different proportions of FA, GGBS, and MS. The w/b ratio was found out as per IS 4031 (VI) [40]

A metal Marsh cone with the dimensions and experimental setup depicted in Figure 3.7 and Figure 3.8 was used to determine SP's optimum dose and efficiency. The time it took 1000 ml of paste to flow through the cone's orifice was measured. Marsh cone flow time is the name given to this period.

3.3.1 Methodology of Marsh cone test

3.3.1.1 Mixes Production

The fluidity of the paste is assessed based on factors such as cement type, PCE SP dosage, mineral admixture, and the water-to-binder (w/b) ratio. The evaluation of paste fluidity includes assessments at replacement percentages of 10% MS, 30% FA, and 50% GGBS. The binder is mixed with water at varying w/b ratios—0.40, 0.45, 0.50, 0.55, and 0.60.

PCE SP dosages range from 0.2% to 2.0%, including increments of 0.2% (e.g., 0.4%, 0.6%, ..., 1.8%, 2.0%).



Figure 3.5 Casting of mortar cube



Figure 3.6 Compressive strength of mortar testing machine (UTM)

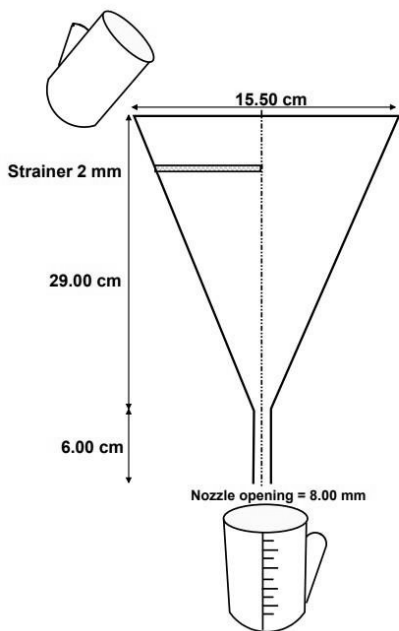


Figure 3.7 Marsh Cone dimension



Figure 3.8 Experimental setup

Four sets of paste are used in this experimental study presented in Table 3.1, abbreviated as S-I/C, S-II/MS, S-III/FA and S-IV/GGBS. The term (S-I/ C) denotes OPC 43 grade cement that contains no mineral admixtures. S-II/MS has MS, S-III/FA contains FA, and S-IV/GGBS contains GGBS. The physical properties of a different combination of materials and the experimental setup are shown in Table 3.1 and Figure 3.8, respectively.

Table 3.1 Mix proportions of the binder used in the study

Binder (abbreviations)	Replacement rate (%) of mineral admixture	w/b	Superplasticizer dosage (%)
OPC (S-I/C)	0	0.40, 0.45, 0.50, 0.55, and 0.60	0, 0.2, 0.4, 0.6, 0.8, 1.0, 1.2, 1.4, 1.6, 1.8, and 2.0
OPC + MS (S-II/MS)	10		
OPC + FA (S-III/FA)	30		
OPC +GGBS (S-IV/GGBS)	50		

3.3.1.2 The optimum dosage of superplasticizer

Binding material and water were mixed thoroughly by hand to prepare the paste/slurry till uniformity was achieved. One litter of the slurry was taken and poured into the Marsh cone apparatus by duly closing the opening with one finger. Then the time took for the slurry to empty the Marsh cone was measured with a smart stopwatch. The experiment was repeated for different plasticizer dosages for the slurries of all combinations of cement and mineral admixtures (MS, FA, and GGBS) with different w/b, and the dose with the least flow time was termed the saturation point for each combination. The flowchart presented in Figure 3.9 depicts finding the saturation dosage of SP.

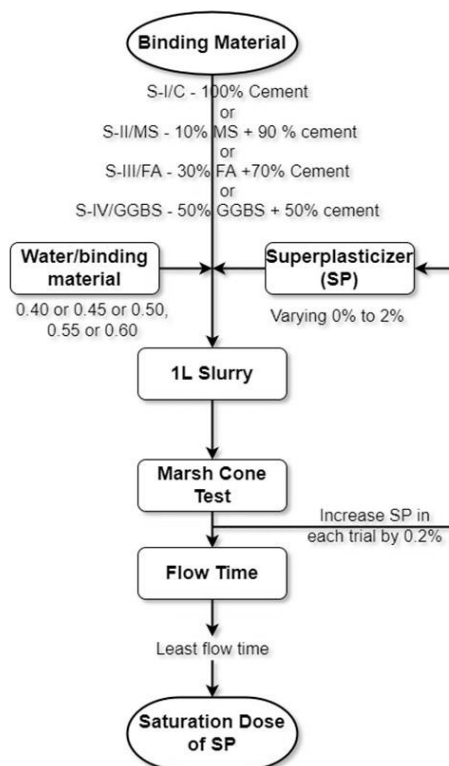


Figure 3.9 Process of finding saturation dosage of SP

3.3.1.3 Efficiency of Superplasticizer

With binding material and required w/b, a slurry/paste was made without adding SP. The Marsh cone test was performed on the paste to evaluate FT-I's flow time (for paste

without SP). Then a new slurry of binding material and water with a saturation dose of SP was prepared, but the amount of water in this paste was adjusted till the flow time FT-II equals the flow time FT-I. The efficiency of the SP for each paste sample S-I/C, S-II/MS/, S-III/FA, and S-IV/GGBS at all w/b was evaluated as follows Equation 3.2 and, below Figure 3.10 shows a flowchart for determining the efficiency of the SP.

$$\text{Efficiency of admixture} = \frac{(W_1) - (W_2)}{(\text{SP})} \times 100 \quad \text{Equation 3.2}$$

W_1 = water content without superplasticizer by weight

W_2 = water content with superplasticizer by weight

SP = superplasticizer by weight

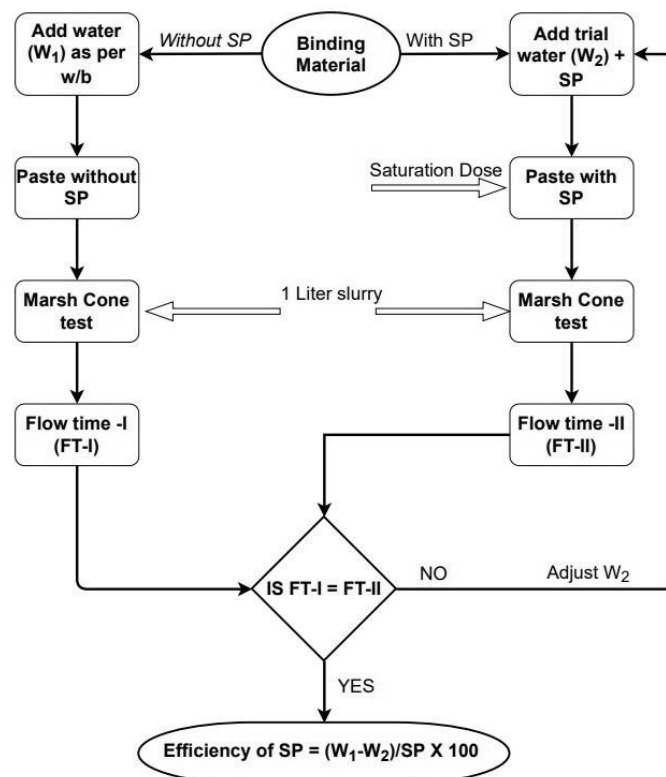


Figure 3.10 Flowchart for finding out efficiency of SP

3.4 AGGREGATES

3.4.1.1 Grain Size Analysis

The grain size analysis of coarse and fine aggregates was done in accordance with [248]. The aggregates were washed and dried in the oven at 110° C temperature until a constant mass was achieved. The sieves were arranged in the order of decreasing size. The gradation curve was plotted between sieve sizes on the x-axis (log scale) and percentage finer on the y-axis. The fineness modulus was calculated by dividing the total cumulative percentage of weight retained from 100. The ratio of coarse (20 and 10 mm) and fine aggregates were balanced appropriately to accomplish the combined grading requirement of IS 383 [249].

3.4.1.2 Crushing Value Test

It was performed as per IS 2386 (IV) [250]. The oven-dried aggregates passing through a 12.5 mm IS sieve and retained on a 10 mm IS sieve were filled in the cylindrical mould in three layers, and each layer was given 25 blows by a tamping rod. The aggregates in the mould were subjected to 15 blows of a 14 kg metal hammer from the height of 380 mm in the impact test apparatus. The tested aggregates were then sieved through a 2.36 mm IS sieve, and the weight of the finer material was expressed as a percentage of the initial weight.

3.4.1.3 Impact Value Test

It was performed as per IS 2386 (IV) [250]. The oven-dried aggregates passing through a 12.5 mm IS sieve and retained on a 10 mm IS sieve were filled in the cylindrical mould in three layers, and each layer was given 25 blows by a tamping rod. The aggregates in the mould were subjected to 15 blows of a 14 kg metal hammer from the height of 380 mm in the impact test apparatus. The tested aggregates were then sieved through a 2.36

mm IS sieve, and the weight of the finer material was expressed as a percentage of the initial weight.

3.4.1.4 Specific Gravity And Water Absorption Test

These tests for coarse as well as fine aggregates were performed as per IS 2386 (III) [251]. The wire basket method was adopted for coarse aggregates, while the pycnometer method was used for fine aggregates.

3.4.1.5 Shape Test

The shape test of the coarse aggregates was performed as per IS 2386 (I) [248].

3.5 MIX DESIGN CONCRETE

Thirty-two different concrete mix designs were done to study various mechanical and durability properties as per IS 10262 [252]. w/b was taken at 0.4, 0.45, 0.50, and 0.55 with and without SP for plain concrete; similarly, for each water w/b ratio, 30% FA admixed concrete, 50% GGBS admixed concrete, and 10% micro silica admixed concrete was prepared with and without SP as per IS 10262. Table 3.2 Different concrete mix shows the different mixed designs considered in the study.

Table 3.2 Different concrete mix

Concrete Mix	w/b	C %	FA %	GGBS %	MS	FA	CA20	CA10	SP
C40	0.40	100	0	0	0	Y	Y	Y	<i>N</i>
C45	0.45	100	0	0	0	Y	Y	Y	<i>N</i>
C50	0.50	100	0	0	0	Y	Y	Y	<i>N</i>
C55	0.55	100	0	0	0	Y	Y	Y	<i>N</i>
CF40	0.40	70	30	0	0	Y	Y	Y	<i>N</i>
CF45	0.45	70	30	0	0	Y	Y	Y	<i>N</i>
CF50	0.50	70	30	0	0	Y	Y	Y	<i>N</i>
CF55	0.55	70	30	0	0	Y	Y	Y	<i>N</i>
CB40	0.40	50	0	50	0	Y	Y	Y	<i>N</i>
CB45	0.45	50	0	50	0	Y	Y	Y	<i>N</i>
CB50	0.50	50	0	50	0	Y	Y	Y	<i>N</i>
CB55	0.55	50	0	50	0	Y	Y	Y	<i>N</i>
CM40	0.40	90	0	0	10	Y	Y	Y	<i>N</i>
CM45	0.45	90	0	0	10	Y	Y	Y	<i>N</i>
CM50	0.50	90	0	0	10	Y	Y	Y	<i>N</i>

CM55	0.55	90	0	0	10	Y	Y	Y	<i>N</i>
SC40	0.40	100	0	0	0	Y	Y	Y	<i>Y</i>
SC45	0.45	100	0	0	0	Y	Y	Y	<i>Y</i>
SC50	0.50	100	0	0	0	Y	Y	Y	<i>Y</i>
SC55	0.55	100	0	0	0	Y	Y	Y	<i>Y</i>
SCF40	0.40	70	30	0	0	Y	Y	Y	<i>Y</i>
SCF45	0.45	70	30	0	0	Y	Y	Y	<i>Y</i>
SCF50	0.50	70	30	0	0	Y	Y	Y	<i>Y</i>
SCF55	0.55	70	30	0	0	Y	Y	Y	<i>Y</i>
SCB40	0.40	50	0	50	0	Y	Y	Y	<i>Y</i>
SCB45	0.45	50	0	50	0	Y	Y	Y	<i>Y</i>
SCB50	0.50	50	0	50	0	Y	Y	Y	<i>Y</i>
SCB55	0.55	50	0	50	0	Y	Y	Y	<i>Y</i>
SCM40	0.40	90	0	0	10	Y	Y	Y	<i>Y</i>
SCM45	0.45	90	0	0	10	Y	Y	Y	<i>Y</i>
SCM50	0.50	90	0	0	10	Y	Y	Y	<i>Y</i>
SCM55	0.55	90	0	0	10	Y	Y	Y	<i>Y</i>

3.6 SLUMP TEST

The slump test was done to determine the workability of concrete and the different dosages of SP in the concrete with FA, MS, and GGBS admixture. It was performed in accordance with IS 1199 [253].

3.7 STUDY ON MECHANICAL STRENGTH OF CONCRETE

3.7.1.1 Compressive Strength (CS)

The concrete cubes of sizes 100mm and 150 mm were cast as per the mix design of concrete. They were left covered in the casting room for 24 hours. Following 24 hours of casting, the cubes were removed from the mould and put in the curing tank for curing in water as per ASTM C192[254]. The curing water was restored every week, and its temperature was maintained at $27^{\circ} \pm 2^{\circ}$ C. After completion of 7, 28, and 90 days for 150mm cubes and 56 and 118 days for 100 mm of curing, cubes were removed and examined for their compressive strength in CTM as per IS 516[255] as shown in Figure 3.11.



Figure 3.11 150 mm cube casting demolding and testing

3.7.1.2 Flexural Strength (FS)

The concrete prisms of size 700 x 150 x 150 mm were cast as per the mix design of concrete. They were left covered in the casting room for 24 hours. Following 24 hours of casting, the prisms were removed from the mould and placed in the curing tank for curing in water as per ASTM C192 [254]. The curing water was restored every week, and its temperature was maintained at $27 \pm 2^{\circ}$ C. After completion of 28 and 90 days of curing, prisms were removed and examined for their flexural strength in Flexural Strength Test Machine as per IS 516 [255] as shown in Figure 3.12.

3.7.1.3 Split Tensile Strength (STS)

Similar to the casting of concrete cubes and prisms, the concrete cylinders of size 150 mm dia. ('D') and 300 mm in height ('H') were cast and cured in water. After completion of 28 and 90 days of curing, cylinders were removed and examined for their split tensile strength in CTM as per IS 5816 [256] as shown in Figure 3.13.



Figure 3.12 Curing and testing of FS



Figure 3.13 Testing of cylinder for STS

3.8 STUDY ON DURABILITY PROPERTIES OF CONCRETE

The experiment described involves observing the effects of acidic rain on concrete mixes that have been admixed with different materials, including FA, GGBS, and MS, with and without the addition of superplasticizer (SP).

3.8.1.1 Acidic Attack and Corrosion of Steel Bar

To conduct the experiment, 100 mm size cubes of each concrete mix were cast with a 10 mm diameter and 50 mm long steel rod immersed in the cube. The cubes were left covered in the casting room for 24 hours, after which they were removed from the mould and placed in a water curing tank for 28 days, in accordance with ASTM C192 [254] standards.

After the 28-day curing period, the cubes were removed from the water curing tank, dried in an oven for 24 hours at 105⁰C, and their initial mass was recorded. The cubes were then immersed in aerated acidic solutions with a concentration of 0.75% sulphuric acid and 0.75% nitric acid for 90 days, with air coming from the bottom of the tank by an air bubble machine as shown in Figure 3.14 and Figure 3.15. After the immersion periods, the cubes were washed with potable water to remove any loose or deposited materials and were then placed in an oven at 105⁰C for 24 hours. Upon cooling, their final mass was noted to compare with the initial mass of the concrete and steel. Finally, the cubes were subjected to a compression strength test, following the IS 516 [255] standards.

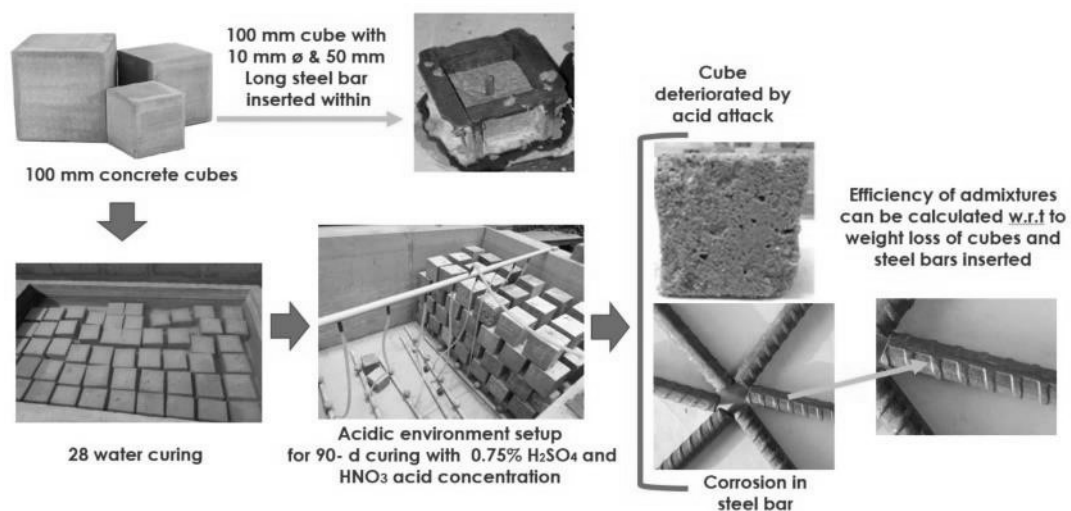


Figure 3.14 Casting, curing, testing setup of acid attack on concrete and steel



Figure 3.15 Experimental setup for aerated acidic attack

3.8.1.2 Carbonation

To observe the effects of Accelerated Carbonation Curing, three 100 mm-sized cubes for compressive strength were cast for each mix of concrete. After casting, all the specimens were left covered in the casting room for 24 hours. The specimens were then removed from the mould and placed in a water curing tank, following ASTM C192[254] standards.

Samples of the concrete cube were kept in the water curing tank for 28 days. After this period, the samples were taken out and placed in an oven for 24 hours at 60°C. Subsequently, they were kept in a carbonation chamber for another 28 days for accelerated carbonation curing. The concentration of CO₂, temperature, and relative humidity in the carbonation chamber was maintained at 10%, 27 ± 2°C, and 65 ± 5%, respectively as shown in Figure 3.16.

After the completion of ACC, these samples of concrete were subjected to a compression strength test as per IS 516[255]. The compressive strength of the concrete samples at 56 days of combined curing (water + ACC) was compared with the strength at 56 days of water curing to study the effect of ACC.

The cubes that underwent ACC were cut vertically into two parts, and a phenolphthalein indicator was sprayed on the cut faces. The phenolphthalein indicator was prepared by mixing 1g of phenolphthalein with 90 ml of ethanol, which was then diluted to 100 ml with water. The carbonation affected zone was colourless, while the unaffected zone (where CO₂ was not able to penetrate) turned pink in colour. The depth of CO₂ penetration in each cube was measured as shown in Figure 3.17.

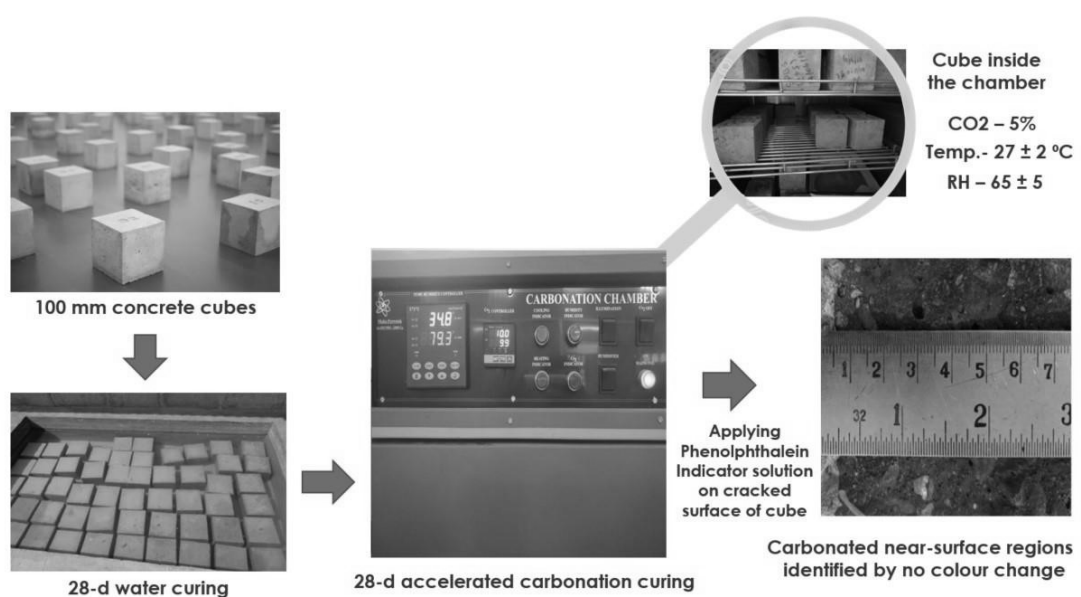


Figure 3.16 Water curing, accelerated carbonation curing and testing of 100 mm cube

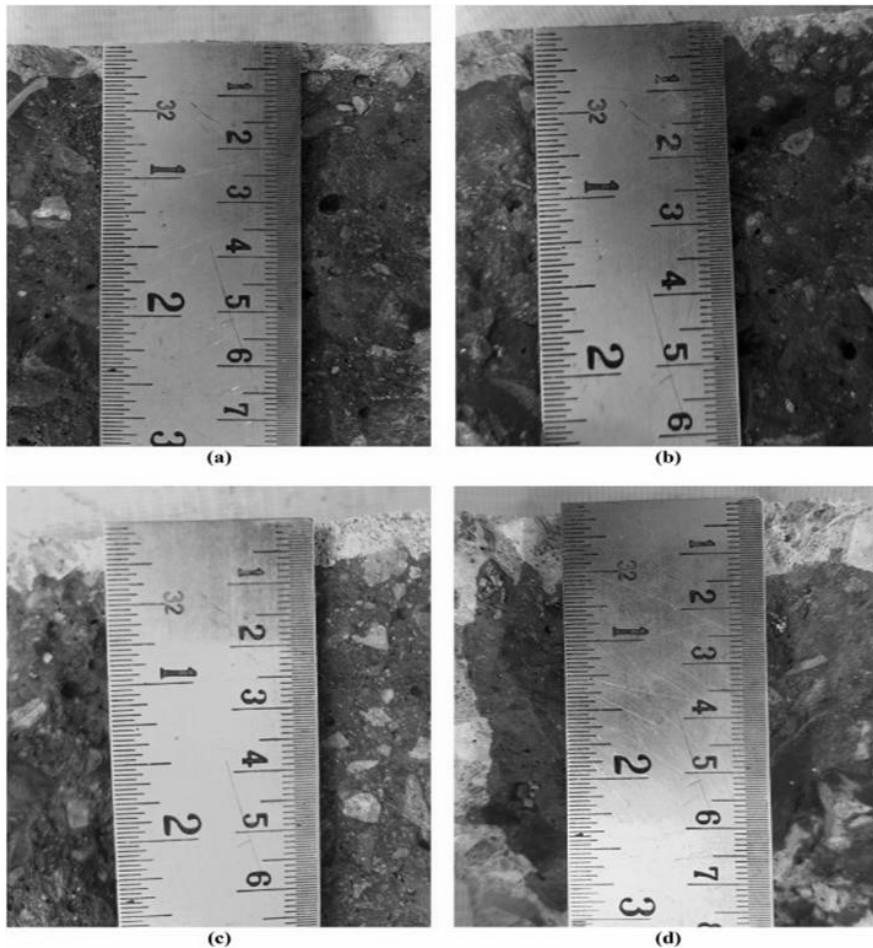


Figure 3.17 Depth of carbonation in different concrete mix

3.8.1.3 Water permeability

In the water permeability test, the concrete cubes of $150 \times 150 \times 150$ mm size were cured in water for 28 days and 90 days and further tested as per the procedure described in IS 3085 [257]. They were centrally placed in a specially designed watertight permeability cell, and the desired hydrostatic pressure was applied from one side. The amount of water percolating through the concrete cube was measured, and the permeability coefficient was calculated as per IS 3085 as shown in Figure 3.18

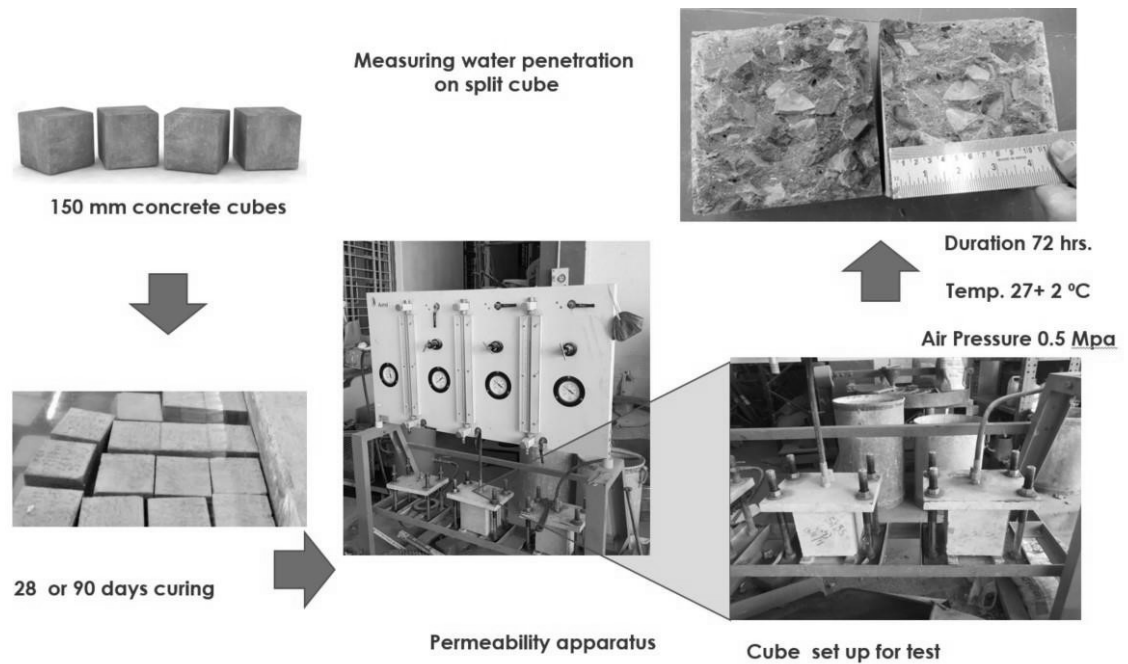


Figure 3.18 Curing, experimental setup and testing of cube for water permeability

3.8.1.4 Microstructural analysis

For their SEM investigation, the thin sections of hardened concrete after 56 and 90 days of curing in water were created. By utilizing a powerful adhesive to fix a concrete sample on a glass slide, the thin slices of concrete were made. Samples were thinned with diamond saws after 24 hours. The sample was further polished using lapping tools to create an incredibly thin slice as shown in Figure 3.19. To investigate the impact of FA GGBS, MS and SP on the microstructure of hardened concrete, ZEISS SEM analysis was used. To make it easier to compare various concrete samples, the SEM pictures of the hardened concrete were collected at a comparable resolution. For the in depth analysis of a few concrete samples, higher resolution and magnification photos were also occasionally produced

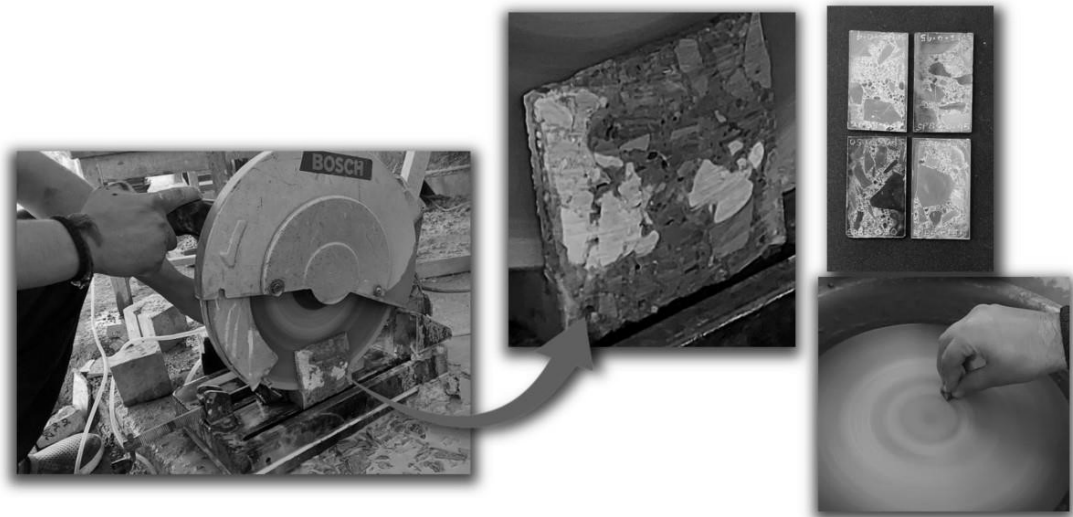


Figure 3.19 Thin section preparation

3.9 PREDICTIVE MODELS BASED ON MACHINE LEARNING

Different machine learning techniques have been performed to laboratory collected data for predicting the best suitable method for concrete compressive strength and concrete mix constitute.

3.10 CONCLUSION

This chapter provides a brief discussion about the methodology adopted to determine various properties of materials used in the current investigation. Subsequently, the methods utilized to identify the physical properties of cement paste and cement mortar containing a different proportion of FA, GGBS and MS were discussed in detail. Also, the process adopted to study the results related to mechanical and durability properties of concrete of these mixes were discussed. The procedure chosen for mineralogical and microstructural analysis of selected admixed concrete mixes was explained. This Chapter also shows the instruments used for various tests and the standard codes which were followed during the experiments.