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Experimental Study on Viscosity Modifying Agents On Self-Compacting Concrete

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ABSTRACT
This projects aims at bringing out the role of Viscosity Modifying Agents (VMA) and how various VMAs affect the properties of self-compacting concrete differently. The main reason behind this study is to find out which VMA is best suited for the particular cement being used in the manufacture of SCC. In this project, two different viscosity modifying agents are used namely Glenium Stream 2 and Rheomac VMA 358. The quantity of the VMA added is the same for both the test conditions and their properties are checked as per standard Self Compacting Concrete testing methods. Comparative study is done between the test mixes and the results are drawn to bring out the more optimum VMA for the cement used. Only fresh concrete tests are done so as to attain the workablity related results.

***Keywords*—** Glenium Stream 2, Glenium B 233, Rheomac VMA 358, Viscosity Modifying Agent (VMA), Self Compacting Concrete (SCC), Workability

Introduction:

Self-Compacting Concrete (SCC) is a kind of exceptional solid that has high functionality and self-compacting property, for example the compaction happens because of its high streaming property and the requirement for outside vibrators are not required. The solid is strong enough to abstain from draining or isolation. For the creation of self- compacting concrete for high quality reason the water bond apportion ought to be kept to the base. So as to expand the stream property and high usefulness, compound admixtures are utilized so as to build the functionality of the solid without settling on the water bond proportion and quality of the solid.

This task intends to examine the properties of SCC when different Viscosity Modifying Agents (VMAs) are added to a similar blend of cement and how different VMAs influence oneself compacting properties of SCC.

1.1 SELF COMPACTING CONCRETE

Cement is a champion among the most adaptable and comprehensively used improvement materials. With the enthusiasm growing for reinforced strong structures in the propelled society to address the issues of new enhancements, extending masses and new forceful helper plan contemplations, the help in strong structures is winding up progressively thick and grouped.

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The mind-boggling and thick help can raise issues of pouring and compacting the strong. The strong must have the ability to pass the thick rebar game-plan without blocking or secluding. The arrangement of such concrete is incredibly trying since poor position and the nonappearance of good vibratory compaction can provoke the consolidation of voids and loss of whole deal durability of strong structures. This has been a stress for originators for quite a while.

SCC with its excellent properties, astonishing deformability, gives originators and creators greater chance of inventiveness that was unreasonable as of now. Lighter and thin people can be delivered utilizing SCC, greater range expansions can be made, and submerged structures can be amassed, making SCC an extraordinarily promising material for the inevitable destiny of the in-situ and pre-tossed improvement organizations. Since its underlying use in Japan, SCC has now started to be a choice to vibrated concrete over the world in such regions where common vibrated cement is inconvenient or hard to pour and vibrate. At any rate those applications are up 'til now few and vibrated cement is so far considered as the standard bond. As a consistently expanding number of assessments are done into SCC, it is presumably going to move from being a fringe advancement to transforming into a strong of choice for improvement in light of decreased prosperity concerns, for example no vibration-actuated noise.

Dependent upon its creation, SCC can have a broad assortment of different properties; from a run of the mill to a ultra-high compressive quality, from a poor to a to an extraordinary degree high strength. The mix of SCC is solidly dependent on the creation and characteristics of its constituents in its fresh state. The properties of SCC in its new state sway its properties in the cemented state. Along these lines it is essential to appreciate its stream lead in the fresh state. Since the SCC mix is fundamentally described similar to its stream limit, the depiction and control of its rheology is crucial for its successfulcreation.

Differentiated and normal bond of tantamount mechanical properties, the more critical material cost of SCC is a result of the by and large fame of cementitious materials and compound admixtures, including high-run water diminishing admixtures (HRWRS) and consistency improving admixtures (VEAs). Regularly, the substance in cementitious materials can vary some place in the scope of 450 and 525Kg/m3for SCC centered for the filling of kept regions and fix applications. Such applications require low absolute volume to energize stream among restricted scattering without blockage and assurance the filling of the casing work without association. The joining of high volumes of finely ground powder materials is essential to improve cohesiveness and addition the paste volume required for productive tossing of SCC.

Cement containing mineral admixtures is used generally all through the world for their incredible execution and for ecological and fiscal reason. The most broadly perceived cementitious materials that are used as strong constituents, despite Portland bond are fly ash, ground granulated effect radiator slag (GGBS), silica smoke and rice husk red hot

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trash. They save imperativeness, screen resources and have various particular points of interest. Metakaolin is a continuous extension in the summary of pozzolanic materials.

Impenetrability to fire of bond is astoundingly dependent on its constituent materials, particularly the pozzolans. The effect of high temperature on concrete containing flyash or trademark pozzolans has not been explored in detail. Right when the strong is presented to a temperature of more than 300 ^{o}C there is consistency in supposition concerning a decrease in mechanical characteristics. In any case, quality declines which have been represented in the composition reveal basic quantitative differences due to the grouping of high temperature condition attempted, and the combination of constituent materials of concrete used. It is seen that the lead of concrete presented to high temperature is a result of various segments, for instance, warming degree, top temperatures, drying out of C-S-H gel, organize changes, and warm oppositeness among aggregates and bond stick. On the other hand, quality control of bond, by techniques for non-hazardous methodologies, in structures presented to fire or not too high temperature presentation conditions, isn't particularly basic o be finished. Since human prosperity if there ought to be an event of fire is one of the genuine examinations in the arrangement of structures, it is to an incredible degree critical to have a whole finding out about the direct of all improvement materials before using them in the fundamental parts.

In this assessment, a general blueprint of the warm properties and uses of SCC will be given, including the effect of materials used on its characteristics in the new and set states. Finally, the testing procedures for SCC in its new state will be sketched out. The degree of this work to give exploratory data on the waiting mechanical and physical properties of High Strength SCC presented to warm, containing little scale silica as pozzolanic materials. These properties are fundamental for safe arrangement of concrete and in the fix of strong structures.

The following advantages can be achieved by using self-compacting concrete

- Avoids honeycombs
- Reduces skilled man power requirement
- The structures built with SCC shall be highly durable
- Faster construction
- Better surface finish
- Easier placing

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1.2 VISCOSITY MODIFYINGAGENT

Thickness Modifying Agents are added to expand the consistency of the solid to abstain from draining and isolation as compound admixtures increment the stream capacity of the solid. To ensure that the solid isn't excessively runny, has a long setting period and loses its holding VMAs are utilized. The expansion of VMA relies upon the concrete being utilized. Aftereffect of VMA expansion may change from concrete to bond. Each concrete has one specific VMA which acts best with it. This task expects to draw an outcome dependent on this for Birla Cement OPC 53 grade. The example of the VMA utilized is appeared in Fig.1.1

VMA's are admixtures designed for specific applications.

1. Reducing the segregation in highly flow able / self-compacting concrete
2. Reducing the washout in underwater concreting
3. Reducing the friction and pressure in pump able concrete
4. Compensating for poor aggregate grading, especially the lack of finer particles in the sand
5. Reducing the powder content in self-compacting concrete
6. Reduction in bleeding in the laid concrete.

The main function of VMA is to modify the rheological properties of concrete, namely the yield point and plastic velocity.

1. The yield point is the force needed to start the flow of concrete. It is related to workability of the concrete and can be assessed by the Slump Cone test.
2. The plastic velocity is the resistance to flow under external pressure. Viscosity as we know is the resistance to flow caused by internal friction in the material. The speed of flow in concrete is related to the plastic velocity and can be asses by the T500 during slump cone test or the V-Funnel test.

Fig. 1.1: Superplasticizer and VMA samples

VMA, otherwise called enemy of washout admixtures, can be added to the solid blends to improve isolation opposition, cohesiveness and diminish dying. When all is said in done these admixtures increment yield pressure and plastic thickness. They might be likewise utilized as an option in contrast to expanding the powder substance or lessening the water substance of a solid blend (Koehler et al.,2007).

Acrylic-or cellulose-based water-solvent polymers or polysaccharides of microbial sources, for example, welan gum are the generally utilized thickness changing specialists in cement. Water-dissolvable polymers can assimilate a portion of the free water in the framework, therefore expanding the consistency of the concrete glue which, thusly, empowers the glue to hold total particles in a steady suspension.

GLENIUM TM STREAM2

GLENIUM STREAM 2 is a head prepared to utilize fluid, natural, consistency altering admixture (VMA) exceptionally created for delivering concrete with improved thickness and controlled rheological properties. Cement containing GLENIUM STREAM 2 admixture displays prevalent soundness and controlled draining qualities, in this manner expanding protection from isolation and encouraging situation which ought to be added to the solid after every single other part. For best execution it is prudent to keep blending until the blend is totally homogeneous. To produce rheodynamic concrete, GLENIUM STREAM 2 ought to be utilized in blend with the other super-plasticizer admixtures of the GLENIUM extend so as to ensure most extreme efficiency. The VMA utilized in this examination was Glenium stream-2 which is a result of Degussa development synthetic concoctions. The properties of VMA are given in underneath.

Table: 1.1.Properties of VMA

S.No.	Property	Result
1.	Aspect	Colour less free flowing liquid
2.	Relativedensity	1.01
3.	Ph	≥6

Water

This is the least expensive but most important ingredient in concrete. The water, which is used for making concrete, should be clean and free from harmful impurities such as alkali, acid etc. In general the water is fit for drinking should be used for concrete. Water should confirmtoIS456.Waterhasprofoundeffects on both the fresh and the hardened properties of SCC. Water decreases both the yield stress and the plastic viscosity. Concrete is much more prone to segregation if only water is added to increase the filling ability. Because of this, SCC could not have been developed until suitable super-plasticizers were produced.

Water in the fresh concrete includes freely movable water and the water retained by the powder (addition sand cement), sand and VMA. Coarse aggregate does not confine water. It is the free water that controls the performance of SCC. Free water is one of the main factors determining the filling ability and segregation resistance. This is confirmed by Kasemchaisiri and Tangermsirikul (2008), free water content was used to predict slump flow and T500 with satisfactory accuracy in a deformability model.

Advantages and disadvantages of using SCC:

1. Simple inclusion even in complicated formwork and tight reinforcement.
2. Higher installation performance since no compaction work is necessary which leads to reduced construction times, especially at large construction sites.
3. Reduced noise pollution since vibrators are not necessary.
4. Higher and more homogenous concrete quality across the entire concrete cross-section, especially around there in for cement.
5. Improved concrete surfaces (visible concrete quality)
6. Typically higher early strength of the concrete so that formwork removal can be performed more quickly.
7. SCC ensures a uniform architectural surface finish with little to no remedial surface work.
8. Improved quality of concrete and reduction of on site repairs.
9. Faster construction times.
10. Possibilities for utilization of “dusts”, which are currently waste demanding with no practical applications and which are costly to dispose of.
11. SCC makes the level of durability and reliability of the structure independent from the existing on-site conditions related to the quality of labour, casting and compacting systems available.
12. The high resistance to external segregation and the mixtures self-compacting ability allow the elimination of macro-defects, air bubbles, and honeycombs responsible for penalizing mechanical performance and structure durability.

The disadvantages of SCC may include:

1. Increased material costs, especially for admixtures and cementitious
2. Increased formwork costs due to possibly higher form work pressures.
3. Increased technical expertise required to develop and control mixtures.
4. Increased variability in properties, especially workability.
5. Increased quality control requirements.
6. Reduced hardened properties—possibly including modulus of elasticity and dimensional stability—due to factors such as high paste volumes or low coarse

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aggregate contents.

7. Delayed setting time in some cases due to the use of admixtures.
8. Increased risk and uncertainty associated with the use of a new product.

1.3 NEED FORSTUDY

For a self-compacting solid blend to be great, right off the bat we have to know the admixtures and their concoction properties. In light of the admixtures utilized the thickness changing specialist must be chosen. This is significant as not all VMAs are integral to the super plasticizer (SP) utilized.

That is the principle motivation behind this examination, to check for the reciprocal properties for the VMAs utilized when the admixture is consistent (Glenium B233) for a specific kind and grade of concrete (Birla Cement OPC 53 grade).

1.4 OBJECTIVES

In this project, it is proposed to;

1. To optimize the proportion for high strength self-compacting concrete
2. To compare the effect of different VMAs for the same mix proportion and Super plasticizer content
3. To study the workability of SCC using
4. Slump cone test

A. U-box test

B. L-box test

C. V-funnel test

1.5 SCOPE

The scope of this project is limited to the availability of VMAs. The super plasticizer used is Glenium B 233. The study is conducted to see which of the two VMAs complements the super plasticizer better.

These “Guidelines for Viscosity Modifying Admixtures for Concrete” represent a practical state-of-the-art document addressed to specifiers, designers, contractors and concrete producers who wish to enhance their expertise and use of VMA’s. The Guidelines covers information for the use of VMA’s in selected applications such as SCC, pumped concrete and underwater concrete and includes sections on problem solving.

Methodology:

GENERAL:

The materials are procured and the concrete mix design is computed. The mix is made and the tests on SCC fresh concrete are conducted. Based on the results got, the comparison is made and the results are drawn.

3.1 MATERIAL USED INSCC

Material used plays a very important role in determining the workability of concrete, especially in SCC. The aggregates that are to be used should strictly adhere to the code and in case of coarse aggregates; maximum aggregate size to be used for good workability should be 12.5mm

3.1.1 CEMENT

The cement used is a 53 grade Ordinary Portland Cement. The cement selected is as per the IS code IS 12269 (1987). The preliminary material test conducted to check the properties of cement are:

1. Fineness Test
2. Consistency of cement Test
3. Initial Setting Time
4. Final Setting Time
5. Specific Gravity

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6. Compressive Strength Test

3.1.2 FLYASH

Class F Fly ash is used as the mineral admixture in partial replacement of cement. The mineral admixture used is conforming with IS 3812 (2000). Tests that are conducted to determine its properties are:

1. Specific Gravity Test
2. Fineness Test

3.1.3 FINEAGGREGATES

Fine Aggregates used is river sand, which is the best for concreting. The Fine Aggregates conform to IS 383. The sand used as fines is well graded and passing 4.75mm IS sieve. Material testing is done in order to determine the physical properties of the sand being used. Tests conducted are:

1. Specific Gravity
2. Sieve Analysis
3. Fineness Test
4. Test for Silt and Clay

3.1.4 COARSEAGGREGATES

For conventional concrete, 20 mm passing aggregates are used but for SCC, 20 mm passing with maximum aggregate 12.5 mm are preferred as they allow for easy flow ability of concrete hence helping in self-compaction. The aggregates used are conforming to IS code IS 383. Like the fine aggregates material testing is done for coarse aggregates also.

1. Impact Factor Test
2. Crushing Strength Test
3. Specific Gravity Test
4. Absorption Test

TESTING AND MIX DESIGN

4.1 MATERIALTESTING

All the materials used are tested for their physical properties

4.1.1 CEMENT

4.1.1.1 FINENESSTEST:

1. Weigh accurately 100 gram of cement and place it on a standard 90-micron sieve
2. Shift the sample continuously for 15 minutes by holding the sieve in both the hands and give a gentle wriest motion. More are less continuous rotation of the sieve shall be carried out throughout the sieving. The underside of the sieve shall be lightly brushed with a 25 or 40 mm bristle brush after every 5 minutes of sieving.
3. Weighing the residue left after sieving and report the value as a percentage weight of original sample taken.

Fig 4.1 Fineness test

4.1.1.2 SPECIFIC GRAVITYTEST

1. Weight of specific gravity bottle(W1)
2. Fill the bottle with distilled water and weigh the bottle(W2).
3. Dry the specific gravity bottle and fill with kerosene and weigh(W3)
4. Pour the weighed quantity of cement in to the bottle Roll the bottle gently in the inclined position until no further air bubble rise to the surface Weigh the bottle with kerosene and cement.(W4)
5. Weighed quantity of cement isW5
6. Specific gravity of cement = W5 * (W3-W1) / (W5+W3-W4)(W2-W1)

4.1.1.3 COMPRESSIVE STRENGTHTEST

1. Place a non-porous plate a mixture of cement and sand in the proportion of 1: 3 by weight. Mix a dry mix with the trowel for one minute and then add water until the mix is of uniform colour.
2. Gauging time should not be less than 3 minutes and should not exceed 4minutes.
3. Oil the interiors face of the mould.
4. Place the assembled mould on the table of the vibration machine and firmly hold it in position by means of suitable clamps.
5. Immediately after mixing the mortar as specified above, place the entire quantity of the mortar in hopper of the cube mould and compact.
6. The water in which the cubes are submerged should be renewed after 7 days. The cubes should not be allowed to dry up before testing.
7. Test the 3 cubes for compressive strength at periods mentioned below, 7 & 28 days.
8. Place the test cubes on the platform of compression testing machine without any packing between the cube and the steel plates of the testing machine.

4.1.1.4 Apply the loads steadily and uniformly starting from zero at the rate of 350 kg/sq.cm/minute till the cubes Billed CONSISTENCY TEST

The standard consistency of cement is designed as the percentage water required, by weight, to produce a paste, which permits the vicat plunger to penetrate a point 5 to 7mm from the bottom of the vicat mould,

1. Weigh 400 gram of sample of cement on non- porous platform and make it in to a heap with a depression in the center to hold the mixing water.
2. Take 30% of water by weight of dry cement and add this to the cement.
3. Mix the cement and water carefully together thoroughly. The process of mixing shall include kneading and threading. The total time elapsed from the moment of adding water to the moment when mixing is completed shall not less than 4 minutes and not more than 5minutes.

4.1.1.5 CONSISTENCY TEST

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6. Mix the cement and water carefully together thoroughly. The process of mixing shall include kneading and threading. The total time elapsed from the moment of adding water to the moment when mixing is completed shall not less than 4 minutes and not more than 5minutes.
7. Fill the mould completely with the cement paste and smooth of the surface of the making it level with the top of the mould. The mould may be shaken to expel the air. Keep the mould under the plunger, lower the plunger gently touches the surface of the paste and release the rod quickly. After the plunger comes to rest, note the reading against the scale
8. Repeat the experiment with the trial test of varying percentage of water till the plunger

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comes to rest between 5 to 7 mm from the bottom.

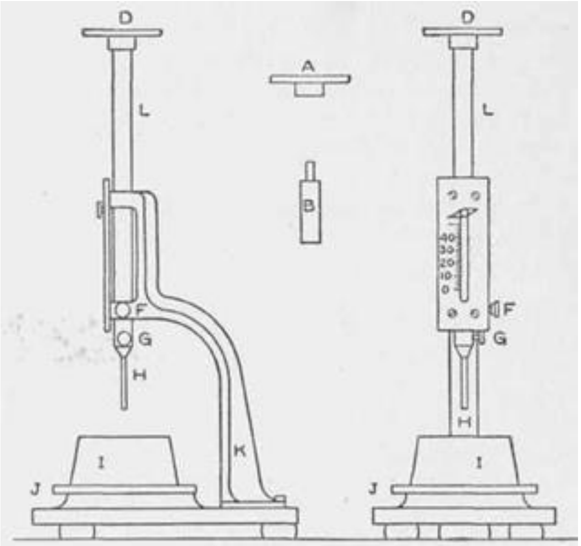

Fig 4.2 Consistency Test

4.1.1.6 CRUSHING STRENGTHTEST

The aggregate crushing value gives a relative of an aggregate to crush under gradually compressing load.

1. The aggregate passing through 12.5 mm sieve and retained on 10 mm sieve is taken as 6.5 kg
2. The dry aggregate is filled in standard cylinder measure in three layers on tamped 25 times with a tamping rod and then it is leveled and weighted as (W6)gram.
3. He cylinder is put in position on the base plate and then plunger is inserted vertically on its surface
4. The cylinder along with the test sample and the plunger is placed on a compression testing machine a uniform load of 40t is applied for 10minutes.
5. The load is then released the whole material removed from the cylinder and sieved on

2.36 mm is sieve. The fraction passing is weighted (W7) g. Aggregate crushing value = (W7/W6) x 100
Where

W7 = weight of fraction passing through 2.36mmsieve

W6 = weight of sample taken

Fig 4.4 Aggregate crushing test

4.1.1.7 SPECIFIC GRAVITY

1. Take the pyconometer of about 900 ml capacity with a conical brass cap.
2. Find the mass of clean pyconometer as M1
3. Take about 200-400 gram of dry sand, put it in pyconometer and find the massM2
4. Fill the pyconometer to half its weight with distilled water and mix thoroughly with glass rod. Dry the pyconometer outside and the mass is recorded.M3
5. Empty the pyconometer and fill it with distilled water to whole of conical cap and find the mass as M4

Specific gravity = (Weight of dry sample/Weight of equal volume of water)

Fig 4.5 Pyconometer test

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4.1.1.8 SIEVEANALYSIS

1. The sample is dried and weighted and is placed on the sieve and sieved successfully on the appropriate sieves with the largest at the top
2. The end of sieving 150 and 75-micron sieves are cleaned from the bottom by light brushing
3. On the completion of sieving, the material retained on each sieve together with and material cleaned from the brush, is weighted

4.1.1.9 TEST FOR SILT ANDCLAY

1. Fill half the measuring cylinders with sand and pore water with a pinch of salt to hasten the process.
2. Save the cylinder and to Roding (to dislodge silt particles adhering to sand) and shake vigorously.
3. Clean sand will settle down at bottom and silt and clay will make the water muddy
4. Clay and silt will settle down slowly on the top of sand.

Fig 4.6 percentage of silt and clay

RESULTS AND CONCLUSION

5.1 MATERIAL TESTRESULTS

5.1.1 CEMENT

A cement is a binder, a substance used for construction that sets, hardens, and adheres to other materials to bind them together. Cements used in construction are usually inorganic, often lime or calcium silicate based, and can be characterized as either hydraulic or non-hydraulic, depending on the ability of the cement to set in the presence of water

The test result for cement tests carried out are given in the table 5.1 shown below.

Table 5.1: Test results for cement

Test	IS Standard	Test Results
Fineness Test	< 10%	8%
Consistency Test	30% to 40%	34.5%
Initial Setting Time	>30 minutes	68 minutes
Final Setting Time	< 10 hours	10 hours 45 minutes
Specific Gravity	3.1 to 3.5	3.38
Compressive Strength	53 N/mm^2 (cement grade 53)	54 N/mm^2

5.1.2 FINEAGGREGATE

The test results for fine aggregate are shown in Table 5.2 given below. The Sieve analysis results are given in table 5.3

Table 5.2: Fine aggregate test results

Test	IS Standard	Test Result
Specific Gravity	>2.55	2.65
Fineness	< 10%	6.8%
Test for Silt and Clay	< 7%	4%

Table 5.3: Sieve analysis result for fine aggregates

Is Sieves	% Passing
4.75 mm	100
3.35 mm	94.3
2.36 mm	57.3
1.68 mm	38.4
1.18 mm	32.7
600 µm	15.3
300 µm	5
150 µm	1.3

5.1.3 COARSEAGGREGATE

Table 5.4: Material test result for coarse aggregates

Tests	IS Standard	Test Result
Specific Gravity	> 2.6	2.84
Crushing Test	< 30%	28.93%
Impact Test	< 30%	20.32%
Absorption Test	< 3%	1.2%

5.2 FINAL TESTRESULTS

The consolidated table of the result is given below. Based on the below values we can draw to conclusion that the Glenium Stream 2 is the more suitable VMA that is to be used along with the Glenium B233 SP. The results clearly show that Glenium VMA provides greater stability and workability to the SCC compared to the Rheomac VMA.

5.2.1Compressive Strength Test

To know there duction of the compressive strength the following procedure to be adopted.

Apparatus: Pan Mixer, Mufflefurnace of capacity 1100^{o}C, Compression testing machine, Stop watch and Weigh balance were used.

5.3 Loss in weight

To know the loss in weigh tthe following procedure to be adopted.

Apparatus:

Pan Mixer, Mufflefurnace of capacity1 100^{O}C ,and Weigh balance were used.

Procedure:

Set up the 3D shapes of 100X100mm in size according to standard techniques for the previously mentioned blend extents in Table. 3.4. Expel he examples from molds following 48 hours for HSSCC and following 24 hours for HSVC. Spot the examples in submerged water for relieving submerged in clear crisp water around 28 days. Expel the example from water after indicated relieving time and crash abundance water from the surface. Take the element of the example to the closest 0.2m and Weigh every example before warming and subsequent to warming .Heat the examples in mute heater to the testing temperatures of 1000C, 2000C, 4000C& 6000C and keep up consistent temperature to required testingspan hours (i.e., 1hr, 2hrs, 3hrs,4hrs& 6hrs).Allow to cool the examples under typical conditions until they gains to room temperature. Clean the bearing surface of the testing machine. Spot the example in the compressive testing machine in such a way, that the heap will be connected to the contrary sides of the solid shape cast. Adjust the example halfway on the base plate of the machine. Pivot the versatile

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bit delicately by hand with the goal that it contacts the top surface of the example. Apply the heap slowly without stun and ceaselessly at the rate of 140kg/cm2/minute till the example flops any abnormal highlights in the kind of disappointment. For each set test at any rate three Specimens are to be tried under typical temperature and just as subsequent to warming to required temperature (i.e., at 1000C, 2000C, 4000C and 6000C)moreover.

Percentage of loss in weight =

Weight of specimen before test ×100

Weight of specimen after test

Precautions

1. The water for curing should be tested every 7 days and the temperature of water must be at 27±2°C.

2. Minimum three specimens should be tested at each selected age. Average of three specimens gives the weight loss of the specimen

Fig.5.1.MuffleFurnace

Fig.5.2.Specimens after heating 200^0C at1hr duration

Fig.5.3.Specimensafterheating 200^0CCat6hrduration

Fig.5.4.Specimens after heating 400^0C at 1hr duration

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Fig5.5.Specimens after heating 400^0C at 6hr duration

Fig5.6.Specimens after heating 600^0C at 6hr duration

Fig 5.7.Specimen of M12 after heating to 600^0C at 6 hr duration.

Fig.5.8.Specimen of HSVC after heating to 600^0C at 6hr duration

Fig.5.9.SpecimenofHSSCCwhiletestingafterheatingto40**0^0**Cat6hrduration

CONCLUSION

We can draw to a conclusion from this project that each SP has a particular VMA which complements it and enhances the workability and stability of the SCC. In this particular case Glenium B233 SP is well complemented by the Glenium Stream 2 VMA rather than the Rheomac VMA 358.

But it was noticed that upon over dosage undesirable effects take place making the concrete less workable and rapid setting. The dosage of the VMA shouldn’t exceed 1% by mass of the cementitious material at all times.

Optimum range ranges from 0.2% to 0.4% for best effects.

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