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AN EXPERIMENTAL STUDY ON STRENGTH AND DURABILITY CHARACTERISTICS OF FIBRE REINFORCED SELF COMPACTION CONCRETE

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Abstract:- The sustainable development in construction can be achieved by using industrial waste products in concrete. This work aims at developing a new composite by incorporating Granite Sawing Waste (GSW) in Poly Propylene fibre (PP) reinforced self compacting concrete along with Fly Ash(FA). Shrinkage studies and durability studies like water absorption, porosity, acid resistance, sulphate resistance and chloride penetration have been done. It is found that the shrinkage of Self Compacting Concrete (SCC) is considerably reduced by using GSW and PP fibre. Resistance against acid attack and chloride penetration are found to improve. Reduction in water absorption and porosity are found to be better than control concrete up to 10% of GSW and the sulphate resistance is improved.

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I INTRODUCTION

Self-compacting concrete (SCC) become first brought in Japan at some point of 1980's, given that then it has been the difficulty to severa investigations so as to attain the preferred homes of contemporary concrete structures. At the same time the producers of components have developed greater and greater sophisticated plasticizers and stabilizers tailored for the precast and the geared up-blend industry.

Concrete generation has made remarkable strides within the beyond decade. Concrete is now not a cloth consisting of cement, aggregates, water and admixtures but it is an engineered fabric with several new elements acting satisfactorily beneath one of a kind publicity situations. Concrete today may be a tailor made for particular applications and it carries unique substances like micro silica, colloidal silica and lots of different binders, fillers and pozzolonic materials. The development of specifying a concrete according to its performance and necessities, as opposed to the ingredients and ingredients have opened innumerable possibilities for manufacturers of concrete and users to layout concrete to in shape their specific necessities. One of the maximum wonderful advances within the concrete era inside the last decade is "self compacting concrete" (SCC).

Self compacting concrete (SCC) has developed as an revolutionary era, capable of attaining the popularity of being an terrific advancement within the field of concrete era. No vibration is vital for SCC which could flow around obstructions, encapsulate the reinforcement and fill up the formwork absolutely under its very own self weight. Making concrete systems with out vibration were executed inside the beyond. For instance, placement of concrete under water is performed via the usage of tremie without vibration.

Mass concrete and shaft concrete may be efficiently placed without vibration. But these concretes are typically of decrease power and tough to attain constant first-class. Modern application of self compacting concrete is centered on excessive performance, better and greater dependable and uniform nice.

The method for achieving self-compatibility involves now not only excessive deformability of paste or mortar, but additionally resistance to segregation among coarse aggregate and mortar when

the concrete flows thru the constrained sector of reinforcing bars. Such concrete must have a rather low yield value to ensure high flowability, a slight viscosity to withstand segregation and bleeding, and must preserve its homogeneity all through transportation, setting and curing to ensure adequate structural overall performance and long time sturdiness. The a hit improvement of SCC should ensure a good stability among deformability and stability.

The Self compacting concrete is typically categorized in to a few different sorts based at the composition of the mortar

1. **Powder –type SCC:** This mix achieves the fluidity requirement via the reduction of the coarse mixture quantity and the use of High Range Water Reducer (HRWR). The balance comes from a low water to cement ratio with excessive sand to stick ratio, i.E., massive amount of first-rate aggregates are essential to resist segregation in the mix.

2. **Stabilizer or Viscosity agent –type SCC:** In VMA – kind SCC, the fines content material may be in variety required for conventional vibrated concrete, but the required viscosity to inhibit segregation is ensured with the aid of the usage of a viscosity enhancing admixture(VMA). This blend uses a high water to cement ratio with little to no HRWR to acquire the fluidity requirements, bearing in mind a slight volume of coarse mixture, whilst the steadiness is performed via the use of VMA and mild sand to stick ratios.

3. **Combination – type:** This mix is received with the aid of including a small quantity of stabilizer to the powder type SCC to stability the moisture fluctuations.

At ordinary mixing or putting situations, the ionic interaction of the viscosity modifier offers the homogeneity of the mix and prevents segregation. The stability among the yield strain and the plastic viscosity is the important thing to the proper SCC rheology. Hence some of factors ought to be considered whilst designing SCC.

Following are the essential requirements to develop self co mpacting concrete.

1. Limited aggregate content
2. Low water-powder ratio
3. Use of superplasticizer

ADVANTAGES OF SCC

- Faster and greater green placement of sparkling concrete is achieved. Total concreting time is reduced.
- SCC may be very nicely applicable for unique and technically demanding structures consisting of tunnel linings, as the possibility to compact the concrete is limited in the closed area among formwork and rock.
- SCC can be used to create structural and architectural shapes and surface finishes now not manageable with traditional concrete.
- It ensures higher pleasant of in-situ pile basis.
- Noise stage on creation website online is reduced as a result of not the use of a vibration system. Thus the number of running hours on the development web page can be increased and the night time shift in urban zones is enabled.
- SCC yields homogeneous concrete in conditions in which the castings are tough due to congested reinforcement, difficult get right of entry to ect.
- Good bond between concrete and reinforcement is obtained, even in congested reinforcement
- SCC indicates a very good filling capacity particularly round reinforcement and resistance to segregati.
- Required quantity of employees on creation site may be minimized as well as theenergy consumption.
- Safer and healthier working environment is obtained.
- Eliminates troubles with blood move leading to "white fingers" due to compacting device, hence referred to as a wholesome concrete.
- Possibility for utilization of "dusts", which can be presently waste merchandise having no sensible packages and which might be pricey to dispose off.
- Shortens the development time via accelerating creation method, mainly in precast industry.
- Its ease of placement improves the productiveness and the price saving via reduced device and labor equipment.
- High fine of concrete floor finish is acquired with no need for subsequent restore and with a higher very last look of concrete floor, smooth wall surface and flat floor surfaces that want no in addition completing.
- The excessive resistance to outside segregation and the mixture"s self-compacting capability permit the elimination of macro defects, air bubbles and honeycombs which lead to progressed mechanical overall performance.
- Improved sturdiness of systems is completed

DISADVANTAGES OF SCC

- Production of SCC calls for more experience and care than the conventional vibratedconcrete. Since an uncontrolled variant of even 1% moisture content material within the first-classcombination will have a miles larger impact on the rheology of SCC at very low water cement ratio.

- Formwork should be designed to face up to fluid concrete stress to be able to be better than normal concrete.
- Full capacity mixer of self-compacting concrete may not be possible due to capability spillage along the road, generating environmental and infection risks.
- The development of a SCC calls for a massive range of a tribulation batches. In addition to the laboratory trial batches, area size trial batches should be used to simulate the standard manufacturing situations. Once a promising mixture has been set up, similarly laboratory trial batches are required to quantify the characteristics of the aggregate.

OBJECTIVES OF THIS STUDY

- An attempt has been made to produce M40 grade self-compacting concrete the use of the Nan Su mix design manner.
- To look at the float characteristics of SCC withwaste plastic fibres of element ratio 50 with extent fraction zero%, 0.25%, 0.5%, zero.Seventy five%, 1%, 1.1%, 1.2% & 1.3% by using weight of cement.
- To determine the compressive energy and flexural strength of SCC with and without plastic fibres with extent fraction 0%, 0.25%, 0.Five%, 0.Seventy five%, 1%, 1.1%, 1.2% & 1.3% by weight of cement after 28 day water curing.
- To decide the effect strength of SCC with and with out plastic fibres with quantity fraction zero%, 0.25%, 0.5%, zero.Seventy five%, 1%, 1.1%, 1.2% & 1.3% by using weight of cement after 28 day water curing by means of drop ball approach.
- To decide the sturdiness traits particularly effect energy, flextural power of SCC with and without plastic fibers, with volume fraction zero%, 0.25%, 0.5%, zero.75%, 1%, 1.1%, 1.2% & 1.3% by means of weight of cement while immersed in sulphuric acid with a pH 2 for 30, 60 & ninety days.

II LITERATURE SURVEY

Kazumasa Ozawa (1989)

Completed the primary prototype of self compacting concrete the use of materials already in the marketplace. By the use of different varieties of outstanding plasticizers, he studied the workability of concrete and evolved a concrete, which become extra attainable. It turned into appropriate for fast placement and had a excellent permeability. Ozawa (1989) executed experiments by using focusing at the have an effect on of of mineral admixtures, like fly ash and blast furnace slag, at the flowing capacity and segregation resistance of self-compacting concrete. He discovered out that the flowing capacity of the concrete advanced remarkably whilst Portland cement become partially replaced with fly ash and blast furnace slag. After attempting exclusive proportions of admixtures, he concluded that 10-20% of fly ash and 25-45% of slag cement, by using mass, confirmed the quality flowing capacity and strength traits.

Nan Su, Kung-Chung Hsu, His-Wen Chai (2001)

They proposed a comparatively better mix design approach for self-compacting concrete (SCC), that ensured better flowability, self-compacting capacity and other favored SCC houses. The paste of binders is filled into the mixture voids after figuring out the amount of aggregates required. Thus by way of using appropriate cloth residences the amount of aggregates, binders and mixing water, as well as type and dosage of superplasticizer (SP) for use ardetermined. Fresh residences like Slump float, V-funnel, L-drift, U-container and compressive electricity tests had been achieved correctly to find out the overall performance of produced high pleasant SCC. The approach is more easy while compared to the technique evolved via the Japanese Ready-Mixed Concrete Association, because it is easy for implementation, simple, less time-ingesting, saves fee and calls for a smaller amount of binders.

Hajime Okamura and Masahiro Ouchi (2003)

The most important intention is to establish a rational blend-layout technique. Self- compactability checking out techniques have been achieved from the view point to make self-compacting concrete a widespread concrete There are 3 goals for self-compactability exams relating to realistic functions.

Test (1): To check whether or no longer the concrete is self-compactable for the shape

Test (2): To adjust the mix share when self-compactability is not sufficient

Test (three): To symbolize materials

For conducting Test (1) U-drift take a look at or Box take a look at is recommended. The U-waft test changed into advanced with the aid of the Taisei Group (Hayakawa 1993). In this test, the degree of compactability can be indicated via the peak that the concrete reaches after flowing thru an impediment. Concrete with a filling peak of over 30mm may be judged as self-compacting. The Box-check is more suitable for detecting concrete with higher possibility of segregation among coarse combination and mortar. If the concrete is judged to be having inadequate self-compactability via test (1), the reason has to be detected quantitatively so that the mixture percentage may be adjusted. Slump-go with the flow and funnel assessments were proposed for checking out deformability and viscosity, respectively. Flow and funnel checks for mortar or paste had been proposed to represent materials utilized in self compacting concrete, e.G. Powder material, sand, and terrific-plasticizer. Testing strategies for the mortar residences had been all so proposed and the indices for deformability and viscosity.

Narayana P.S.S, SrinivasaRao. P, Swami.B.L.P(2004)

The development in 28 days compressive electricity is 20% greater with 5% addition of micro silica compared with 0% addition. With the addition of micro silica the resistance of concrete to the assault of acids and sulphates advanced. The percent of weight loss could be less at 20% addition of micro silica, while immersed in H_2SO_4,HCl and Na_2SO_4.

H.J.H. Brouwers, H.J. Radix(2005)

The important goal factor in their evaluation is the packing theory. The Japanese Method uses the packed densities of gravel and sand in my opinion, in the Chinese Method the packing of those aggregates is considered integrally. The higher the packing, the greater water is available to act as lubricant for the solids, and higher the fluidity. The foremost consideration of the Chinese Method is that voids present in free aggregate are packed with paste and that the packing of the aggregate is minimized. This is achieved by using using more sand and less gravel. In the Chinese Method the void discount is expressed with the help of Packing Factor (PF). ThePF represents the plain density of combination in kingdom of packing in SCC as compared with the plain density of loosely packed aggregate.

ParatibhaAggarwal, RafatSiddique, Surinder, M Gupta, YogeshAggarwal (2008)

They presented an experimental technique for the design of self-compacting concrete mixes. In this paper rational mix layout technique is taken. The required water /powder ratio is decided by means of conducting some of trials. One of the restrictions of SCC is that there's no hooked up mix layout procedure but. Self- Compacting Concrete is characterized with the aid of filling capacity, passing potential and resistance to segregation. Many extraordinary techniques have been advanced to represent the homes of SCC. No unmarried technique has been found until date, which characterizes all of the relevant workability factors, and as a result, every blend has been tested through a couple of check method for the one of a kind workability parameters.SCC may be evolved with out the usage of VMA as become carried out on this observe. According to the manner adopted on thispaper, the trials had been started at 50 percentage extent of overall concrete as content material of coarse aggregates and 40 percent through quantity of mortar in concrete as contents of high-quality aggregates and variant in w/p ratio and extremely good plasticizer turned into achieved to acquire SCC mixes. In case of further trials, the coarse combination content and fine combination content material had been numerous with in addition variation in water/cement ratio. Similarly, one-of-a-kind trials were carried out till blend characterizing all the residences of SCC turned into received.

Krishna Rao B, Ravindra V (2010)

It is located that once fly ash became used (that's anticipated to boom water necessities of concrete mixture) the easy surface traits and round form of the fly ash enhance the workability traits of concrete mixtures and comparable workability properties have been done via a smaller water powder ratio. Using fly ash in better extent decrease the water call for of SCC aggregate for similar workability measures. The metal fibers affected the clean concrete aggregate. The addition of metallic fibers did no longer affect the water requirements of the combination for the equal workability. At higher values of fiber content material, in reality a discount in closing load has been observed. This can be due to the insufficient matrix across the fibers for transfer of strain from concrete to fibers thru bond.

Noratan M.D, HanizamAwang (2011)

The mix layout was primarily based on the rational technique wherein solid parts had been fixedwhile water and superplasticizer contents were adjusted to provide most advantageous viscosity and flowability. All mixes were designed to acquire hunch glide with conformity standards ≥ 520mm and ≤ 700mm. Test results display that 15% alternative of cement the usage of raw rice husk ash produced grade 40 concrete. When debris show off large specific area, huge amount of water is absorbed on the particles‟ floor resulting in much less water to be had to lubricate and to disperse the debris. This phenomenon produces poor effect on flowability of sparkling SCC. In order to increase flowability even as with out reducing the viscosity excessively that could purpose segregation of coarse mixture, water is brought to the mix.

Kandasamy R, Murugesan (2012)

The Japanese approach of self compacting concrete blend design became accompanied. The have an effect on of addition of polythene (home waste polythene bags) fibers at a dosage of 0.Five% by way of weight of cement is studied. Here the writer has made a comparative examine between fibre bolstered concrete and self compacting concrete the use of plastic fibres by means of taking the plain cement concrete because the bench mark. The research had been performed on a M20 mix and tested the compressive electricity, flexural electricity and break up tensile strength. The addition of fibers in SCC do no longer make a contribution a lot to improvement inside the compressive strength compared to FRC. But within the case of break up tensile energy and flexural strength of fiber reinforced self compacting concrete is better compared to fiber strengthened concrete or plain concrete.

Slamet widodo (2012)

Concrete mixes have been organized containing 0%, 0.05%, zero.1% & zero.15% of polypropylene fibres measured through fibers volume in concrete volume. Drop – weight check changed into carried out the use of ACI 544 Committee recommendation to decide the impact resistance of 15cm diameter and 30cm length concrete specimens. The blows were brought thru a four.45kg hammer falling continually from 457mm peak, which stood at the middle of the top floor of the disc. The effect resistance of the concrete specimen examined after 28 days of water curing. The quantity of blows required for the first crack and failure is mentioned.

III METHODOLOGY

MIX DESIGN

The Mix design may be defined because the method of choosing suitable elements of concrete like cement, sand, coarse combination and water and to optimize their relative proportions to meet the necessities of layout. That is, it complies with the specifications of structural electricity required, and the durability requirements within the environment in which it's miles used which additionally meets the workability necessities. That is it have to be capable of being mixed, transported and compacted sufficiently and efficiently as feasible and be low cost

with out sacrificing the above necessities.

One of the considerable barriers in adopting self compacting concrete in India is the loss of availability of appropriate mixture proportioning methods. SCC requires a few unique considerations in aggregate proportioning, given that the required flowing ability can not be done by way of just growing the water content of the mixture. In the aggregate proportioning of SCC the portions to be determined are air, water, cement, filler, first-rate and coarse mixture aside from the dosages of superplasicizer and viscosity modifying agent. All the aggregate proportioning techniques given below contain trial castings and corrections.

MIX DESIGN METHODS FOR SCC

In 1993, Okamura proposed a mix design approach for SCC. His essential concept was to conduct first the take a look at on paste and mortar that allows you to study the properties and compatibility of superplasticizer, cement, exceptional aggregates and pozzolanic substances, then accompanied with the aid of the trial mix of SCC. The most important benefit of this technique is that it avoids having to repeat the identical type of best manage take a look at on concrete, which consumes each time and labour. However, the drawbacks of Okamura‟s method are that: It calls for exceptional manipulate of paste and mortar previous to SCC mixing, even as many equipped- mix concrete producers do now not have the essential facilities for undertaking such tests.

The mix design approach and techniques are too complicated for sensible implementation.

Different mix design methods available for self-compacting concrete are:

1. The Japanese Method.
2. Sedran et al Method.
3. Method proposed by Gomes, RavindraGettu et al.
4. Nan-Su et al Method.
5. Method proposed by JagadishVengala .
6. European practice and specifications

In the present take a look at, the combination share turned into decided by Nan Su approach of mix design and excellent tuned by using using distinct tips to get the mix with the required clean and hardened residences.

The essential attention of Nan Su method is to fill the paste of binders into voids of the combination framework pilled loosely. When surface-dry coarse and nice aggregates are loosely stacked collectively, friction and voids exist between them. Lubrication occurs, when water and binders are added to the aggregates, for that reason, making the pile of aggregates greater compact.

Usually the volume ratio of mixture after lubrication and compaction in SCC is about fifty nine- 68%. In this look at, the packing component (PF) of mixture is described because the ratio of mass of combination of tightly packed nation in SCC to that of loosely packed nation. Clearly, PF influences the content of aggregates in SCC. A higher PF fee might suggest a extra quantity of coarse and great aggregates used, for this reason reducing the content material of binders in SCC. Consequently, its flowability, self-compacting capability and compressive power will be reduced. On the alternative hand, a low PF cost would imply accelerated dry shrinkage of concrete. As a result greater binders are required, consequently elevating the cost of materials. In addition, extra binders used might also affect the workability and sturdiness of SCC. Therefore, it's miles critical to pick out the top-quality PF value in the blend design technique so one can meet the requirements for SCC residences, and on the identical time taking financial feasibility into attention.

3.3.2 Mix design procedure to fabricate SCC by Nan-Su method.

STEP 1: **Calculation of coarse and fine aggregate contents.**

The content of fine and coarse aggregate can be cal culated from the following

equations:

Wg = PF x WgL (1 - S/a)

Ws = PF x WsL x S/a

Where, Wg

: Content of coarse aggregate in SCC (kg/m^3)

Ws : Content of fine aggregate in SCC (kg/m^3)

WgL

: Unit volume mass of loosely piled saturated s urface-dry coarse aggregate inair (kg/m^3)

WsL

: Unit volume mass of loosely piled saturated su rface-dry fine aggregate in air(kg/m^3)

PF

: The ratio of mass of aggregates of tightly packed state in SCC to that of loosely

packed state in air

S/a

: Volume ratio of fine aggregates to tot al aggregates, which ranges from 50% to

58%

STEP 2: **Calculation of cement contents.**

To secure good flowability and segregation resistance, the content of binders should not

be too low. According to the “Guide to Construction of Hi gh Flowing Concrete,” the minimum

amount of cement to be used for producing normal concr ete and the high durability concrete are

270 and 290 kg/m^3 respectively. However, too much cem ent used will increase the drying

shrinkage of SCC.

C = fc x 7

Where, C : Cement content (kg/m^3)

fc

: Design compressive strength (MPa)

STEP 3: **Calculation of mixing water content required by c ement.**

The relationship between compressive strength and water-cement ratio of SCC is similar to that of normal concrete. The content of mixing water required by cement can then be obtained using the equation:

Wwc = (W/C) C

Where, Wwc : Content of mixing water content required by cement (kg/m^3)

W/C : The water / cement ratio by weight, which can be determined by compressive strength

C : Cement content (kg/m^3)

STEP 4: **Calculation of GGBS contents.**

Large amounts of powdery materials are added to SCC to increase flowability and to facilitate self-compacting. However, an excess amount of cement added will greatly increase the cost of materials and dry shrinkage. More over its slump loss would become greater, and its compressive strength will be higher than required in the design. In view of this, the proposed mix design method utilizes the appropriate cement content and w/c to meet the required strength. To obtain the required properties, such as segregation resistance, pozzolanic materials, like fly ash or ground granulated blast-furnace slag are used to increase the content of binders.

Then the volume of the total pozzolanic materials will be calculated as

VpB= 1 – [Wg / (1000-Gg)] - [Ws / (1000-Gs)] - [C / (1000-Gc)] – [Wwc / (1000-Gw)] - Va

VpB= [(W/C) x WB/(1000 x Gw)] x [WB / (1000 x GB)]

Where, VpB : Volume of GGBS paste

Wg : Content of coarse aggregate in SCC (kg/m^3)

Ws : Content of fine aggregate in SCC (kg/m^3)

Wwc : Content of mixing water content required by cement (kg/m^3)

C : Cement content (kg/m^3)

Va : Air content in SCC (%)

Gg : Specific gravity of coarse aggregate

Gs : Specific gravity of fine aggregate

Gc : Specific gravity of cement

Gw : Specific gravity of water

GB : Specific gravity of GGBS

W/S : Ratio of water/ GGBS by weight

WB : Total amount of GGBS in SCC (kg/m^3)

STEP 5: **Determine the mixing water content required for GGBS**

The mixing water content required for GGBS is calculated by the equation

WwB = (W/C) WB

Where, WwB : Water content required for GGBS

W/C : The water / cement ratio by weight

WB : Total amount of GGBS in SCC (kg/m^3)

STEP 6: **Calculation of mixing water content needed in SCC**

According to the Japanese Architecture Society the total amount of water required forthe mixing of SCC should lie in the range of 160 to 185 kg/m^3. The mixing water content

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AND ENGINEERING TRENDS

required by SCC is the total amount of water needed for cement and GGBS in the mix.

Therefore it can be calculated as follows

Ww = Wwc + WwB

STEP 7: **Calculation of superplasticizer dosage**

Adding an adequate dosage of super plasticizer can i mprove the flowability, self compacting ability and segregation resistance of fre sh SCC for meeting the design requirements. Water content of the SP can be regarded as p art of the mixing water. If dosage of superplasticizer used is equal to n% of the amount of bi nders and its solid content of super plasticizer is m%, then the dosage can be obtained as follo ws:

Wsp = n% (C + WB)

Wwsp = (1-m%) Wsp

Where, Wsp : Dosage of SP used

Wwsp : Water content in SP

n% : Percentage of the amount of binders

m% : Percentage of the solid content of sup erplasticizer

WB : Total amount of GGBS in SCC (kg/m^3)

C : Cement content (kg/m^3)

STEP 8: **Adjustment of mixing water content needed in SC C**

According to the moisture content of the aggregate at the ready mix concrete plant or construction site, the actual amount of water used for mixin g should be adjusted.

Amount of mixing water needed in SCC,

W = Wwc +WwB - Wwsp

STEP 9: **Trial mixes and tests on SCC properties**

Trail mixes can be carried out using the contents of the materials calculated as above.Then, quality control tests for SCC should be performed to ensure that the f ollowing

requirements are met:

- Results of slump flow, L-box and Vfunnel tests should be as per the specifications ofthe recommended range should be satisfied for PFSCC differs because of decrease inflow due to addition of fibr es in order to satisfy the flow properties extra dosage of super plasticizer was added.
- The segregation phenomenon of materials should be sat isfactory.
- Water – binder ratio should satisfy the requirements of durability an d strength.

1. Air content should meet the requirement of the mix design

IV RESULTS AND ANALYSIS

4.2 COMPRESSIVE STRENGTH OF SCC

Table 4.9 Compressive strength of SCC after 28 days of water curing

Sl.No.	% of fibre	Failure load (KN)	Compressive strength in N/mm^2	Average compressive strength in N/mm^2
1	0%	1060	40.11	40.2
2		1102	40.24	
3		1089	40.21	
4	0.25%	1128	41.52	41.3
5		1098	40.98	
6		1132	41.5	
7	0.5%	1142	41.72	41.5
8		1123	41.56	
9		1108	41.35	
10	0.75%	1156	42.6	42.6
11		1187	43.0	
12		1148	42.25	
13	1.0%	1205	44.21	43.8
14		1187	43.32	
15		1198	44.01	
16	1.1%	1182	43.30	42.9
17		1156	42.29	
18		1185	43.33	
19	1.2%	1176	43.27	42.1
20		1144	41.58	
21		1139	41.54	
22	1.3%	1159	42.31	41.7
23		1119	41.44	
24		1131	41.46	

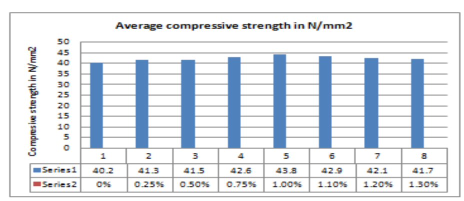
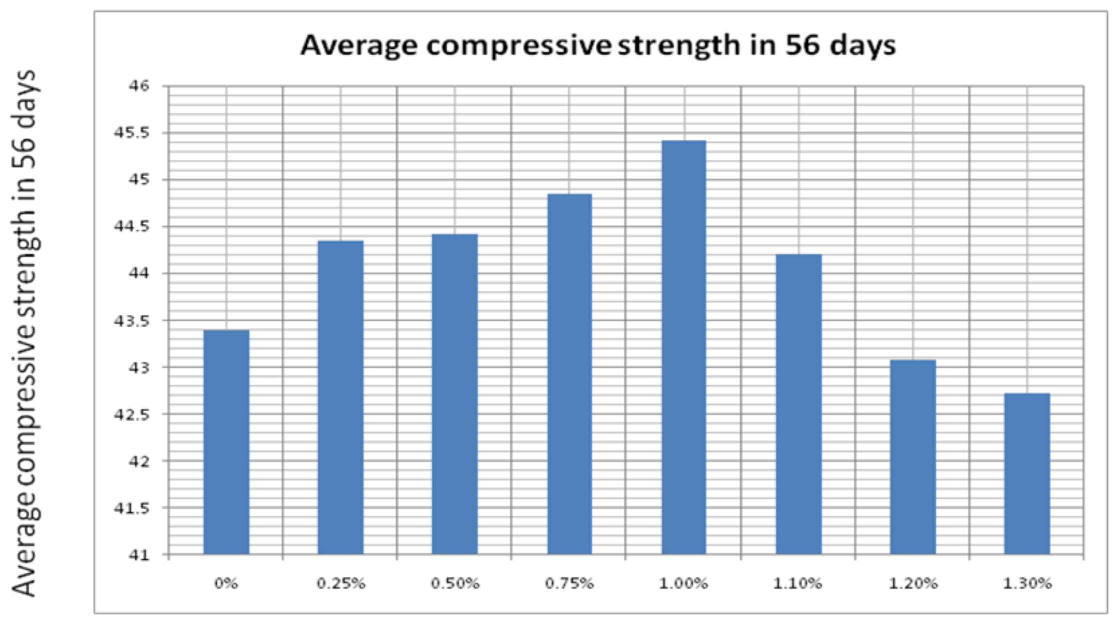


Table 4.10 Compressive strength of SCC after 56 days of water curing

Table 4.10 Compressive strength of SCC after 56 days of w ater curing

Sl.No.	% of Fibre	Failure load	Compressive strength in	Average compressive strength in
1	0%	979	43.50	43.40
2		976	43.37	
3		975	43.35	
4	0.25%	1004	44.64	44.35
5		987	43.86	
6		1003	44.56	
7	0.5%	1004	44.64	44.42
8		998	44.36	
9		996	44.28	
10	0.75%	986	44.80	44.8
11		995	44.90	
12		976	44.76	
13	1.0%	1017	45.18	45.42
14		1014	45.06	
15		1036	46.04	
16	1.1%	999	44.40	44.2
17		987	43.86	
18		990	44.34	
19	1.2%	995	44.24	43.08
20		960	42.68	
21		952	42.32	
22	1.3%	978	43.46	42.72
23		954	42.40	
24		952	42.20	



series 1	43.4	44.35	44.42	44.84	45.42	44.2	43.08	42.72
series 2	0%	0.25%	0.50%	0.75%	1.00%	1.10%	1.20%	1.30%

Figure 4.2 Average compressive strengths of SCC after 56 days of water curing

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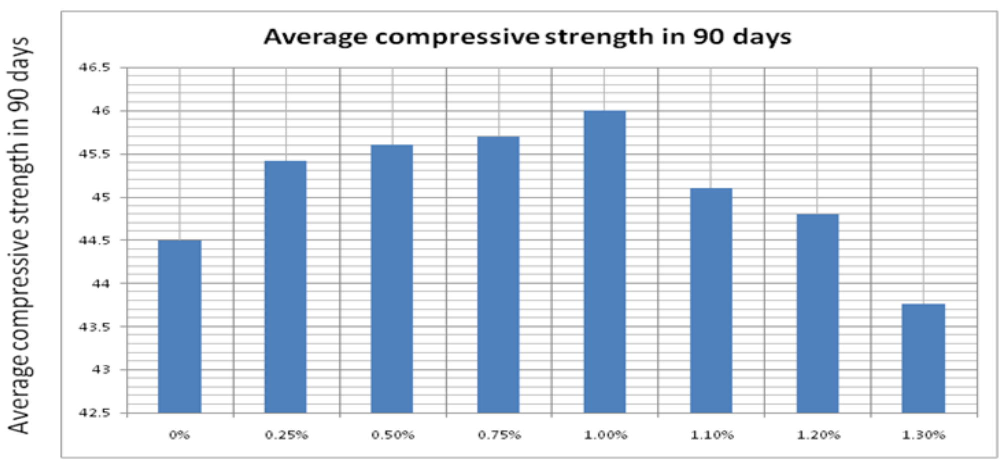
AND ENGINEERING TRENDS

Table 4.11 Compressive strength of SCC after 90 days of water curing

Sl.No.	% of Fibre	Failure load (KN)	Compressive strength in N/mm²	Average compressive strength in N/mm²
1	0%	1008	44.80	44.5
2		1000	44.46	
3		995	44.22	
4	0.25%	1028	45.68	45.42
5		1012	44.96	
6		1027	45.64	
7	0.5%	1031	45.82	45.6
8		1025	45.56	
9		1020	45.32	
10	0.75%	1011	45.92	45.7
11		1018	45.80	
12		1000	45.44	
13	1.0%	1032	45.86	46
14		1037	46.08	
15		1031	45.84	
16	1.1%	1022	45.40	45.1
17		1008	44.78	
18		1016	45.16	
19	1.2%	1019	45.28	44.8
20		1009	44.84	
21		998	44.34	
22	1.3%	995	44.20	43.76
23		983	43.68	
24		977	43.40	



series 1	44.5	45.42	45.6	45.7	46	45.1	44.8	43.76
series 2	0%	0.25%	0.50%	0.75%	1.00%	1.10%	1.20%	1.30%

4.5.5 Impact resistance and Impact energy of SCC after 60 days of acid curing

Table 4.18 Impact resistance and Impact energy of SCC after 60 days of acid curing

Sl.No	% of Fibre	Impact Resistance (blows)		Average Impact Resistance (blows)		Impact Energy (Nm)		Average Impact Energy (Nm)	
		1st crack	Failure	1st crack	Failure	1st crack	Failure	1st crack	Failure
1	0%	3	4	3	4	26.19	34.92	23.28	32.01
2		3	4			26.19	34.92		
3		2	3			17.46	26.19		
4	0.25%	3	5	4	7	26.19	43.65	32.01	61.11
5		4	7			34.92	61.11		
6		4	9			34.92	78.57		
7	0.50%	4	14	4	11	34.92	112.22	34.92	92.70
8		4	9			34.92	78.57		
9		4	10			34.92	87.31		
10	0.75%	5	16	5	16	43.65	139.68	40.74	139.68
11		5	13			43.65	113.49		
12		4	19			34.92	165.87		
13	1%	3	24	5	21	26.19	209.52	40.74	183.33
14		5	17			43.65	148.41		
15		6	22			52.38	192.06		
16	1.1%	4	21	4	18	34.92	183.33	34.92	157.14
17		4	16			34.92	139.68		
18		4	17			34.92	148.41		
19	1.2%	3	15	4	15	26.19	130.95	31.52	128.04
20		4	12			34.19	104.76		
21		4	17			34.19	148.41		
22	1.3%	3	7	3	12	26.19	61.11	26.19	104.76
23		3	13			26.19	113.50		
24		3	16			26.19	139.69		

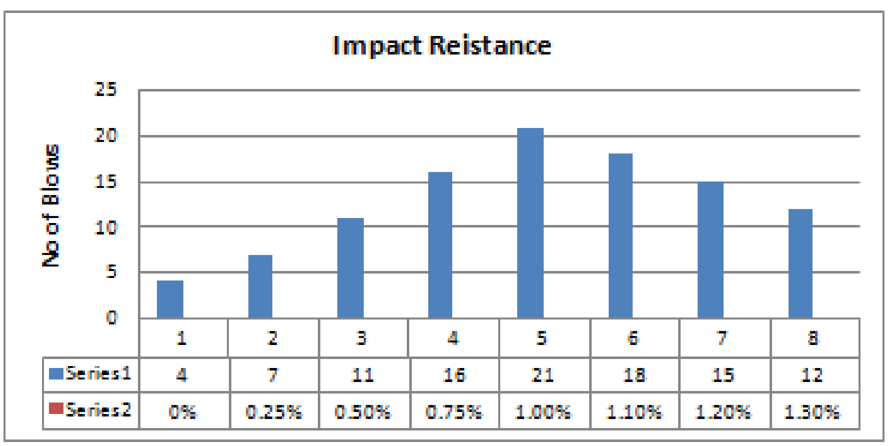


Figure 4.10 Average impact resistance of SCC after 60 days acid curing

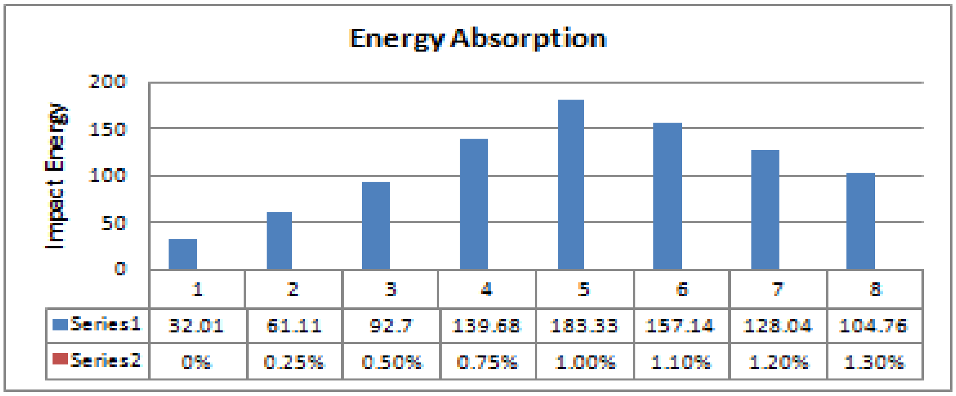


Figure 4.11 Average impact energy of SCC after 60 days acid curing

In order to evaluate the effects of plastic fiber addition on hardened properties of SCC,the impact resistance and impact energy of the concrete specimens tested after 60 days ofsulphuric acid curing with a pH 2. The following Table 4.10 and 4.11 shows the 60 days durability test on impact resistance and impact energy.

From the above graph, it indicated that the impact resistance and impact energy tends to increase when the fiber added up to 1.0 percent, and then decrease after 1.0 percent of plastic fiber addition.

4.5.6 Impact resistance and Impact energy of SCC after 90 days of acid

curing

Table 4.19 Impact resistance and impact energy of SCC af ter 90 days of acid curing

Sl.No	% of Fibre	Impact Resistance (blows)		Average Impact Resistance (blows)		Impact Energy (Nm)		Average Impact Energy (Nm)	
		1st crack	Failure	1st crack	Failure	1st crack	Failure	1st crack	Failure
1	0%	3	5	3	5	26.19	43.65	26.19	40.74
2		3	5			26.19	46.65		
3		3	4			26.19	34.92		
4	0.25%	3	9	4	8	26.19	78.57	32.01	72.75
5		4	7			34.92	61.11		
6		4	9			34.92	78.57		
7	0.50%	4	10	4	12	34.92	87.30	34.92	104.63
8		4	11			34.92	96.03		
9		4	15			34.92	130.58		
10	0.75%	4	13	4	18	34.92	113.49	37.83	157.14
11		5	18			43.65	157.14		
12		4	23			34.92	200.7949		
13	1%	4	17	5	21	34.92	148.41	40.74	192.04
14		5	23			43.65	200.79		
15		6	26			52.38	226.93		
16	1.1%	3	15	4	18	26.19	130.95	32.01	157.14
17		4	18			34.92	157.14		
18		4	21			34.92	183.33		
19	1.2%	3	14	4	14	26.19	122.22	31.52	122.22
20		4	12			34.19	104.76		
21		4	16			34.19	139.68		
22	1.3%	2	8	3	12	17.46	69.84	23.28	101.18
23		3	12			26.19	104.76		
24		3	15			26.19	130.95		

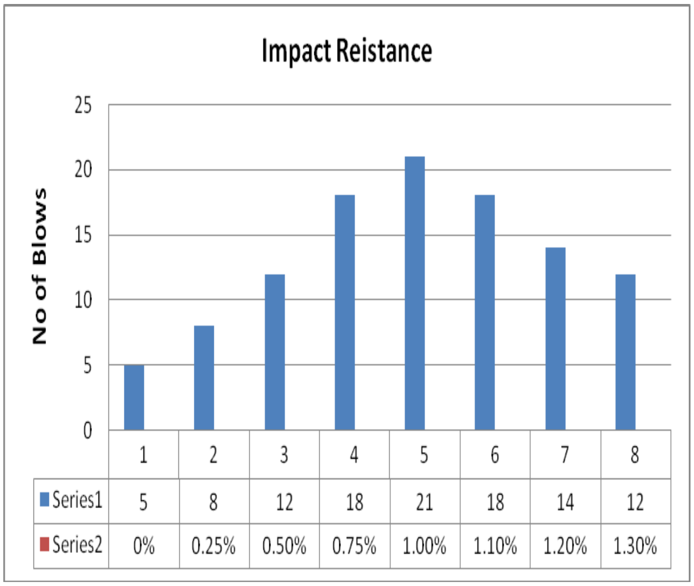
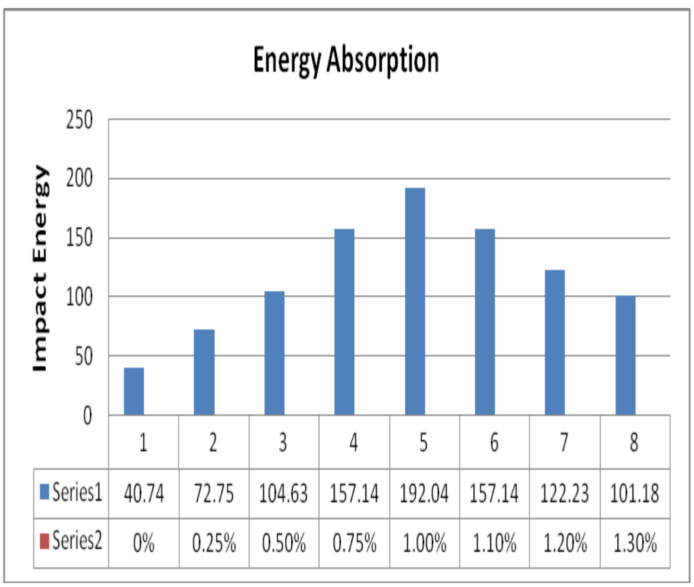


Figure 4.12 Average impact resistance of SCC after 90 days acid curing



In order to evaluate the effects of plastic fiber addition on hardened properties of SCC,the impact resistance and impact energy of the concrete specimens tested after 90 days ofsulphuric acid curing with a pH 2. The following Table 4.12 and 4.13 shows the 90 days durability test on impact resistance and impact energy. From the above graph, it indicated that the impact resistance and impact energy tends to increase when the fiber added up to 1.0 percent, and then decrease after 1.0 percent of plastic fiber addition.

VI . CONCLUSION

Based on the tests results of the fresh and hardened state of self compacting concrete with plastic fiber, the following conclusions can be drawn

- In the fresh state of SCC, when the percentage of plastic fibres increased it caused lower flow ability and passing ability of SCC mixes.
- Based on the fresh concrete properties it can be concluded that higher the powder content in SCC mixes higher will be the slump flow.
- SCC gives good finishing as compared to ordinary concrete without any external means of compaction.
- SCC mix was developed without using viscosity modifying agent (VMA).
- It is advantageous to mix the super plasticizer and water initially and mix the constituents for six minutes for achieving better adsorption on cement particles and to get good results of the fresh properties.
- The addition of 1% of fibres attains maximum compressive strength, flexural strength and impact resistance compared to 0.25%, 0.5%, 0.75% , 1.1%, 1.2% and 1.3% of fibres.
- After immersing in sulphuric acid with a pH 2 for 30, 60 and 90 days, the impact resistance was found to be increasing up to1% of fibres.
- The impact resistance of fibre reinforced self-compacting concrete with 1% plastic fibre content was found to be more when compared with impact resistance of SCC without plastic fibres.
- By experimental investigations it is indicated that the strength parameters such as compressive strength, impact strength and flexure strength after 28, 30, 60 and 90 days is more when compare to the normal SCC.(compared to SCC without plastic fibers)

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