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APPLICATION OF BY-PRODUCTS IN SELF COMPACTING CONCRETE

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ABSTRACT

Self-compacting concrete (SCC) is the one that can be placed in the form and can go through obstructions by its own weight and without the need of vibration. Since its first development in Japan in 1988, SCC has gained wider acceptance in Japan, Europe and USA due to its inherent distinct advantages. The major advantage of this method is that SCC technology offers the opportunity to minimize or eliminate concrete placement problems in difficult conditions. It avoids having to repeat the same kind of quality control test on concrete, which consumes both time and labour. Construction and placing becomes faster & easier. It eliminates the need for vibration & reducing the noise pollution. It improves the filling capacity of highly congested structural members.SCC provides better quality especially in the members having reinforcement congestion or decreasing the permeability and improving durability of concrete. The primary aim of this study is to explore the feasibility of using SCC by examining its basic properties and durability characteristics i.e. water absorption, shrinkage, and sulphate resistance. An extensive literature survey was conducted to explore the present state of knowledge on the durability performance of self-consolidating concrete.

Keywords: Fresh concrete and Hardened concrete test, Rice husk ash, Self-compacting concrete, Sifica fumes, Water absorption test.

I. INTRODUCTION

1.1INTRODUCTION OF PROJECT: Cement-based products are the nearly all plentiful of many man-made products and so are very essential design products, in fact it is more than likely that they'll go on to own similar value in the future. Nevertheless, these design and also anatomist products need to meet new and also larger demands. As soon as struggling with troubles of production, overall economy, top quality and also setting, weather resistant take on some other design products for instance plastic material, material and also timber. Just one direction within this advancement is usually to self-compacting concrete (SCC), some sort of improved product that will, devoid of additional compaction vitality, passes and also consolidates intoxicated by its bodyweight.The employment of SCC provides a additional industrialized creation. Besides does it reduce the

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harmful responsibilities intended for workers, it can also reduce the specialized prices of in situ solid concrete constructions, on account of improved upon sending your line routine, top quality, sturdiness, area conclude and also trustworthiness of concrete set ups and also eliminating many of the possibility of human being malfunction. Nevertheless, SCC is a sensitive mix, powerfully determined by the composition as well as the attributes of their constituents. It's got to acquire the incompatible houses of substantial circulation ability as well as substantial segregation level of resistance. That harmony is manufactured doable through the dispersing consequence of high-range water-reducing admixture (super plasticizer) combined with cohesiveness manufactured by a higher focus of fine allergens in additional filler product.The principle things controlling this specific fine harmony tend to be relevant to area physics and also chemistry hence, SCC is usually powerfully determined by the game on the admixtures, together with about the large surface area earned through the substantial written content of fees. Fresh new SCC, similar to all cementitious products, is a centred particle suspension together with an array of particle sizing's (from 10- to be able to 25 mm intended for concrete). This allergens are influenced by some sort of sophisticated harmony of inter-particle forces (i. electronic. interlocking, frictional, colloidal, and also electrostatic forces), producing a period of time dependency and also visco-plastic non-Newtonian behaviour.Self-compacting concrete is considered some sort of concrete that could be put and also compacted within its bodyweight without any vibration attempt, telling full answering of formworks even if accessibility is usually hindered through filter gaps between reinforcement cafes. Real that will should not be vibrated is a challenge to the developing industry. To get this kind of behaviour, the new concrete needs to display equally substantial fluidity and also beneficial cohesiveness concurrently.

1.2. SCOPE OF THE PROJECT: The development of self-compacting concrete is considered milestone achievement in concrete technology due to its adittional advantages.In order to be self-compactable the fresh concrete must show high fluidity besides good cohesiveness. Self-Compacting Concrete (SCC) is a type of concrete that has the capacity to consolidate under its own weight. The current trend all over the world is to utilize the treated and untreated industrial by-products, domestic waste etc. as a raw material in concrete, which gives an eco-friendly edge to the concrete preparation process. This practice not only helps in reuse of the waste material but also creates a cleaner and greener environment. This study aims to focus on the possibility of using industrial by-products like Rice husk ash(RHA) and Silica fumes (SF) in preparation of SCC. Self-compacting concrete has ability involves not only high deformability of cement paste, but also resistance to segregation between coarse aggregate and mortar when the concrete flows through the confined zone of reinforcing bars.

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II. LITERATURE REVIEW

Table No.1

Sr. no.	Topic of research paper	References	Workdone (mAethodology)	Summary	Result
1.	Experimental study on self – compacting.	European Scientific Journal April 2014 edition vol.10,No.12 ISSN: 1857–7881 (Print)e-ISSN1857-7431	1.Split Tensile Strength 2.Compressive Strength Test 3. Flexural Strength Test 4. Tests On Fresh And Hardened SCC	In the work, SCC is prepared using the industrial by-products are evaluated in terms of various tests.	The RHA based SCC has good Compressive strength, Split tensile strength and flexural Strength when compared to the SF based SCC.
2.	Self-compacting concrete using industrial by-products	IOSR Journal of Engineering(IOSRJN) e-ISSN: 2250-3021, p-ISSN: 2278-8719 Vol.3,Issue 2(Feb.2013),‖V1‖PP24-30	1. Tests on fresh concrete. 2. Compressive strength. 3. Flexural strength of SCC.	1. To increase the stability of fresh concrete (cohesiveness) using increased amount of fine materials in the mixes. 2. To development of self-compacting concrete with reduced segregation potential.	1. Slump flow, v-funnel, l-flow, u-box and compressive strength tests were carried out to examine the performance of SCC. 2. If we add the mineral admixture replacement for we can have a better workable concrete.
3.	The role of industrial by-products in self-compacting concrete	Department ofmaterials and environment engineering and physics, universitapolitecnica Della marche, via breccebianche, 601311, ancona, Italy-25 march 2011	1.The testing of self-compacting concrete properties 2.Rheologicaltest. 3. Slump flow 4.Compression test.	On the basis of the rheological tests on cement pastes, the rubble powder proved to be the most effective mineral addition.	In the case of fly ash and ground limestone as mineral addition, a certain flow-segregation could be recorded on fresh mixtures.

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4.	Development of self compacting concrete by industrial waste.	International journal of engineering research and application (IJERA), ISSN:2248-9622, vol3, issue 4,jul-aug 2013	Effect of addition of redmud from aluminium industries on scc.	VMA called GLENIUM STREAM 2 was used to induce the flow without segregation.	Compressive strength of ssc with combination of admisture is increased by 2 %.
5.	Application of by-product in self compacting concrete.	Related research papers and books	The Testing Of Self Compacting Concrete properties Slump flow test L – box test Compression test Segregation resistance test	In the work, SCC prepared using the industrial by-products are evaluated in terms of various tests.	On conducting the all the necessary test on SCC, we expect that the results obtained will show the large advantageous differences in the properties of concrete as that compared to the normal one.

III. MATERIALS

3.1.Cement: In this experimental study, Ordinary Portland Cement conforming to IS: 8112 -1989 (53) Grade Ordinary Portland Cement- Specification) is used. The physical and mechanical properties of the cement used are shown in Table.

Table no.2: Physical properties of cement.

Physical property	Results
Fineness	2940 cm^2/gm
Normal consistency	29 %
Vicat initial setting time (min.)	64
Vicat final setting time (min.)	192
Specific gravity	3.12
Compressive strength at 3 days	23.91 MPa
Compressive strength at 7 days	36.95 MPa
Compressive strength at 28 days	45.86 MPa

Table no.3: Chemical properties of cement.

Oxide	Percent content
CaO	60–67
SiO2	17–25
Al2O3	3.0–8.0

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Fe2O3	0.5–6.0
MgO	0.1–4.0
Alkalies (K2O, Na2O)	0.4–1.3
SO3	1.3–3.0

3.2. Chemical Admixture: Super plasticizer (SP) is a chemical compound used to increase the workability, without using any additional water. The super plasticizer used in the present work is the commercially available brand, POLYCARBOXYLATE ETHER superplasticizer.

3.3. Additive Or Mineral Admixture:

3.3.1.Rice Husk Ash (RHA): The Rice Husk used was obtained from Ile Ife, Nigeria. After collection, the Rice Husk was burnt under guided or enclosed place to limit the amount of ash that will be blown off.. The ash was ground to the required level of fineness and sieved through 600 μm sieve in order to remove any impurity and larger size particles.

Table no.4: Physical Properties Of RHA

Physical Property	Value For RHA
Fineness (M^2/Kg)	360
Loss of Ignition (%)	5.9
Bulk Density (Kg/M^3)	96-160

3.3.2.Silica fumes (SF): Silica fumes also referred to as micro silica or condensed silica fume, is another material that is used as a pozzolonic admixture. It is a product obtained from reduction of high purity quartz with coal in an electric furnace in the manufacture of silicon or ferrosilicon alloy.

Table no.5 Properties of SF

Properties	Test result
Colour	Light blue
Consistency, %	106.0
Specific Gravity	2.14

3.4.Aggregates: Locally available natural sand with 4.75 mm maximum size was used as fine aggregate, having specific gravity, fineness modulus and unit weight as given in Table and crushed stone with 16mm maximum size having specific gravity, fineness modulus and unit weight as given in Table was used as coarse aggregate.

Both fine aggregate and coarse aggregate conformed to Indian Standard Specifications IS: 383-1970.

Table no.6 Physical properties of the coarse and fine aggregates

Physical tests	Coarse aggregates	Fine aggregates
Specific gravity	2.96	2.81
Fineness modulus	6.86	2.32
Bulk density	1540	1780

3.5. WATER: Ordinary potable water free from organic content, turbidity and salts will be used for mixing and for curing throughout the experimental work. Water quality must be established on the same line as that for

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using reinforced concrete or pre-stressed concrete. This is the least expensive but most important ingredient of concrete. The water, which is used for making concrete , should be clean and free from harmful impurities such as oil, alkali, acid, etc., in general, the water, which is fit for drinking should be used for making concrete. Ordinary potable water of normally pH 7 is used for mixing and curing the concrete specimen.

IV. METHODOLOGY

4.1 Mix Proportion: The mixture proportion is a key factor to be considered to achieve SCC. Though the SCC was first developed in 1980's, there is no standard mix design adopted or developed to achieve SCC. The European Federation of Specialist Construction Chemicals and Concrete Systems (EFNARC) provide the guidelines for development of SCC. But no method of mix design specifies the grade of concrete in SCC except the Nan Su et al. method. This work mainly concentrates to achieve SCC of M50 grade by the method proposed by Nan Su et al., which specifies the usage of two powders viz., silica fumes and RHA as the replacement for cement in the same mix. In this work the above method is adopted to achieve SCC with RHA and SF in two different mixes.

Table no.7 Concrete Mix Design of M50 for 1m^3(W/C =0.32)

Design	Cement(kg)	RHA(kg)	RHA %	SF (Kg)	S.F %	F.A.(Kg)	C.A. (Kg)	Water (kg)	Super plasticizer (Kg)
S-0	489	00	00	00	00	1062	995	148	5.24
S-14	421	37	7	37	7	943	917	148	5.24
S-15	425	25	5	50	10	954	815	148	5.24
S-19	396	66	12	39	7	975	951	148	5.24
S-22	381	60	12	50	10	942	919	148	5.24

4.2 Tests:

4.2.1 Test on fresh concrete: Once a satisfactory mix will arrived at, it will be tested in the lab for properties like flowing ability, passing ability and blockage by adopting T50 Slump flow, L-Box, U-Box and V-funnel tests as per BIS guidelines to assess the property of the mix to qualify as SCC. Table gives the acceptance criteria for SCC mix prepared using RHA and SF.

Table no.3 Properties of fresh concrete.

Test	Property	Range of values
T50 slump value	Filling ability	2 – 5 Sec
V- funnel	Viscosity	6 – 12 Sec
L- box	Passing ability	0.8 – 1.0
U- box	Passing ability	0 – 30 mm

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Fig.no.1SLUMP CONE

Table No.4 Test Result Of Fresh Concrete

Design	Slump Flow (Mm)		
	$T_{initial}$	T_{30}	T_{60}
S-0	667	669	360
S-14	668	667	663
S-15	664	652	555
S-19	662	-	-
S-22	661	640	-

3.3.2 Tests on hardened concrete: The concrete will be tested for the hardened properties like compressive strength, split tensile and flexural strengths each for 7 days, 14 days and 28 days. All tests will be performed in accordance with the provisions of IS: 516- 1959 (Methods of tests for strength of concrete) and IS: 5816-1970 (Splitting tensile strength of concrete – Method of test).

Fig.No.4. Compression testing machine.

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Table No.5 Test Result OfHardnedConcrete

Design	Compressive Strength	
	3 days	7 days
S-0	35.44	43.64
S-14	29.77	34.79
S-15	36.11	47.84
S-19	27.98	35.62
S-22	24.74	31.48

V. ECONOMY OF PROJECT

On conducting the all the necessary test on SCC, we expect that the results obtained will show the large advantageous differences in the properties of concrete as that compared to the normal one.

Below listed are some of the economical and Environmental advantages of SCC:

1. The concrete becomes economical by using Silica Fumes and RHA in mixes.
2. The Silica Fumes and RHA are industrial waste, they are available in market at minimum cost with some transportation charges.
3. Research before has proved that the cost of concrete decreases with the increase in percentage of RHA and Silica fumes, etc.

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