STUDY ON EFFECTS OF GLASS FIBER ON STRENGTHENING OF SELF COMPACTING CONCRETE

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Abstract: - *Self-Compacting Concrete (SCC) is skilled to flow using its own weight and entirely fill the formwork, in spite of reinforcements in place, without compaction, while maintaining homogeneity of the concrete. Usage of SCC will solve the compacting difficulty while casting and reduce manpower requirement. Adding fibers will enhance the tensile behavior of concrete. SCC was added with moderately discrete, short and irregular glass fibers to produce Glass Fiber Reinforced Self Compacting Concrete (GFRSCC). The glass fibers (1.2mm, 1.8mm and 2.4mm) are introduced in to the self-compacting mix with different percentages (0%, 2%, 4%, and 6%). The maximum dosage of fibers which can be added without compromising the flow characteristics of the self-compacting concrete was found to be up to 6% addition of glass fiber. The main aim of this study is to examine the workability and mechanical properties of plain SCC and GFRSCC. The powder content should be added the 60% of cement and 40% of GGBS. It was observed that the quantity of super plasticizer required increased as fiber content increased. The laboratory experimental investigation includes slump flow test, L- Box test, V-funnel, Compressive Strength test, Splitting Tensile Strength test, and Flexural Strength test Are also investigated by taking tests casting cube, cylinder and beams after curing of 7,14 and 28 days.*

***Key words: SCC, Glass Fiber, GGBS,* Super Plasticizer.**

1. Introduction

Cement concrete production at the construction site is still a very big problem for the construction industry despite various technological advancements. For producing durable concrete proper compaction is necessary which helps to reduce the voids in the concrete. However it is not done in many of the construction sites leading to reduced quality of concrete. Compaction is done using vibration from power equipment which leads to highly undesirable noise, increased construction time and labour and sometimes injurious to workers. Hence to overcome all these difficulties Self-Compacting Concrete (SCC) was produced in Japan in the end of 1980s as a solution to achieve durable concrete structures independent of the quality of construction work. SCC can be defined as a concrete which has high flowability when placed can fill entire formwork under its own weight even when reinforcements are closely spaced without any external compaction. SCC in its fresh state is characterised by high flowability and greater strength in its hardened state because of its compact matrix structure. SCC has many advantages that include quicker construction, easier insertion, better surface finishing, and decrea se in noise levels and enhanced durability. The term Fibre Reinforced Concrete (FRC) can be defined as concrete having randomly oriented and dispersed fibres. Fibres can be described as thin wire-like reinforcements which are made of either steel or polymers having high ductility. The fibres are produced in variety of sizes and shapes, stiff or flexible etc. Addition of fibres into concrete improves the ductility of the concrete by developing toughness, greater tensile strength, and resistance to impact, fatigue, blast loading and abrasion. Fibres are more importantly added to control the cracking, by the bridging of the fibres across the cracks, which delay the development of localized cracks. The usage of glass fibres in SCC might bring both the advantages of both fibres and SCC. Glass Fibre Reinforced Self-Compacting Concrete (GFRSCC) gives the advantages of SCC in its fresh state and that of fibres in its hardened state. Because of the greater performance of SCC in its fresh state, addition of fibres will lead to a more uniform dispersion of fibres which is very critical for the performance of any fibre reinforced concrete. Even the density of SCC matrix due to higher amount of finer particles may improve the interface zone properties and as a result the fibre-matrix bond leading to better post-cracking toughness and energy absorption capacity. The objective of this experimental work is to find out the maximum dosage of fibres that can be added without compromising the flow characteristics of the self-compacting concrete and to study the effective utilization of glass fibre in self-compacting concrete by conducting the corresponding tests for the following properties like workability, Compressive strength and Split tensile strength.

2. Experimental Investigation

Properties of Material

1. Cement
2. Fine aggregate (M-sand)
3. Coarse aggregate
4. Water
5. Super plasticizer

2.1 Cement

Ordinary Portland Cement (OPC) is one of the most popular building materials used all across the globe. There is a fascinating story behind the naming of this widely used cement product. The name 'Portland' was given by the British cement manufacturer, Joseph Aspdin in 1824, due to its strong resemblance to Portland Stone, a type of white grey limestone found in the isle of Portland, Dorset in England. Joseph Aspdin is also credited to have patented the first true artificial cement, which he named as the Portland cement. While the chief chemical constituents of ordinary Portland Cement (OPC) are Calcium, Silica, Alumina and Iron, cement manufacturers continuously research and make efforts to further strength and improve the quality and other features of this particular type of cement. We offer the 53 Grade OPC Cement which gives even higher cement strength to match the rising demands of higher strength building material in the urban world. Property of cement details given below the table 2.1.1

S.No	Test	Value
1	Specific Gravity	3.15
2	Bulk density	1330 kg/m^3
3	Normal Consistency	34%
4	Initial Setting Time	35 Min
5	Final Setting Time	10 Hrs

2.2 M-Sand (Manufactured Sand)

For aggregate produces concrete aggregate are end products while for concrete manufacturers, aggregates are raw materials to be used for concrete production. The quality of aggregates can be influenced while raw materials, gravel or rock may have characteristics which can't be modified by the production process. One extremely important factor is consistent supply of course, fine aggregate. In this regard a course aggregate produced by crushing basaltic stone and river sand is the major natural source of fine aggregate in our country.

However the intense construction activity is resulting in growing shortage and price increase of the natural sand in the country in addition the aggregate and concrete industry are presently facing a growing public awareness related to environmental threats. Therefore, looking for a viable alternative for natural sand is a must. One alternative used as replacement is the use of M sand. Property of cement details given below the table 2.2.1:

S.No	Test	Value
1	Specific Gravity	2.90
2	Fines Modulus	3.64
3	Bulk density	1550 kg/m^3

Fig 2.2.1 Manufacture- Sand (M-Sand)

2.3 Coarse Aggregate (20mm)

It is the aggregate most of which is retained on 4.75 mm IS sieve and contains only so much finer material as is permitted by specification. According to source, coarse aggregate may be described as:

- **Uncrushed Gravel or Stone**– it results from natural disintegration of rock
- **Crushed Gravel or Stone**– it results from crushing of gravel or hard stone.
- **Partially Crushed Gravel or Stone**– it is a product of the blending of the above two aggregate. According to size coarse aggregate is described as graded aggregate of its nominal size i.e. 40 mm, 20 mm,

16 mm and 12.5 mm etc. for example a graded aggregate of nominal size 20 mm means an aggregate most of which passes 20 mm IS sieve. A coarse aggregate which has the sizes of particles mainly belonging to a single sieve size is known as single size aggregate. For example 20 mm single size aggregate mean an aggregate most of which passes 20 mm IS sieve and its major portion is retained on 10 mm IS sieve.

20mm size of aggregate:

It is used for road construction as a lower layer beneath the asphalt surface. Currently this fraction is the most commonly used in Ukraine's construction industry. It is used both for small private construction and for construction of large industrial spaces. Aggregates of this fraction are used as sub-bases in construction of highways and railways and in production of concrete and massive structures from reinforced concrete. Property of cement details given below the table 2.3.1:

S.No	Test	Size of aggregate 20mm
1	Specific Gravity	2.95
2	Crushing value	60%
3	Impact value	14%
4	Water absorption	0.50%

Fig2.5.1(20mm Aggregate)

2.4 Water:

Water is an important ingredient of concrete as it actually participates in the chemical reaction with cement. Since it helps to form the strength giving cement gel, the quantity and quality of water are required to be looked into very carefully.

2.5 Super Plasticizer:

Polycarboxylic ether based superplasticiser (Conplast SP430) complying with ASTM C-494 type F was used in this study.

3. Mix Proportion

General:

Mix design is the process of selecting suitable ingredients of the concrete and determining their relative proportion with object of producing concrete possessing certain minimum desirable properties like workability in fresh state minimum desirable and durability in hardened state.

Design Mix based on 10262-2009 method: Target Mean Strength:

fck = fck +1.65*s

From table 1 IS:10262-2009(Page 2)Value of

Standard deviation(s)for M25grade = 4 N/mm^2

Target mean strength = 25+(1.65*4)= 31.6 N/mm^2

Table 3.1 Mix Proportion for Trial Number:

Material	Weight(kg)	Volume(m^3)
Cement	350 kg/ m^3	0.111 m^3
Water	139.5 kg/ m^3	0.139 m^3
fine aggregate	915kg/ m^3	0.424 m^3
coarse aggregate	1264 kg/ m^3	0.576 m^3
Chemical	0.7 kg/ m^3	0.0058 m^3

4. Result and Discussion

Test on Fresh Concrete

1. Slump flow test
2. V-funnel
3. L-box

Mix Notation	Slump Flow (mm)	t500 sec	L-Box H2/H1	V- funnel second
Conventional concrete	660	2	0.20	6

Test on Hardened Concrete

1. Compressive strength test
2. Split tensile strength test
3. Flexural strength test

1. Compressive strength test

One of the important properties of concrete is strength in compression. The strength in compression has definite relationship with all other properties of concrete. These properties are improved with the improvement in compression strength. The aim of the experiment test is to determine the maximum load carrying capacity of test specimens. The compression test specimens were tested on a compression tested on a compression testing machine (CTM) of capacity 2000KN.The specimen was placed on machine in such a way that its position is at right angle to it shown position which it had at the time of casting. Load is applied gradually as the rate 14N/mm2/min or 320KN/min. Test results given below the table:

Table 1.1 Compressive Strength at 7, 14 and 28 Days

Typeof Concrete	Compressive Strength(N/mm^2)		
	7 Days	14 Days	28 Days
Conventional concrete	22.05	27	31.75

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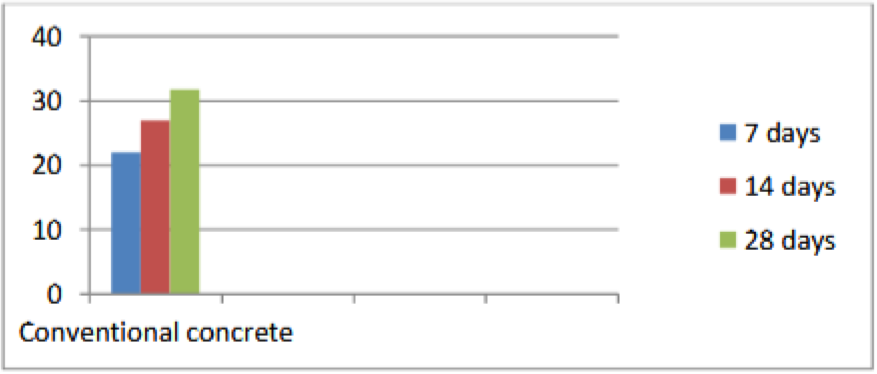

Chart 1.1 Compressive Strength at 7, 14 and 28 Days

5. Conclusions:

Based on the observations made during the various tests conducted on the scc specimens, the features are concluded as follows:

- The variation of 7 days , 14 days,28 days compressive strength of self compacting concrete without ggbs as increased
- It also emphasis on achieving the fresh concrete properties such as slump flow, L-box,V- funnel test. The flow of slump flow 660mm and L-box flow 0.20 and V-funnel flowing timing is should increase from 6 sec.
- we are concluded the fresh concrete for phase-I project.
- For phase-I we have tested compressive strength of concrete.
- Then phase –II we will do specific test for glass fiber.

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