EXPERIMENTAL INVESTIGATION OF SELF COMPACTING CONCRETE WITH SISAL FIBER

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Abstract: *This study mainly focusing on to improve the tensile strength of concrete by addition of different types of fibers at different percentages. Self compacting concrete is highly flow able type of concrete that spreads into the form without the need for mechanical vibration. Self compacting concrete reduce the bleeding and segregation of concrete. It can be used in situations where it is tedious to use mechanical compaction for fresh concrete such as under water concreting , cast insitu pile foundation , wall with congested reinforcement. The main aim of this project is to improve performance of self compacting concrete using natural fiber (sisal fiber). The various type of fibers like steel, nylon, sisal, banana, coir fiber etc. The above mentioned fibers are used to arrest the cracks, fiber are able to hold the matrix together even after extensive cracking. To increase the workability and reducing the bleeding and segration of concrete by super plasticizers, viscosity modified agent and fibers are used .sisal fibers are derived from the leaves of the plant the botanical name of the plant is aqua sisalana. It is usually obtained from machine decortications in which the leaf is crushed between rollers and mechanically scraped, the present study was carried out to check the fresh and hardened properties of sisal fiber reinforced self compacting concrete with different percentage of fiber addition. Degree of workability of concrete mix with super plasticizer and water cement ratio 0.35. Materials were machine mixed with 0.25%, 0.5%, 0.75%, 1.00%, 1.25%, and 1.50%. Addition of sisal fiber in M30 mix desing and casted in cube cylinder prism and beams. The specimens were subjected to compressive, split tensile and flexure tests. The specimens were tested after curing period of 7and 14 and 28days.*

Key words: *M-Sand, Sisal Fiber, compressive strength, slump flow.*

1. Introduction

Concrete is a type of homogeneous mixture which plays a prominentrole in development of Infra-Structure and new innovative Structures in Civil Engineering. It is a mixture of different Materials such as Cement, Fine Aggregate, Coarse Aggregate and Water. Concrete it-self has an extensive role among construction materials. To enhance the workability of Concrete, Admixtures are to be added. The mix is now a tough and homogenous material which is to satisfy adequate workability with durable conditions. To compact the concrete without voids, internal and external vibration is required. To achieve good compaction of concrete, vibration is to be done. It is difficult to vibrate the concrete at places of congested reinforcement. Concrete is one of the world's most widely used materials. Every day, research is carried out such as to improve the performance of concrete in various ways through various approaches for different applications. One such advancement in concrete led to the development of Self Compacting Concrete (SCC) by Okamura in the 1986 due to the unavailability of skilled workers for proper compaction and vibration of concrete in Japan. Fiber Reinforced self-Compacting Concrete is a type of concrete consisting of discrete fibers which are added to SCC and has an ability to compact under its own weight. Hardened properties of concrete are increased by the addition of fibers. Fiber reinforced self compacting concrete should satisfy the workability properties specified by the EFNARC 2guidelines. These fibers acts as crack arresters and increases the structural integrity.

2. Experimental Investigation

Properties of Material

1. Cement
2. Fine aggregate (M-sand)
3. Coarse aggregate
4. Water
5. Hyper 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	40 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 2.4.1:

S.No	Test	Value
1	Specific Gravity	2.60
2	Fines Modulus	4.56
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 ndustrial 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 2.5.1:

S.No	Test	Size of aggergate 20mm
1	Specific Gravity	2.90
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 Hyper Plasticizer:

Admixtures is a new generation super plasticizer admixture based on modified polycarboxylic ether which allows its delayed absorption on to the cement particles and disperses them.

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 M30grade = 5N/mm^2

Target mean strength = 30+(1.65*5)= 38.25N/mm^2

Table 3.1 Mix Proportion for Trial Number:

Material	Weight(kg)	Volume(m^3)
Cement	310 kg/ m^3	0.0984 m^3
Water	139.5 kg/ m^3	0.139 m^3
fine aggregate	821.39kg/m^3	0.424 m^3
coarse aggregate	1244.6kg/m^3	0.576m^3
Chemical Admixture	0.7 kg/ m^3	0.0175 m^3

4. Result and Discussion

Test on Fresh Concrete

1. Slump flow
2. L-Box
3. V-funnel

Mix Notation	Slump Flow (mm)	t50cm	L-Box H2/H1	V- funnel second
Conventional concrete	700	3	0.24	8

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	37.53	38.15	39.42

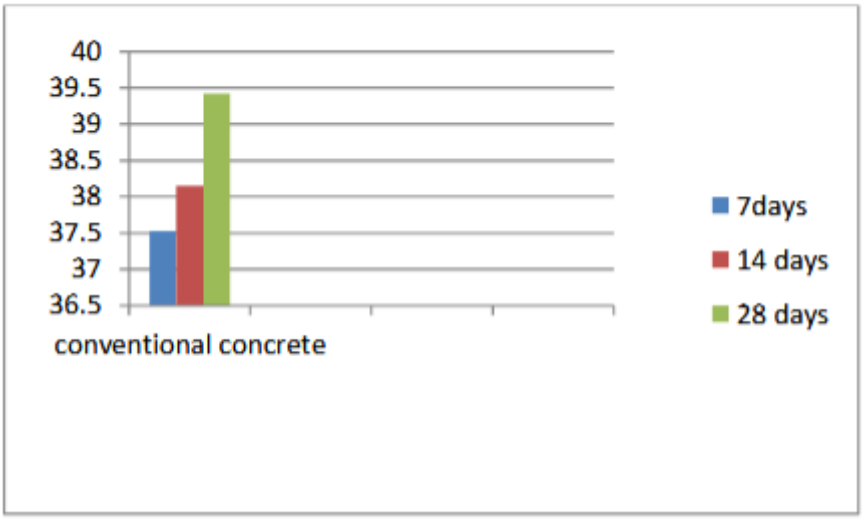

Chart 1.1 Compressive Strength at 7, 14 and 28 Day

5. Conclusions:

- The natural sand demand also reduced by introducing the M-Sand as it provides greater strength and being economical.
- Concrete can be obtained by reducing water content by adding the super plasticizer.
- The result of concrete workability test, showed that the adding of glass fiber would reduce the value of slump flow, t50cm, blocking ratio of L-Box test and time flow of V-funnel test, but these results would remain within the standard classification.
- Hardened concrete inspection results show the increasing of compressive and splitting strength and modulus of rupture (MOR) when using of sisal fibers and this increment is proportionate directly with volume of fibers which are used.
- It is recommended to use sisal fibers in the self-compacting concrete (SCC) for the reason of it has a positive affect in the improvement of concrete properties.

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