

Experimental Study On Compressive Strength Of Concrete By Replacement Of Fine Aggregate With Sea Shells And Addition Of Steel Fibers

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Abstract- *Concrete is one of the most widely used construction material. The present trend of the concrete technology is towards increasing the strength and durability of the concrete to meet the demands of the modern construction. Now a day's Fiber reinforced concrete is widely using because of its high tensile strength and fire-resistant properties. Adding fiber to a concrete mix can reduce cracks and increase impact resistance. To reduce the huge amount of usage of river sand in concrete, sea shells are using as a replacement of fine aggregate in concrete. To provide an economical concrete, improve the durability of concrete and reduce the demand of fine aggregates. The present study determines the compressive strength of the concrete when 1% of steel Fibers are added, by weight of cement and compressive strength of a concrete when 70% of fine aggregate is replaced with sea shells. The study also determines the strength of concrete in combination of 70% of sea shells replacement and 1% of steel Fibers addition. For experimental work M25 grade concrete cubs are casted and tested for 7 days and 28 days strength. The conclusion of present study is the compressive strength of concrete will increase by 86.73% than conventional concrete by 70% replacement of fine aggregate with sea shells and 1% addition of steel fibers.*

Keywords- Concrete, Fine Aggregates, Sea Shells, Steel Fibers

I. INTRODUCTION

In India, numbers of waste materials are produced by different manufacturing companies, thermal power plants, municipal solid wastes and also the dead remain of sea shells. Liquid as well as solid waste management is one of the emerging problems on the entire earth. Release of waste into the land causes adverse impact on environment. Use of disposal of these materials as replacement of fine aggregate partially in civil engineering applications is extremely useful as it reduces the impact of environment and is economical in cost of operations in quarrying, processing and transport. Reuse of waste materials is becoming increasingly advisable due to increasing hauling costs and tipping fees for placing this

material into landfills. In recent years, sustainable construction initiatives have also made reuse of waste materials from industries as an appealing option in construction.

Generally in the common sense, cement is a binding material, a substance which solidifies and sets independently, and can stick other materials together. Cements used in construction are characterized as hydraulic and non-hydraulic. The predominant feature of the cement is the manufacture of binding mortar and concrete. Cement sticks all the aggregates together to form a hard building material which has long life in front of general environmental effects. Concrete is the word which should not be bewildered with the word cement. Because the term cement indicates only the non-moist powdered material used to stick the aggregate materials together in concrete. Concrete is a construction material that contains cement (OPC) as well as other cementitious materials such as Fly ash, Slag cement, Ceramic powder and aggregate water and may be admixtures. Cement solidifies and sets after combining with water due to hydration, which is a chemical process.

The water combines with the cement, which sticks all the constituents together, thus generating a stone-like hard material and the exothermic reaction occurs.

PROPERTIES OF CONCRETE

A hardened concrete must possess the following properties,

- Strength
- Durability
- Workability
- Shrinkage & Creep

Strength

Strength is defined as the opposite reaction of the hardened concrete to rupture at different loading conditions and accordingly different tests are conducted to compressive strength, split-tensile strength, flexural strength, etc. The

increase of strength depends upon grade, type of cement, curing and environmental conditions.

Durability

A durable concrete is one that performs efficiently in the working environment during its probable exposure conditions during the service. The main characteristic that influences the long life of concrete is the permeability to entering of water, harmful gases like sulphates, oxygen, chloride, carbon dioxide etc.

Workability

Workability of concrete is the characteristic of concrete which is used to find the amount of internal work, which is necessary to produce the condition of full compaction. The biggest unique factor affecting the workability is the quantity of water content which is present in the mix.

Shrinkage

Shrinkage is defined as the change of volume of concrete due to thermal properties of aggregates and the environmental conditions. The total amount of moisture content present in the concrete at the time of mixing mostly influences the total shrinkage of concrete and to a lesser extent, by the cement content.

Creep

The time dependent division of strain affecting due to stress in concrete is known as creep. It depends upon duration of loading, mix proportions and influence of aggregates.

Segregation and Bleeding

Segregation can be termed as the process of dissociation of the constituent materials which are present in concrete. A good concrete is the concrete in which all the materials are thoroughly and evenly distributed to make an even mixture. Bleeding in concrete is termed as gaining of water. It is a particular form of segregation, in which. Some of the water content from the concrete extracts out to the surface of the concrete, which have the lowest specific gravity amongst all the materials of concrete. Bleeding is comparatively observed in mostly wet mix, ill proportioned and unevenly mixed concrete

Souliotiet. al, has worked on Effects of Fiber Geometry and Volume Fraction on the Flexural Behaviour of Steel- Fiber Reinforced Concrete. The compressive strength, flexural strength was studied and compared with unreinforced concrete. The effect of Fiber on workability and air content properties of fresh concrete was also evaluated.

Ghosniet. al, has worked on Flexural behaviour of high strength concrete composite incorporating long hooked end steel Fibers. In this research long hooked steel Fibers have been added to mix and compressive strength, flexural strength of concrete have been found out for 7, 28 and 56 and 14, 28, and 56 days.

Bhawukverma Use of steel Fiber reinforced concrete over plane concrete for shotcrete in underground tunnelling. On underground tunnels and his study proved that generally tunnelling requires very strong support and steel Fiber reinforced concrete provided much strength when compared to plane concrete.

Mohd Muzammilahmed and Mohdmajidudd in Flexural Behaviour of Ternary Blended Steel Fiber Reinforced Concrete Beams Using Crimped Fibers has worked on the flexural behaviour of beams have improved by adding Fibers. The flexural strength of the beam increased nearly by 21.58%. The moment carrying capacity of beams with 0.5% of Fiber is 7.16%, 0.75% of Fiber is 12.60% and 1.25% is -6.65%. On adding of 1% crimped steel Fiber the moment carrying capacity of beam is increased by 21.58%. Specimens with more percentage of Fibers shown greater elastic properties.

Raghunath and k. suguna has worked on Flexural behaviour of high strength steel Fiber reinforced concrete beams by In this study total 4 beams of 3m length and 150mmx250mm in cross section were casted and tested in laboratory. Three different steel Fibers volume were taken i.e. 0.5%, 1% and 1.5%. All beams were tested under two-point load condition in a loading frame of 750kn capacity.

Avinash .S and Parekar Suresh .R has worked on Steel Fiber Reinforced Concrete Beams under Bending Shear and Torsion without Web Reinforcement. The results for 6 bending, shear and torsion tests on steel Fiber reinforced concrete beams without web reinforcement are discussed. Vikrant s.

Valragade and kavita s. Kene has worked on Introduction to steel Fiber reinforced concrete on engineering performance of concrete. Steel Fiber reinforced concrete is used for long

II. LITERATURE REVIEW

lasting sustainable concrete structures. All over the world is using steel Fiber as Fiber reinforced concrete.

Sudheeret. al, has worked on Experimental Investigation on Strength and Durability Properties of Hybrid Fiber Reinforced Concrete. The compressive strength of high Fibers reinforced concrete is more when compared to conventional concrete. The increase in compressive strength by addition of 0.5%, 1.0% and 1.5% of Fiber is 10.75%, 27.26% and 33.79% respectively. Adding 0.5% of Fibers may decrease the tensile strength but 1.5% of Fiber gives maximum strength when compared to other proportion

Shireesha has worked on Experimental studies on steel Fiber reinforced concrete. The effects of steel fiber reinforcement in concrete. The design mix of M40 grade was taken and steel Fiber of aspect ratio 80 was added. It is observed that the compressive strength increases from 8- 21% and 6-12% for 7 and 28 days, split tensile strength increases from 14-36% and 15-39% for 7 and 28 days. Adding 1.5% of Fiber the absorbed energy by specimen was 8 and 10 for 7 days and 28 days.

R. Gowri and M. Angeline Mary, this study, the present trend in concrete technology is towards increasing the strength and durability of concrete to meet the demands of the modern construction world at lower cost. These factors can be achieved in concrete by adding natural or synthetic Fiber. The strength parameters of concrete such as compressive strength and tensile strength were studied by varying the percentage of Fiber from 0.025% to 0.075% of the weight of concrete.

T.Subramani and C. Sumathi the study, Concrete has been used in various structures all over the world since last two decades. Recently a few infrastructure projects have also seen specific application of concrete.

E. Arunakanthi and J. D. Chaitanya Kumar the development of concrete has brought about the essential need for additives both chemical and mineral to improve the performance of concrete. Most of the developments across the work have been supported by continuous improvement of these admixtures.

C. Selin Ravikumar and T. S. Thandava moorthy, the study there has been a significant increase in the use of Steel Fibers in concrete for improving its properties such as tensile strength and ductility. The Fiber concrete is also used in retrofitting existing concrete structures. Among many different types of Fibers available today, glass Fiber is a recent introduction in the field of concrete technology.

Kavita S Kene has died the Concrete is most widely used construction material in the world. Fiber reinforced concrete (FRC) is a concrete in which small and discontinuous Fibers are dispersed uniformly. The Fibers used in FRC may be of different materials like steel, G.I., carbon, glass, aramid, asbestos, polypropylene, jute etc.

Specific Gravity of Coarse Aggregates

Specific gravity of an aggregate is considered to be a measure of quality of the material. Stones having low specific gravity are weaker than those with higher specific gravity values. It is determined using wire basket apparatus Figure 3.10. The experiment is carried out as per IS 383- 1970.



Figure 1 Apparatus for Specific Gravity of Coarse Aggregates

Procedure:

1. About 2 kg of aggregate sample is taken, washed to remove fines and then placed in the wire basket. The wire basket is then immersed in water, which is at a temperature of 22⁰C to 32⁰C.
2. Immediately after immersion the entrapped air is removed from the sample by lifting the basket 25 mm above the base of the tank and allowing it to drop, 25 times at a rate of about one drop per second.
3. The basket, with aggregate are kept completely immersed in water for a period of 24 ± 0.5 hour.
4. The basket and aggregate are weighed while suspended in water, which is at a temperature of 22⁰C to 32⁰C.
5. The basket and aggregates are removed from water and dried with dry absorbent cloth.
6. The surface dried aggregates are also weighed.
7. The aggregate is placed in a shallow tray and heated to about 110⁰C in the oven for 24 hours. Later, it is cooled in an airtight container and weighed.

Table 1 Properties of Coarse Aggregate

Properties	Value Obtained	Limits as per IS 2386-1963
Specific Gravity	2.67	2.6-2.8
Fineness Modulus	6.9	5.8-8.0

III. RESULTS OF FRESH CONCRETE

Slump Cone Test

Table 2 Slump test on Trial Mixes

Trial	W/C Ratio	Slump Value(mm)	Remarks
Trial 1	0.4	70	Target Slump not achieved
Trial 2	0.45	100	Desired Slump Value is obtained

COMPRESSIVE STRENGTH TEST RESULTS

Table 3 Compressive Strength of Conventional concrete(M1)

Specimen	W/C Ratio	7 days strength (N/mm ²)	Average strength for 7 days (N/mm ²)	28 days strength (N/mm ²)	Average strength for 28 days (N/mm ²)
A1	0.45	22.8	22.83	30.8	30.9
A2		22.9		31.0	
A3		22.8		30.8	

Table 4 Compressive strength of concrete with replacement of sea shell as fine aggregate(M2)

Specimen	W/C Ratio	% of sea shells replaced by weight of fine aggregate	7days strength (N/mm ²)	Average strength for 7 days (N/mm ²)	28 Days strength (N/mm ²)	Average strength for 28 days (N/mm ²)
B1	0.45	70%	34.9	34.53	48.9	48.4
B2		70%	34.8		47.7	
B3		70%	33.9		48.6	

Table 5 Compressive strength of Fiber reinforced Concrete(M3)

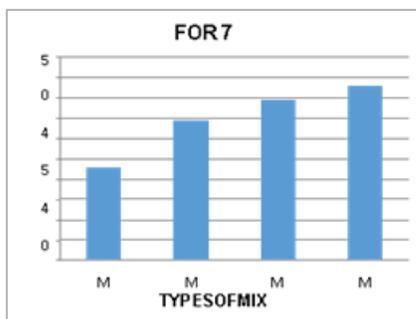
Specimen	W/C Ratio	% Of steel fibers	7days strength (N/mm ²)	Average strength for 7 days (N/mm ²)	28days strength (N/mm ²)	Average strength for 28 days (N/mm ²)
C1	0.45	1%	39.8	39.4	51.6	51.2
C2		1%	39.5		50.9	
C3		1%	38.9		51.3	

Table 6 Compressive strength of concrete with replacement of sea shells as fine aggregate plus addition of steel Fibers(M4)

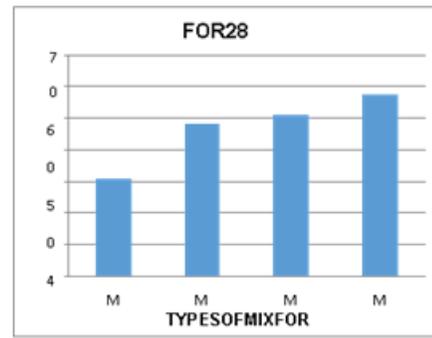
Specimen	W/C Ratio	% of both sea shells and steel fibers	7days strength (N/mm ²)	Average strength for 7 days (N/mm ²)	28 days strength (N/mm ²)	Average strength for 28 days (N/mm ²)
		70% of				

D1		sea	43.6		58.2	
		shell				
		s				
		and				
		1%				
		of				
		70%				
		of				
		sea				
		shell				
		s				
D2	0.45	and	43.2	43.23	57.7	57.7
		1%				
		of				
		steel				
		fiber				
		s				
		70%				
		of				
D3		sea	42.9		57.3	
		shell				
		s				
		and				
		1%				
		of				
		steel				
		fiber				
		s				

- = Conventional concrete.
- = Concrete replaced with 70% sea shell as fine aggregate.
- = Concrete Made with Adding Of 1% Steel Fibers.
- = Combination of both replacement of sea shells and adding of steel fibers



Graph 1 Compressive strength variation between M1, M2, M3, M4 for 7 days



Graph 2 Compressive strength variation between M1, M2, M3, M4 for 28 days

FOR 7 DAYS M1= 22.83, M2=34.53, M3=39.4 M4=43.23
 FOR 28 DAYS M1=30.90, M2=48.40, M3=51.2, M4=57.7

Table 7 Percentage Increases between Different Samples

Variation Between Samples	% of increase in strength	
	7 Days	28 Days
M1-M2	51.24%	56.63%
M1- M3	72.57%	65.69%
M1- M4	89.35%	86.73%
M2-M3	14.10%	5.78%
M2-M4	25.19%	19.21%
M3-M4	9.70%	12.69%

IV. CONCLUSIONS

- 70% of fine aggregate replaced with sea shell be increases the 56.63% of compressive strength than Conventional concrete.
- Adding of 1% steel Fibers increases the 65.69% of compressive strength than conventional concrete.
- And the adding of 1% steel Fiber and also replacing the sea shells as fine aggregate will increases the 86.73% of compressive strength than Conventional concrete.
- The experimental results show that the compressive strength of concrete made of sea shells and steel fiber is high. Hence this replaced concrete can be used in various purposes where the sea shells available.

Review of conclusion

- Combination of both replacement of sea shells and adding of steel Fiber gives the more strength than other samples.
- It was noted that implementing seashells in the concrete mix can be used to produce a lightweight concrete with high strength.

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