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An Experimental Study Investigation on Self Compacting Concrete and Strength Properties by using Fiber Reinforcement

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ABSTRACT

Over the decade there is exemplary & increased growth in the field of construction after the innovation of SCC resulting in wider usage of it in the world nowadays. It has a greater value over conventional concrete in terms of its usage & the finishing, cost, labor reduction. By using of fibers improves the properties crack behavior. The objective is to carry out an investigation on strength properties of SCC. Different types of fibers and proportions are used in this study. In this the most important types and properties are studied. In these different types of mixes are used to improve the strength and bond between the structures. In these different types of fibers are used. In This different percentage of fibers are used. This investigation consists of 2 halves. 1st half consists of creating a design mix of a specified such as M30 for SCC & in the later half, different Fibers are added to the SCC. By using this we can determine properties of concrete and finally results are analyzed. The investigation shows clear improvement in all aspects of SCC by including fibers of different types and in change volume. Carbon fiber shows better improvement. The current investigation displayed better results in for basalt fiber in cost and overall performance.

KEYWORDS: *Glass fiber, Basalt Fiber, Carbon Fiber, Fracture Energy, Sorptivity & Bond development.*

INTRODUCTION

Self-compacting concrete is one of important type of concrete and it can be used widely. The growth of SCC is increasedday by day in world wide. The main important concept of SCC is compaction. So, the concrete does not require compaction. So, the most problems in concrete are solved bySSC.

Day by day new challenges are coming to the concrete and many researches are going on concrete material. in this SCCis one of major area of study of concrete. There are different types of SCC are available in market for construction of structures. In this depending on the purpose different types are used with respect to the purpose. Development of concrete is also achieving day by day and some of are still there, these are trying to solve. Some of the difficulties are also present andall are trying to fixing in researches. These drawbacks are eliminating by conducting researches on concrete. Generally Tensile strength of Concrete is subjected tolow.

LITERATURE REVIEW

Ouchi, et al.(1997)

In this paper explained about SCC and its properties on concrete. In this paper also

explained about properties of concreteanditseffectsonstrengthanddurabilityofr einforced concrete structures. This study is very useful for concrete structures.

Peiwei., et al. (2000)

In this paper is explained more about ingredients andmaterials used in the reinforced cement concrete structures. In this also explained about few of special types of concrete. This paper also discusses about comparison of special concrete with respect to conventional concrete. In these few admixtures are used to get good results. The main objective is to decrease cement content in special concrete to get good results. It also decreases cost and within economic conditions. It gives good strength and durability to the concretestructures.

Mailvaganamet al. (2001)

In this paper mainly focuses on various types of admixtures used in special concretes. By using of it improve the strength and as well performance too. These are depending on size and composition and shape of the aggregates. This is also depending on surface area and grade of aggregates used and finally water cement ratio used for the concrete structures.

Jiang, et al (2014)

This paper is explained about fibers and its uses and its effects on strength of reinforced cement concrete structures. By using of this we can get and determine the properties of concrete. It can be used to improves strength and durability of reinforced cement concrete structures. We can improve strength and durability and its properties by adding of these fibers into the cement concrete structures.

FIBERS AND TYPES

Glass fibers are one of important and common type of fibers used in cement concrete structures. It can be obtained from molten glass. generally, these fibers are cooled once hardened. Basalt Fibers are one of common type used in constructions. These are obtained from basalt rock at a higher temperature.

Carbon fibers are one of common and important type of fibers used in constructions and it is subjected to low density. thermal conductivity of these fibers is also high. These fibers are good against chemical stability. It is also used for crack resistance and resistance against abrasion also. By using this we canknow fracture behavior of SCC.

OBJECTIVES

- Improve properties ofSCC
- To know fresh properties ofconcrete
- filling and passing ability and resistance to the concrete structure aredetermined.
- Strength of SCC isDetermined
- Determine moduluselasticity
- Fracture energy
- Improvetoughness
- Improveworkability
- To know the micro structure ofSCC
- Stress deformations arestudied

METHODOLOGY

- M30 grade SCC isused
- Slump flow, V-funnel and L-box apparatus areused
- SCC strengths and fracture energy aredetermined
- Fibers areused
- Strength is calculated at 7days and 28days
- Sorptivity test isused
- ToStudyofmicrostructuresofconcreteatdifferent ages.

MATERIALS USED

- Cement
- CoarseAggregate
- FineAggregate
- SilicaFume
- Admixture
- Water
- Fiber

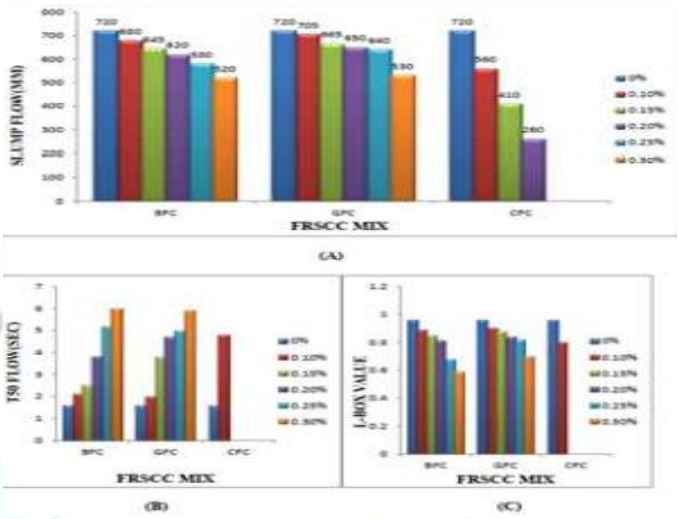
MIX DESIGN ANDPROPERTIES

Mechanical Properties of Fibers

Fiber variety	Length (mm)	Density (g/cm3)	Elastic modulus(GPa)	Tensile strength(MPa)	Elong. at break(%)	Water absorption
BASALT	12	2.65	93-110	4100-4800	3.1-3.2	<0.5
GLASS	12	2.53	43-50	1950-2050	7-9	<0.1
CARBON	12	1.80	243	4600	1.7	

Cement (kg/m3)	Silica fume(kg/m3)	Water(kg/m3)	FA (kg/m3)	CA (kg/m3)	SP (kg/m3)
450.33	45.03	189.13	963.36	642.24	5.553
1	0.10	0.42	2.14	1.42	0.012

sample	Slump flow 500-750mm	T_{50} flow 2-5sec	L-Box(H_2/H_1) 0.8-1.0	V-Funnel 6-12sec	T5 Flow +3sec	Remarks
PSC	720	1.6	0.96	5	9	Low viscosity (Result Satisfied)
BFC-1	680	2.1	0.89	8	12	Result Satisfied
BFC-1.5	645	2.5	0.85	8	13	Result Satisfied
BFC-2	620	3.8	0.81	9	14	Result Satisfied
BFC-2.5	580	5.2	0.68	10	16	High viscosity Blockage (RNS)
BFC-3	520	6	0.59	11	18	Too high viscosity Blockage (RNS)
GFC-1	705	2.0	0.90	7	10	Result Satisfied
GFC-1.5	665	3.8	0.88	7.7	11	Result Satisfied
GFC-2	650	4.7	0.84	8.5	12	Result Satisfied
GFC-2.5	640	5.0	0.82	9	12	Result Satisfied
GFC-3	530	5.9	0.70	11	15	Too high viscosity Blockage (RNS)
CFC-1	560	4.8	0.80	10	14	Result Satisfied
CFC-1.5	410	–	–	18	–	Too high viscosity Blockage (RNS)
CFC-2	260	–	–	23	–	Too high viscosity Blockage (RNS)



Specimen	Ultimate load(KN)
PSC	12.800
BFC-1	15.540
BFC-1.5	20.690
BFC-2	22.420
BFC-2.5	22.540
BFC-3	15.810
GFC-1	15.650
GFC-1.5	19.580
GFC-2	19.620
GFC-2.5	17.900
GFC-3	17.590
CFC-1	15.950
CFC-1.5	23.330
CFC-2	19.980

RESULTS ON SCC

Mixes	7-Day compressive strength (MPa)	28-days compressive strength (MPa)	28-days split tensile strength (MPa)	28-days flexural strength (MPa)
PSC	33.185	40.89	4.1	7.37
BFC-1	31.11	38.67	3.11	7.84
BFC-1.5	34.22	49.77	4.95	11.4
BFC-2	37.77	50.99	5.517	11.78
BFC-2.5	45.48	61.4	4.52	11.92
BFC-3	20.89	32.89	4.24	7.54
GFC-1	24.88	40.89	2.97	7.44
GFC-1.5	33.77	46.19	4.81	9.74
GFC-2	32.89	47.11	4.95	10.08
GFC-2.5	31.55	45.33	3.96	9.46
GFC-3	23.55	39.11	3.678	8.32
CFC-1	24.44	42.22	3.82	7.52
CFC-1.5	43.11	62.22	5.23	12.32
CFC-2	40.89	55.2	4.52	10.54

LOAD(KN)	CMOD(MM)					
	PSC	GFC-1	GFC-1.5	GFC-2	GFC-2.5	GFC-3
0	0	0	0	0	0	0
0.75	0	0	0.001	0	0	0
1	0	0	0.002	0	0	0
2	0.01	0.004	0.006	0	0	0
3	0.08	0.006	0.008	0	0.02	0
4	0.26	0.009	0.024	0	0.05	0.04
4.25	0.28	0.01	0.033	0	0.06	0.05
5		0.16	0.05	0	0.08	0.09
5.5		0.2	0.11	0	0.09	0.13
6		0.41	0.18	0	0.13	0.16
6.5			0.25	0.01	0.17	0.18
6.75			0.3	0.03	0.18	0.19
7				0.03	0.21	0.22
8				0.06	0.32	0.35
9				0.13	0.46	0.51
9.5				0.18	0.5	
10				0.22		
10.25				0.27		

LOAD(KN)	CMOD(MM)					
	PSC	BFC-1	BFC-1.5	BFC-2	BFC-2.5	BFC-3
0	0	0	0	0	0	0
2	0.01	0	0.004	0	0	0
3.25	0.1	0.01	0.009	0	0	0
4	0.26	0.05	0.019	0.01	0	0.02
4.25	0.28	0.06	0.023	0.015	0	0.05
6		0.1	0.053	0.06	0.08	0.13
6.25		0.3	0.059	0.09	0.1	0.16
6.5		0.36	0.065	0.15	0.12	0.19
6.75			0.08	0.18	0.14	0.36
7			0.1	0.21	0.17	
7.75			0.33	0.28	0.23	
8					0.26	
9.75					0.36	
10.5					0.43	
10.75					0.45	

CONCLUSION

The main important conclusion of this paper is

- Addition of fibers to SCC results in loss of basic property such as slump flow,etc.
- the strength properties areincreased.
- Increase the flexure strength
- Increase the compressivestrength
- Increase the tensile strength
- Used as crackarrester

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