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Experimental Investigation of Self Compacting Concrete Beams Strengthened with Steel Fibre Reinforcement

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Abstract: *The project mainly aims at studying the mechanical and durability characteristics of the self-compacting steel fibre reinforced concrete with recycled aggregate as coarse aggregate and ecosand as fine aggregate replacement by conducting compressive strength test, consistency test, split tensile strength test, flexural strength test, water absorption test. The project also deals with the comparison of properties of the proposed self-compacting concrete with mentioned replacements with that of existing conventional concrete. For this experiment, M40 grade concrete is used and steel fibre is incorporated and ecosand is used. Conventional concrete tends to present a problem with regard to adequate consolidation in thin sections or areas of congested reinforcement, which leads to a large volume of entrapped air voids and compromises the strength and durability of the concrete.*

Keywords: Self Compacting Concrete, Steel Fibers

I. INTRODUCTION

Concrete is a versatile widely used construction material. Ever since concrete has been accepted as a material for construction, have been trying to improve its quality and enhance its performance. Recent changes in construction industry demand improved durability of structures. There is a methodological shift in the concrete design from a strength-based concept to a performance-based design. At present stage there is a large emphasis on performance aspect of concrete. One such thought has lead to the development of self compacting concrete (SCC). The present investigation is aimed at developing a self-compacting concrete with the addition of steel fibres and using flyash. SCC characteristics such as flowability, passing ability and segregation resistance have been verified using slump flow, L box and V funnel tests.

1.1 Objectives

- The main objective of the current study is to focus on the flexural behaviour of scc beams(with and without steel fibres) with normal RC beam.
- To compare the properties of the proposed self-compacting concrete with mentioned replacements with that of existing conventional concrete.

II. MATERIAL PROPERTIES

2.1 Steel Fibre

Steel fibers acts as a bridge to retard the cracks propagation, and improve several characteristics and properties of concrete. One of the important properties of steel fibre reinforced concrete is that it shows super resistance to crack and propogation.

2.2 Fly Ash

Fly ash is a heterogeneous by-product material produced in the combustion process of coal used in power stations. It is a fine grey coloured powder having spherical glassy particles that rise with the flue gases. As fly ash contains pozzolanic

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materials components which reach with lime to form cementitious materials. Thus, fly ash is used in concrete, mines, landfills and dams. The chemical composition of fly ash depends upon the type of coal used and the methods used for combustion of coal.

2.3 Chemical Composition of Fly Ash

COMPONENT	BITUMINOUS COAL	SUB BITUMINOUS COAL	LIGNITE COAL
SiO_2 (%)	20-60	40-60	15-45
Al_2O_3(%)	5-35	20-30	20-25
Fe_2O_3(%)	10-40	4-10	4-15
CaO (%)	1-12	5-30	15-40
LOI (%)	0-15	0-3	0-5

III. EXPERIMENTAL TEST

3.1 Flexural Test on Beam

Flexural testing measures the force required to bend a beam of plastic material and determines the resistance to flexing or stiffness of a material. Flex modulus is indicative of how much the material can flex before permanent deformation.


Loading Frame (50T)

Types of beams tested;

- TYPE 1 – Controlled specimen
- TYPE 2 – specimen with 0.5% steel fibre reinforcement
- TYPE 3 –specimen with 1% steel fibre reinforcement

IV. RESULTS

4.1 Load Deflection for Various Beams

Load	Type 1	TYPE 2	TYPE 3
1	0.12	0.15	0.14
2	0.23	0.28	0.28
4	0.50	0.55	0.61
6	0.88	0.95	1.05
8	1.21	1.25	1.68
10	1.64	1.72	2.12
12	2.03	2.15	2.42

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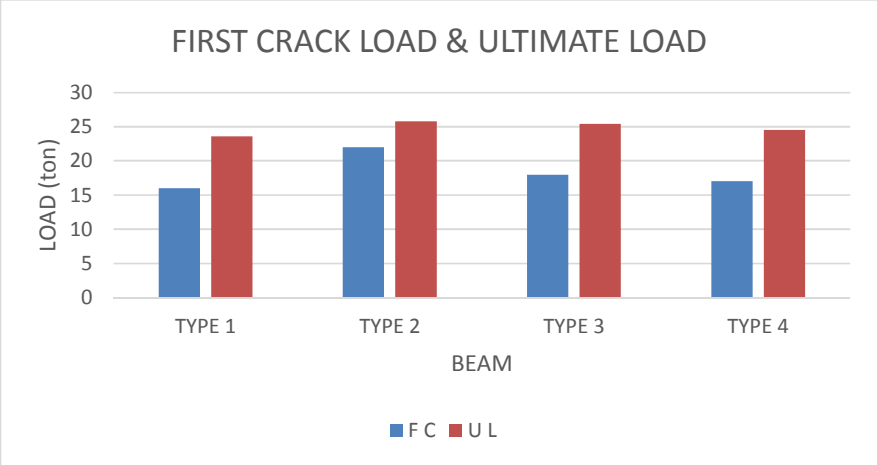
14	2.41	2.68	2.9
16	2.92	3.15	3.46
18	3.32	3.52	4.05
20	3.85	4.15	4.48
22	4.28	4.68	4.78
24	4.52	4.82	5.38
26	0	0	5.7

4.2 First Crack and Ultimate Load of Various Beams

BEAM	TYPE 1	TYPE 2	TYPE 3
First Crack	14	16	19
Ultimate load	23.1	23.8	25.6

Graph



4.3 Maximum Deflection of Various Beams

BEAM	TYPE 1	TYPE 2	TYPE 3
DEFLECTION	4.52	4.82	5.70

Graph

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V. CONCLUSION

From the results it is evident that the increase in steel fibres increases the flexural strength of the beam and also it concludes us that the incorporation of steel fibres and fly ash is feasible.

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