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EXPERIMENTAL STUDY TO INVESTIGATE THE LATERAL LOAD RESISTING BEHAVIOUR OF SHEAR WALL USING SCC

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ABSTRACT

Self-compacting concrete (SCC) has low yield stretch, high deformability and appropriate thickness to guarantee uniform suspension of strong particles amid transportation, arrangement without outer compaction. Shear wall is a structural system which provides stability to the structure. Since reinforcement in shear wall has closely spaced, compaction is difficult which necessitate the incorporation of self-compacting concrete. The present paper focuses on investigating the characteristics of M50 grade of self-compacting concrete where cement is replaced with ground granulated impact heater slag (GGBS) and Micro Silica (MS)with six different proportions. Fresh concrete properties of the concrete were studied. Cubes, cylinders were casted and tested to obtain the optimum proportion. This is further used in fabrication of shear wall and shear wall with opening. Shear behavior of these walls were tested and compared with that of the conventional beam.

Keywords: Granulated blast furnace slag, micro silica, Cement, Split Tensile Test, Diagonal Shear Test.

I. INTRODUCTION

At the point when vast amount of cement is to be set in vigorously fortified solid individuals it is hard to guarantee that the shape work gets totally loaded with solid that is completely compacted without voids [Nan Su et al., 2001] or honeycombs. Self-compacting cement is unique kind of solid which streams and fills every last corner of frame work absolutely by methods for its own particular weight without vibration and accomplishing full compaction even in congested areas. Self-compacting concrete (SCC) can be put and compacted under its self-weight with practically zero vibration exertion in the meantime it is sufficiently firm to be taken care of without isolation. The admixture is used in self compacting concrete because it gives its flowability and it will reduce the high quantity of water. Polycarboxylate ether superplasticizers are used in self-compacting concrete. They are extremely strong so a lower dose will achieve the result. In basic designing [Ramya and Kashyap, 2014], a shear divider is a basic framework made out of supported boards to counter the impacts of horizontal load following up on a structure. Shear dividers are most efficient when they align vertically and are supported on foundation walls or footings. The parallel and gravity stack opposing framework comprises of strengthened solid dividers and fortified solid chunks. Shear dividers are the principle [Dhiyaneshwaran et al., 2013] vertical auxiliary components with a double part of opposing both the gravity and sidelong loads. In the shear divider opening has been provided for 100mm x 100mm, 200x200mm, 300mmx300mm. The slab has been casted and tested.

II.MATERIALS AND ITS PROPERTIES

A. Cement: The type of cement used in this work is 53-grade OPC. The specific gravity of the cement is 3.14 and having a fineness modulus of 2% which is less than the maximum value of 7%.

B. Fine Aggregate: Fine aggregate is stream sand and having the specific gravity of 2.63. The density of the fine aggregate is found to be 511.4 kg/m3. The zone of fine aggregate is determined by sieve analysis. As per Indian standards the zone obtained is Zone – II.

C. Coarse Aggregate: The coarse aggregate used in the experimentation were about 10 mm size and tested as per IS: 383- 1970 specifications.

D. Admixtures

1. Ground Granulated Blast Furnace Slag (GGBS): Ground Granulated Blast Furnace is a by-item gotten in the produce of pig iron. The molten slag rapidly quenched by hose of water a yield a glassy granular product called granulated blast furnace slag.

2. Micro Silica(MS): The term microsilica is the one typically used to portray the fine powder, which is separated from fumes gasses of silicon and ferrosilicon refining heaters and used in cement to enhance the properties of the concrete.

3. Super Plasticizer: Superplasticizer also known as high range water reducers are chemical admixture used where well dispersed particle suspension is required. The strength of solid increments when water to bond proportion decreases. A admixture is represented by polycarboxylate ether superplasticizer [Jagdish and Ranganath, 2004] with a relatively low measurement (0.15-0.3% by bond weight) they permit a water reduction up to 40%.

III.Experimental study:

E.Preliminary tests

Table 1: Preliminary Test Results

Material Properties	Test results
Cement	
Specific Gravity	3.12
Coarse aggregate	
Specific Gravity	2.80
Fine aggregate	
Specific Gravity	2.65
Sieve Analysis	Zone II
Ground Granulated Blast Furnace Slag	
Specific Gravity	2.82
Micro Silica	
Specific Gravity	2.2

F. Mix Design: The mix design of Self compacting concrete is carried out by using Nan su et al method. The design procedure followed is Heba A. Mohamed,2011.

Design strength = 50Mpa (M50)
Specific gravity of coarse aggregate = 2.80
Bulkdensity of coarse aggregate = 1500kg/m^3
Specific gravity of fine aggregate = 2.65
Bulk density of fine aggregate = 1404kg/m^3
Specific gravity of cement = 3.12
Volume ratio of fine aggregate = 58%
Volume ratio of coarse aggregate = 42%
Packing factor = 1.12
Amount of fine aggregate = 912kg
Amount of coarse aggregate = 705.6kg

Determination of cement content

Assume each kg cement provide 10Mpa strength of 20Psi, 28days
C = f'c/20
f'c = 58.5 x 145.038 = 8484.7
C = 8484.7/20 = 425kg/m^3
W/C ratio for M50 = 0.43
Measure of blending water content required for bond = 0.43 x 425
Amount of blending water content required for bond = 182.75 liters (kg/m^3)

Determination of S.P. dosage

(1.5% of cement)
S.P dosage = (1.5/100) x 425
S.P dosage = 6.375kg/m^3

Mix proportion

C: F.A : C.A : W/C
1: 2.14 : 1.66 : 0.43

G. Mix Details

Table 2: Mix proportion details

Designation Id	GGBS content (%)	MS content (%)
M1	10	3
M2	10	6
M3	10	9
M4	20	3
M5	20	6
M6	20	9

Table 3: Workability test values for SCC

Mix	M1	M2	M3	M	M5	M6
Slump flow (mm)	684	680	670	672	665	660
Slump flow (secs)	4	4	5	6	5	6
V funnel	8	9	9	9	10	11
V funnel (secs)	11	11	12	15	13	15

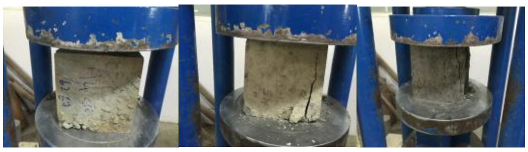
H. Workability Tests

3.4 Compressive strength and Split tensile strength: Cubes & cylinders are casted for six different proportions to obtain their compression and flexure strength.

Table 4 : Compressive strength of M50 grade SCC

Mix	**7th day strength (N/mm^2)**	**14th day strength (N/mm^2)**	**28th day strength (N/mm^2)**
M1	16.04	29.15	42.26
M2	24.79	36.79	52.43
M3	17.55	18.44	25.56
M4	24.71	35.12	52.12
M5	11.55	14.35	22.16
M6	22.75	30.79	40.45

M1 M2 M3



M4 M5 M6

Figure-1: Compressive failures of cubes for all mixes.
[1] - M1 ,[2] - M2 , [3] - M3,
[4] - M 4 ,[5] - M5 , [6] - M6

Table 5: Split tensile strength of M50 grade SCC

Mix	7th days strength (N/mm2)	14th day strength (N/mm2)
M1	1.35	1.93
M2	2.478	3.54
M3	1.554	2.22
M4	0.99	1.42
M5	2.254	3.22
M6	1.792	2.56

Figure 3.2: Split tensile test.

SLABS: The mould for slab has been prepared with dimension 0.6x0.6x0.125. In the slab, opening has been provided with 0.1x0.1, 0.2x0.2, 0.3x0.3 (Jagdish and Ranganath, 2004).

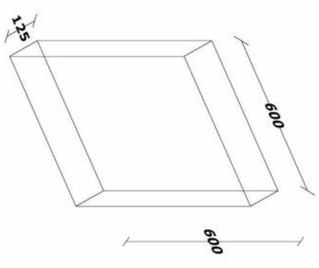


Fig. 2: Slab Cross Section

[a]

[b] **[c]**

Fig 3: [a]– conventional concrete
[b]–200mmopeningself compacting slab
[c]–100mmopening self-compacting slab

SLAB REINFORCEMENT: A shear wall that is primarily design, to resist lateral force in its own plane. Boundary elements are heavily reinforcement in critical zone of shear wall normally located in close edge of the wall (Ramya and Kashyap, 2014). Due to their small span to depth of ratio they require highly congested reinforcement I order to achieve ductile behavior.

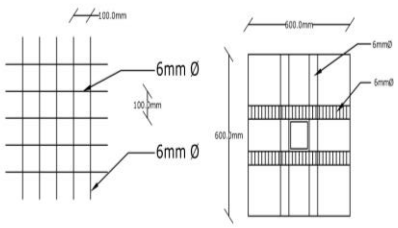


Fig 3 Slab reinforcement

4. LOAD VS DEFLECTION

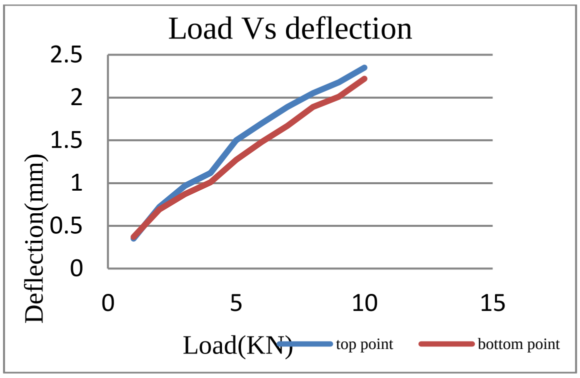


Fig 4 [a]: conventional concrete

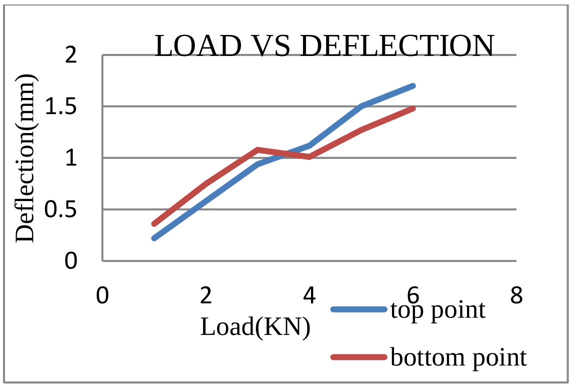


Fig 5 [b]: 200mm self-compacting

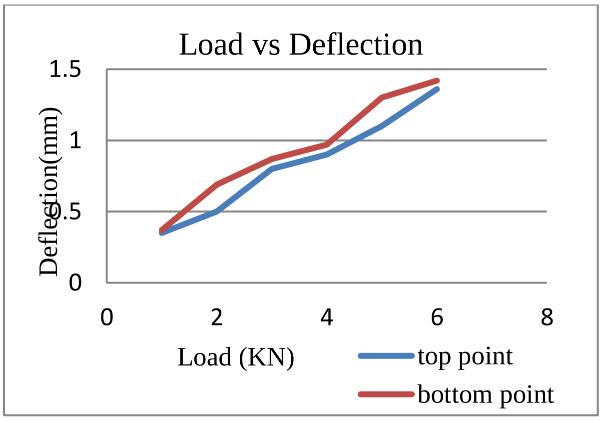


Fig 6 [c]: 100mm self-compacting concrete

2. RESULTS AND DISCUSSIONS

a) It shows that replacement of cement with 10% GGBS and 6% MICRO SILICA helps in attaining M50 grade strength of concrete
b) More the proportion of GGBS and MS increased lesser the strength obtained but these materials shows better performance in workability tests
c) The optimum percentage of GGBS & MS is 10% & 6%.
d) By replacing cement with GGBS and MS it increases durability.

e) The load carrying capacity of conventional shear wall is higher than the corresponding shear wall with opening.
f) The load capacity of shear wall increases with decreases in size of opening

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