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EXPERIMENTAL INVESTIGATION ON INFLUENCE OF BRICKBATS AND STEEL FIBERS IN SELF COMPACTING CONCRETE

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ABSTRACT: Construction and demolition waste contribute to the major portion of land fill which is polluting the environment. Disposal of this waste is a current global issue which scientists are taking it as a challenge. Utilization by the process of recycling of these solid wastes in large quantities in construction will help reduce the environmental hazard imposed by the construction and demolition waste. This study presents the behavior of self compacting concrete (SCC) with the utilization of recycled aggregates as a replacements material. The coarse aggregate was partially replaced with grouted class I brick bats. In addition to that steel fibers are added in proper proportion. Suitable dosage of super plasticizers is also added for achieving increased workability. By conducting fresh and hardened tests on the specimens an attempt has been made to study the rheological properties, compressive strength, split tensile strength, flexural strength and shrinkage characteristics of SCC. Though the replacements of coarse aggregate with grouted brick bats showed a considerable decrease in the strength when compared to the control specimen, the addition of steel fibers increased the same. But there was no major decrease in the split tensile strength and flexural strength.. An eco-friendly atmosphere can be maintained.

Key words: self compacting concrete, brick bats, steel fibers etc.

Introduction

The development of self compacting concrete (SCC) is considered as a milestone achievement in concrete technology due to several advantages: high performance of both fresh and hardened concrete like high flowing ability and segregation resistance, low porosity, durability and high strength. SCC is a special concrete that provides excellent flowing ability in fresh stage. SCC is considered as a concrete which can be placed and compacted under its self weight with little or no vibration effort. SCC also has the ability to flow through the congested reinforcement and uniformly filling the formwork and achieving good compaction.

The development of new technology in the material science is progressing rapidly. In last three decades, a lot of research was carried out through out globe to improve the performance of concrete in terms of strength and durability qualities.

Good quality fine particles of waste materials or by-products particularly mineral admixtures and super plasticizer make the cement concrete sustainable with improved long term performance because of least permeability and very slow chemical reaction with harmful compounds present in the concrete.

SELF COMPACTING CONCRETE is ECONOMICAL

The cost of SCC is much higher than that of the corresponding normal strength or high strength concrete. It is seen that the cost of materials of SCC is higher than that of conventional. If one takes the other components of cost such as cost of composition, finishing etc, then one would realize that SCC is certainty not a costly concrete for comparable strength. Material cost of SCC will be about 16 to 17% higher than that of concrete. But one takes into considerations like saving in labour cost, rate of pouring, savings in repair work etc, the cost of SCC will be comparable with that of conventional concrete.

Difference between Ordinary Concrete and Self Compacting Concrete

- SCC is highly workable
- Highly flow able
- Resistance to segregation, bleeding and paste separation
- Rapid placement due to high flow ability of SCC
- Reduces the labour cost by eliminating the need for vibration

Grouted Brickbats

Water absorption capacity of normal brickbats is high compared to that of grouted brickbats. To reducing the water absorption capacity grouted brickbats are used in this study. The amount of water absorbed by the bricks composites depends on their void volume and the amount proportion of material present. 1:4 proportioned mortar is used to grout the brickbats and it is cured for 7 days and dried for a particular period.

Properties of Self Compacting Concrete

The three main properties of SCC in plastic state as

i. filling ability (excellent deformability)
ii. Passing ability
iii. High resistance to segregation

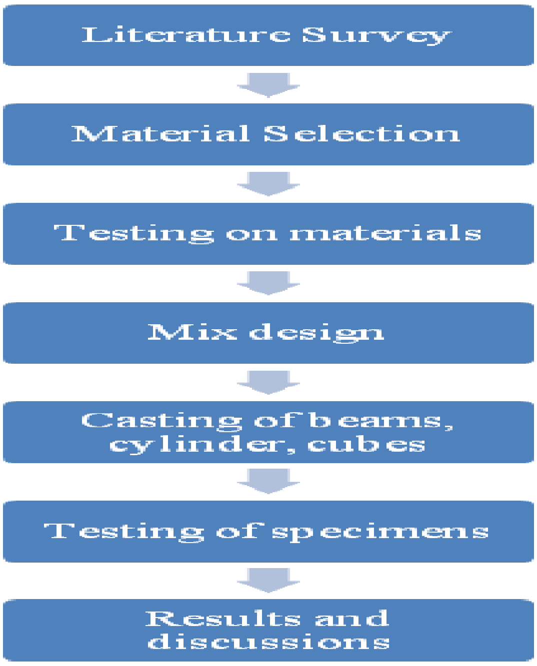
Materials Used

All materials used in this study are commonly available

- Cement – OPC of 53 grade
- Sand – 4.75 mm maximum size.
- Coarse aggregate – 10 to 12 mm size
- Brickbats of class A brick
- Super plasticizers

Methodology

The methodology worked out to achieve the above-mentioned objectives is followed as shown in the flow chart below:



Material Testing

Test for Cement: The following experiments were conducted to find the properties of cement as per IS-4031:

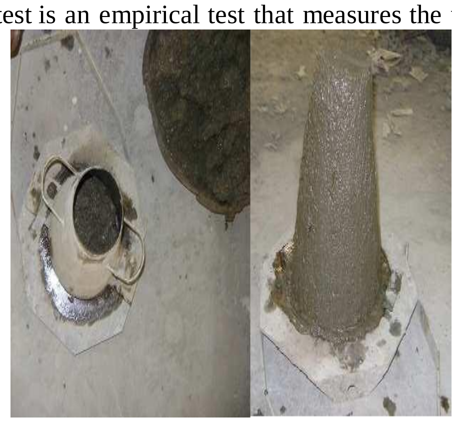
- Standard Consistency Test
- Initial Setting and Final Setting Time Test
- Specific Gravity Test
- Compression Strength test for Mortar Cube.

Compressive Strength of Mortar Cube

S.No	**Period of curing(days)**	**Compressive strength(N/mm^2)**
1	3	3 4
2	7	4 4
3	18	5 4

Fresh Concrete Properties

Slump Test: The concrete slump test is an empirical test that measures the workability of fresh concrete



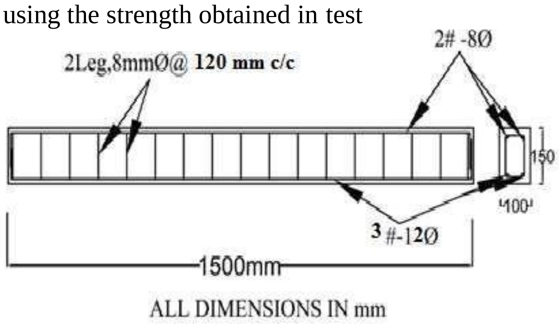
Hardened Concrete Properties

Compressive Strength Test: Cube specimens of size 150X150X150mm are to be cast for the mix proportion. After curing for required period the specimen were tested using compressive testing machine

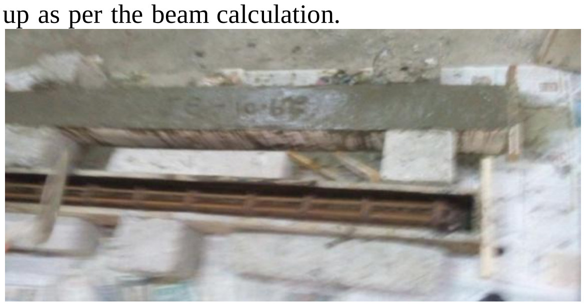
S.No	**Cube Types**	**Load (KN)**	**Compressive strength (N/mm^2)**
1	Control Mix 1	870	38.66
2	Control Mix 2	845	37.55
3	20% Brickbats	765	34
4	30% Brickbats	640	28.44
5	40% Brickbats	535	23.77
6	20% Brickbats + 0.25% Steel	780	34.66
7	30% Brickbats + 0.50% Steel	690	30.66
8	40% Brickbats + 1% Steel	610	27.11

Design of Beam

Design of beam carried out by using the strength obtained in test



Specimens Casted: The wooden formworks required for casting the beam are fitted and the required reinforcement are being tied up as per the beam calculation.

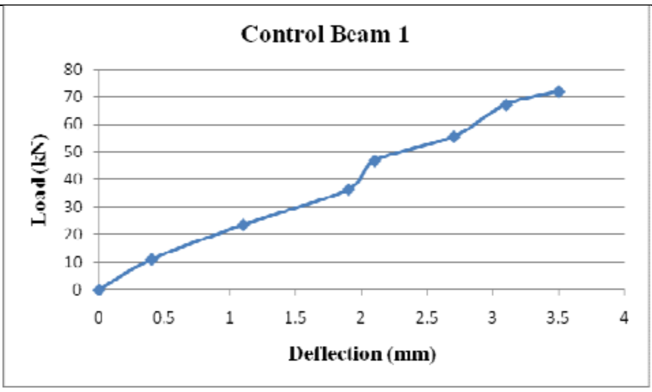


Experimental Setup & Testing Procedure: The tests were carried out in 50T Beam Loading Frame Machine (Model) with necessary fixtures as per ASTM C D 293.

Flexural Strength:

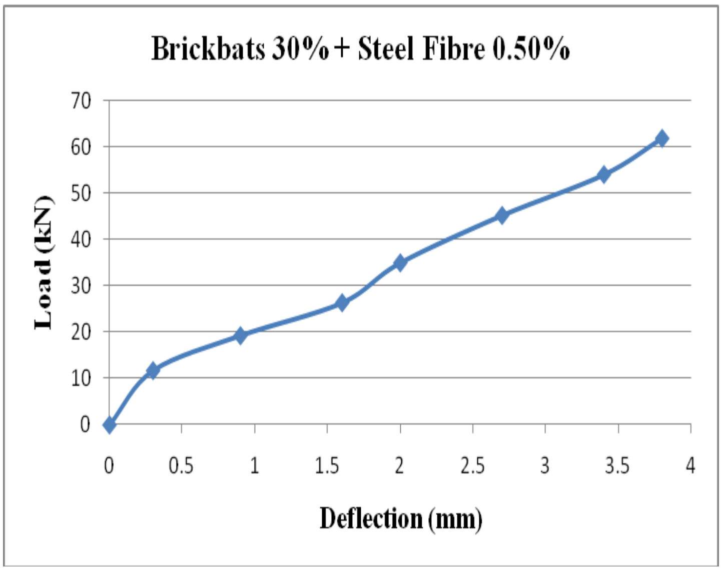
Control Beam 1

Deflection (mm)	Load (kN)
0	0
0.4	11.1
1.1	23.6
1.9	36.5
2.1	46.9
2.7	55.6
3.1	67.2
3.5	72



Beam with Brickbats 30% and Steel Fibers 0.50%

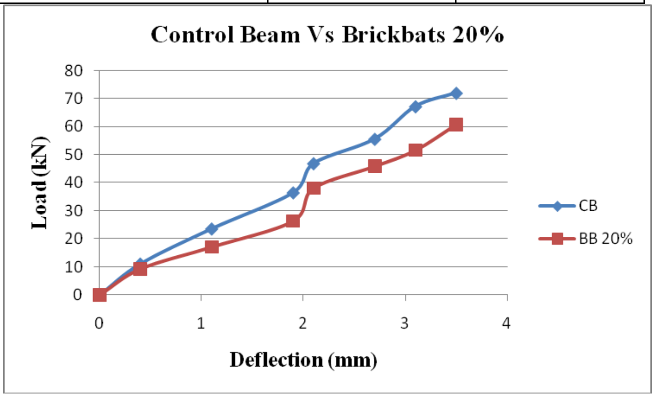
Deflection (mm)	Load (kN)
0	0
0.3	11.7
0.9	19.2
1.6	26.3
2	34.9
2.7	45.1
3.4	53.9
3.8	61.7



COMPARISON RESULTS

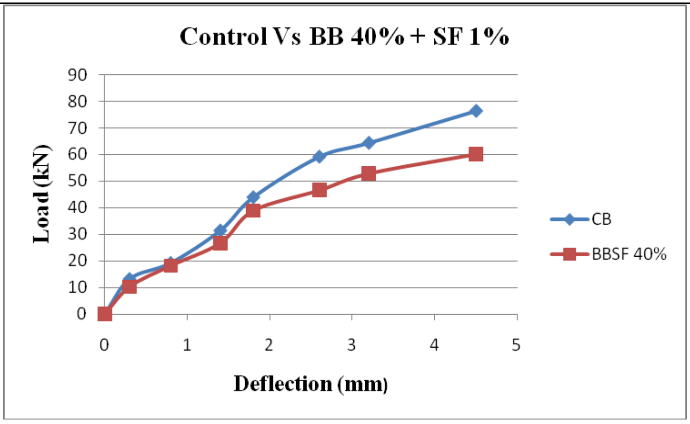
Control Beam with Brickbats 20% Beam

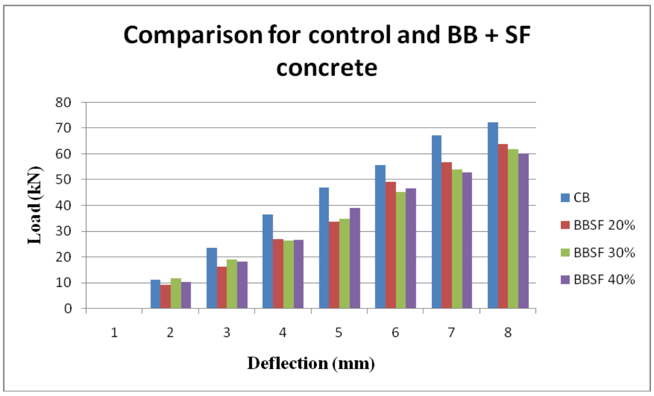
Deflection (mm)	Load (kN)	Load (kN)
0	0	0
0.4	11.1	9.3
1.1	23.6	17.1
1.9	36.5	26.4
2.1	46.9	438.1
2.7	55.6	45.9
3.1	67.2	51.6
3.5	72	60.8



Control Beam with Brickbats 40% and Steel Fibre 1% Added Beam

Deflection(mm)	Load (kN)	Load (kN)
0	0	0
0.3	13.2	10.3
0.8	19.2	18.2
1.4	31.4	26.7
1.8	43.9	38.9
2.6	59.1	46.5
3.2	64.3	52.8
4.5	76.3	60.1





Stiffness Comparison:
Brickbats 30%

Sl No	Load (kN)	Deflection (mm)	Stiffness
1	0	0	0
2	8.1	0.4	20.25
3	18.9	1.1	17.18
4	26.3	1.9	13.84
5	31.9	2.2	14.5
6	42.3	2.9	14.58
7	53.6	3.6	14.88
8	59.1	3.8	15.55

Summary and conclusion:

The detailed study and analysis of the experimental results, it is evident that brickbats which are a waste by-product obtained from construction and demolition debris can be effectively used as aggregates in SCC which could be applied in the construction and fabrication of structural components. Brickbats obtained by breaking down class I bricks to a size of the range of 10 to 12 mm were grouted with suitable proportion of cement mortar and added in various proportions of the order of 20%, 30% and 40% respectively. Also steel fibers are added in the ratio of 0.25%, 0.50% and 1.0% respectively. Though grouted brickbats being an inferior material when compared to that of conventional aggregates when used in SCC, it yields acceptable values of flexural strength, split tensile strength and compressive strength by adapting an ideal mix proportions obtained as a result of experimental investigation. It was found that the addition of 20% grouted brickbats and 0.25% steel fibre gives more strength when compared to others and it was considered as the ideal mix proportion. The investigation gives scope for further investigation of testing of concrete elements like columns, beams, beam column joints and other structural elements using the mix proportions adopted in this experimental investigation

REFERENCES:

[1]. Comparative Analysis Of The Compressive Strength Of Concrete With Gravel And Crushed Over Burnt Bricks As Coarse Aggregates, N.S. Apebo, M.B. Iorwua and J.C. Agunwamba, Nigerian Journal of Technology (NIJOTECH) Vol. 32, No. 1, March, 2013

[2]. 2.Evaluation of the Fresh and Hardened Properties of Steel Fibre Reinforced Self-Compacting Concrete Using Recycled Aggregates as a Replacement Material, N. Nalanth, P. Vincent Venkatesan and M. S. Ravikumar, Hindawi Publishing Corporation, Advances in Civil Engineering, Volume 2014

[3]. 3.The Investigation Of Effect Of Steel Fiber On The Shear Behavior Of Self Compacting Concrete Beams With Normal And High Strength, M H A Beygi, J Vaseghi Amiri, A Rezai Moazen And N Ranjbar Malidareh, 33rd Conference On Our World In Concrete & Structures: 25 – 27 August 2008, Singapore.

[4]. Study Of Self Compacting Concrete Using Brick Dust And Marble Dust, Ranjodh Singh, Rohin Kaushik And Gurniwaz Singh, International Journal Of Engineering Research And Applications, Volume 3, Issue 3, May-June 2013

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