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RECYCLED CONCRETE AGGREGATE WITH BASALT FIBER

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ABSTRACT

Natural aggregate will be replaced by recycled concrete aggregate and adding some amount of basalt fiber for the better workability, the design compressive strength we used 30,45 and 60mpa Locally available dune sand become utilised in concrete mixes as a sustainable substitute to conventional crushed fine aggregate. Mechanical residences may be superior with the aid of usage of basalt fibre reinforced is used in construction to decrease the environmental effect from the huge amount of earthquake waste from collapsed building. The recycled substances used on this examine are Basalt Fibre (BF) and recycled coarse aggregates. The partial cement replacement was done by BF and replacement for coarse aggregate was done by recycled aggregates.

Keywords*: Basalt Fiber Recycled Concrete Aggregates, Sustainability, Compressive Strength, Splitting Tensile Strength.*

1. INTRODUCTION

Natural aggregate can be replaced by RCA in concrete. The basalt fibre is kind of inorganic material with environmental protection. It controls the deformation of the gentle surrounding on Rock tunnel. Basalt fibre with RCA is maximum generally used material in the world. Coarse aggregate, fine aggregate are major constituent in concrete. These are extracted by natural resources. After some time concrete structure can be demolished and they produced excessive amount of waste. This waste can be disposed in landfills or else it is used as sustainable material. RCA gives sustainable construction as it is beneficial to the environmental preservation and saves natural resources. RCA reduces the cost of construction work.

2. METHODOLOGY

A) Procurement Of The Materials Cement – Ordinary Portland cement

- Basalt fibre (BF)
- Natural Fine and Coarse Aggregate
- Recycled and Coarse Aggregate
- Water

B) Determination Of Material Properties

- Cement – Specific Gravity, Standard consistency, initial setting time, Final setting time
- BF - Specific Gravity, physical properties and chemical properties
- Fine Aggregates – Sieve analysis, Specific gravity, water content and water absorption, , Bulk density and Percentage voids
- Coarse Aggregates – Sieve analysis, Specific gravity, water absorption, Bulk density and Percentage voids
- Recycled Coarse Aggregates – Sieve analysis, Specific gravity, water absorption, Bulk density and Percentage voids

Tests:

a) Fresh properties

i. Slump Test

ii. Compaction factor test

b) Mechanical properties

i. Compressive strength

ii. Flexural strength

iii. Splitting tensile strength

3. MATERIAL TESTING

A. Cement

Ordinary Portland cement of 53 grade was used for the study. Supplier was Dalmia cements. The various tests to determine properties as specific gravity, standard consistency, initial and final setting time was carried out. The properties of cement used is tabulated below.

Table 1 properties of cement

Sl. No.	Name of Test	Result
1	Specific gravity	3.125
2	Standard consistency	35%
3	Initial setting time	240 minutes
4	Fineness of cement	5%

B. Fine Aggregate

Manufactured sand which was free from deleterious material was used as fine aggregate.

Table 2 properties of fine aggregate

Sl. No.	Name of Test	Result
1	Specific gravity	2.69
2	Water absorption	1.5%
3	Bulk density	1.323 kg/l
4	Percentage voids	54.44%

C. Coarse Aggregate

20mm size coarse aggregate which was free from deleterious materials was used for the study.

Table 3 properties of coarse aggregate

Sl.No.	Name of Tests	Result
1	Specific gravity	2.67
2	Water Absorption	0.8 %
3	Impact test	20%

4	Abrasion test	27.44%
5	Aggregate crushing value	18.1%

D. Recycled Coarse Aggregate

Recycled coarse aggregate obtained by the demolishing of a reinforced cement concrete staircase having age 25 years are used.

Table 5 properties of recycled coarse aggregate

Sl.No.	Name of Tests	Result
1	Specific gravity	2.5
2	Water Absorption	3.17 %
3	Impact test	25.75%
4	Aggregate crushing test	27.07%
5	Abrasion test	29%

E. BASALT FIBRE

Basalt Fibre was supplied by JSW cements. The specific gravity of BF was determined using Le Chatelier's flask. All the other physical and chemical properties were provided by the supplier.

Table 6 properties of bf

Sl.No.	Name of Tests	Result
1	Specific gravity	2.60

Mix proportioning:

Mix proportioning is the process of selecting suitable ingredients of concrete and determining their relative amounts with the objective of producing a concrete of the required strength, durability and workability as economically as possible. The mix design is carried as per IS 10262:2009. The concrete grade selected for this study is M25. The quantity of materials required for $1m^3$ of concrete is tabulated below.

Table 7 material quantity for cm

Mix grade	M25
Mix designation	CM
w/c	0.45
Cement (kg/m^3)	2.025
Fine aggregate (kg/m^3)	2.025
Coarse aggregate (kg/m^3)	4.05

4. TESTS ON CONCRETE

A. Fresh Properties

i) Slump test

ii) Compacting factor test

B. Mechanical Properties

i) Compressive strength

ii) Flexural Strength

iii) Splitting tensile strength

Cubes, beams and cylinders were cast to test the compressive strength, flexural strength and splitting tensile strength of concrete. Cubes were tested at 3day, 7 day and 28 days after curing. Beams and cylinders were tested at 7 and 28 day after curing.

5. TEST RESULTS

A) CONVENTIONAL MIX (CM):

Conventional mixes for M25 grade were prepared as per the mix proportion. The fresh properties and mechanical properties of CM were determined.

a) Slump test:

The conventional mix shows a slump of 100 mm.

Mix Details	**Designation**
Control Mix	M1
20% replacement of coarse aggregate with Recycled coarse aggregate	M2
20% replacement of coarse aggregate with recycled coarse aggregate and addition of 0.4% of Basalt Fibre	M3

b) Compressive strength:

Table 8 compressive strength for control mix

Age in days	7	28
Compressive strength (N/mm^2)	22.69	31.97

c) Flexural strength:

Table 9 flexural strength for control mix

Age in days	7	28

Flexural strength (N/mm^2)	2.93	4.45

d) Splitting tensile strength:

Table 10 splitting tensile strength for control mix

Age in days	7	28
Splitting tensile strength (N/mm^2)	2.67	3.83

B) REPLACEMENT OF COARSE AGGREGATE WITH RECYCLED COARSE AGGREGATE

Mixes were prepared by replacing 20% coarse aggregate with recycled coarse aggregate (20RCA). The following tests were determined for these mixes.

a) Slump test:

The values of slump for 20 RCA is 110mm.

b) Compressive strength:

Table 11 compressive strength for rca mixes

MIX	**M1**	**M2**
Compressive strength – 7 day (N/mm^2)	22.69	22.66
Compressive strength – 28 day (N/mm^2)	31.97	31.10

The values of compacting factor for 20 RCA are 0.90 respectively.

c) Flexural strength:

Table 12 flexural strength for rca mixes

MIX	**M1**	**M2**
Flexural strength – 7 day (N/mm^2)	2.93	3.3
Flexural strength – 28 day (N/mm^2)	4.45	4.4

d) Splitting tensile strength:

Table 13 splitting tensile strength for rca mixes

MIX	M1	M2
Splitting tensile strength – 7 day (N/mm^2)	2.67	2.64
Splitting tensile strength – 28 day (N/mm^2)	3.83	3.67

C) ADDITION OF BF WITH CEMENT AND FINE AGGREGATE AND REPLACEMENT OF COARSE AGGREGATE WITH RECYCLED COARSE AGGREGATE

Mixes were prepared by adding 0.4%, BF with cement together with 20% recycled coarse aggregate. The following tests were determined for these mixes.

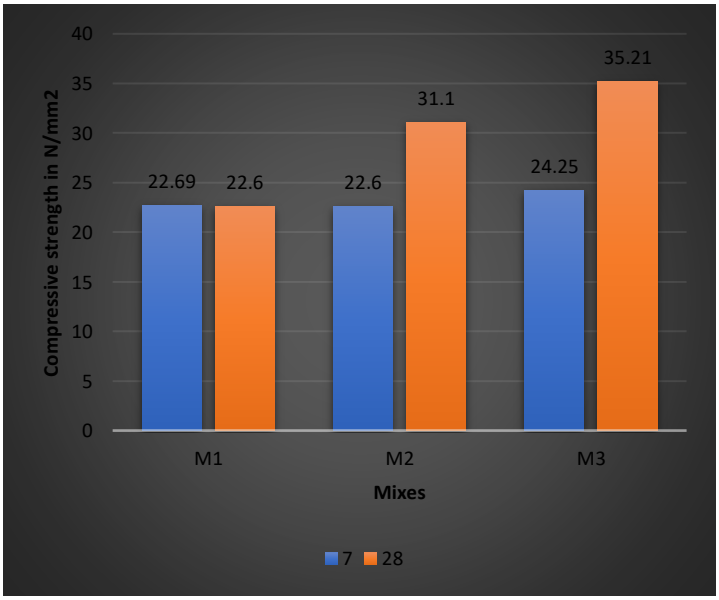
a) Slump test:

The values of slump for all these mixes are 110 mm.

b) Compressive strength:

Table 17 compressive strength for bf mixes

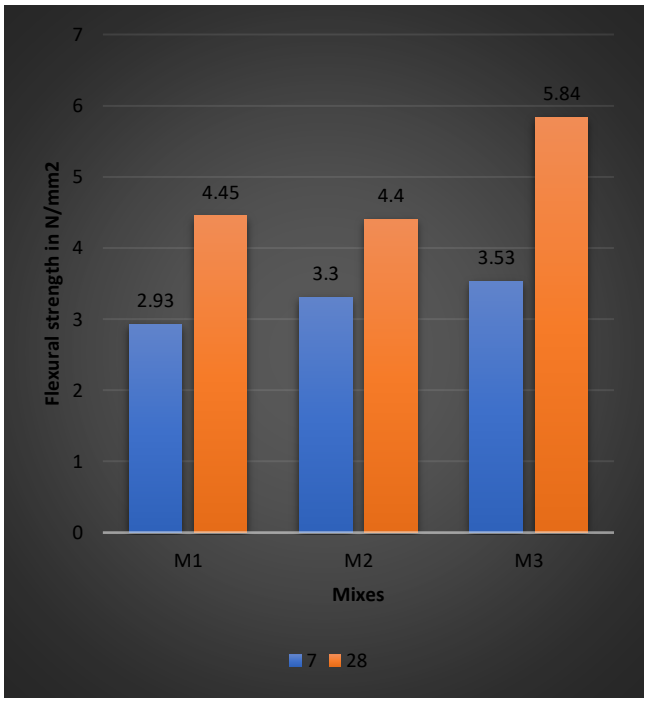
MIX	M1	M2	M3
Compressive strength – 7 day (N/mm^2)	22.69	22.60	24.25
Compressive strength – 28 day (N/mm^2)	31.97	31.10	35.21



c) Flexural strength

Table 18 flexural strength for bf mixes

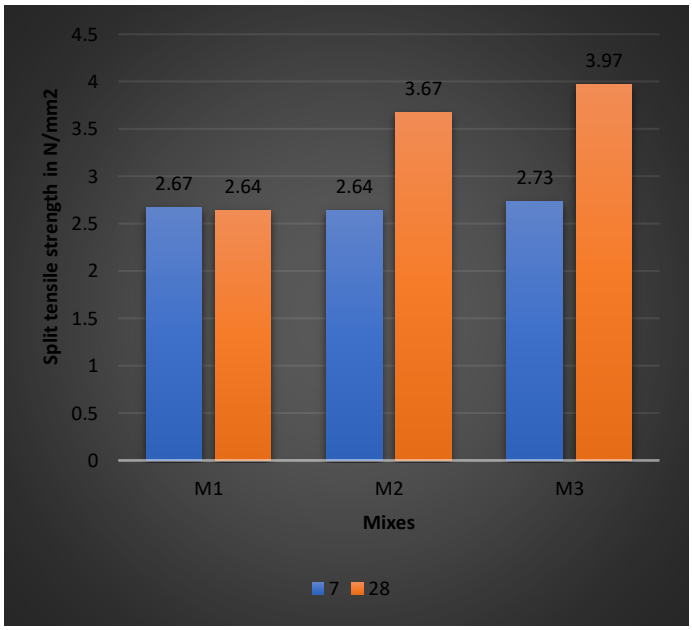
MIX	M1	M2	M3
Flexural strength – 7 day (N/mm^2)	2.93	3.3	3.53
Flexural strength – 28 day (N/mm^2)	4.45	4.4	5.84



d) Splitting tensile strength

Table 19 splitting tensile strength for bf mixes

MIX	M1	M2	M3
Splitting tensile strength – 7 day (N/mm^2)	2.67	2.64	2.73
Splitting tensile strength – 28 day (N/mm^2)	3.83	3.67	3.97



6. CONCLUSIONS

1. The improvement in the fresh and hardened properties of concrete by the inclusion of basalt fibers in low volume fractions was reported.
2. In M3 though there was proportional enhancement in split tensile strength, flexural strength and elastic modulus with the volume fraction.
3. RCA reduces the cost of construction as compared to new concrete.
4. The splitting strength, flexural strength and the compressive strength of recycled concrete are lower than the ordinary concrete.
5. The slump test measures the resulting behavior of a compacted inverted cone of concrete under the action of gravity
6. The relation between the compressive strength and workability of concrete mixes was linear when the w/c ratio and other mix proportions were constant.
7. The shapes of aggregate have great influence on the workability of concrete. Angular and rough aggregates reduces workability.
8. The temperature at which the concrete mix is prepared also affects its workability. The slump of the concrete mix decreases as the temperature of the mix increases.

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