Experimental Study on Cement Concrete Blocks by Using Waste Materials

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Abstract— In this paper deals with an experimental study conducted on fly ash based cement concrete blocks. In this study, the effect of different proportions of fly ash up to 20% to 40%, on compressive strength and flexural strength of concrete has been evaluated. The cement concrete blocks are compared to control mixes, the compressive, split and flexural strength concrete with fly ash 15%, 20% and 25% and quarry dust 5%, 10% and 15%. The mix designs are studied, M-25 grade of concrete are used and it is observed that all the fly ash based mixes are able to achieve the required compressive, split and flexural strength.

Key words: Concrete Blocks, Fly Ash, Quarry Dust, Compressive Strength, Split Tensile Test and Flexural Strength

I. INTRODUCTION

Concrete blocks have been broadly used in a number of countries for moderately some times as a particular trouble-solving technique. For providing concrete blocks are used in less durable due to many operational and environmental solutions. Interlocking connection of paving block, concrete technology has been introduced in India. For an every decade construction materials are increased in specific purpose like gardens, footpaths, parking areas, etc., every new technique have been adopted in different uses. When the conventional construction of pavement blocks using hot bituminous mix or cement concrete technology is not practical or popular.

Interconnecting concrete paving blocks are manufactured from partially dry mixes. During the manufacturing process shaking and stress is applied to the mix. By this process thick and tough concrete blocks can be achieved to strong and heavy-duty paving surfaces. The behavior of concrete paving block gives the ability of distributing loads to superior areas. Interconnecting concrete paving blocks has numerous advantages over asphalt and concrete pavements.

II. CONCRETE BLOCK

Pavement concrete blocks were first introduced in Holland. In those blocks has a replacement of paver blocks which had become limited due to building construction explosion. These blocks were rectangular in shape and had relatively same size as a brick. In India, concrete pavement block introduced for a specific purposes of footpaths, parking areas, veranda etc.

In infrastructural development in India, demand of paving blocks is increasing gradually. At the same time, the sum of different types of waste generated is also growing. Therefore manage of waste disposal shall be given top main concern.

III. ADVANTAGES

The use of 4R policies is considered a merit .The various advantages are

- Using waste material is reducing the cost of manufacturing
- Solving the problem of disposal of construction waste
- Helping in protecting environment.
- Conserving mineral resource of a country
- Preventing environmental Pollution.

IV. DISADVANTAGES

The use of 4R (Reclaim, Reuse, Recycle, and Reduce waste) policies is considered a merit. Although 4R policies have increased sustainability and energy efficiency levels of the pavement technologies, there are still many technical and environmental concerns in the waste storage concern.

V. SCOPE

The main scope of the system can be briefed as

- Economical
- Durable
- Safe
- Recyclable

VI. OBJECTIVE

The main objective of the proposed system is to carry out an experiment study on high strength concrete block by using waste materialsand using waste material to reduce the manufacturing cost.

VII. PROPERTIES OF MATERIALS

A. Cement:

Ordinary Portland cement of 43 grade locally available is used.The cement is tested for various properties as per the IS 4031-1988 and having specific gravity 3.1.

B. Fine Aggregate:

Locally available clean, well graded, natural river sand having fineness modulus of 2.89 and specific gravity of 2.67.

C. Coarse Aggregate:

Crushed angular aggregate of size 20 mm nominal size from the local source with specific gravity of 2.84. The properties of coarse aggregate are listed in table 3.1.

Properties	Value
Specific gravity	2.75
Impact	15.49 %
Crushing strength	5 %
Abrasion	3.16 %

Table 3.1: Properties of Coarse Aggregate

D. Fly Ash:

Ordinary class F fly ash of cementations property collected from the nearer thermal power plant of specific gravity 2.31 is taken.

E. Quarry Dust:

The basic tests on quarry dust were conducted and its specific gravity was around 1.95.

F. Water:

Locally available potable water confirming to standard specified in IS 456-2000 is used.

G. Mix Proportion:

Cement = 425.78 kg/m3
Fine aggregate = 627.45 kg/m3
Coarse aggregate = 1201.75 kg/m3
Water cement ratio = 0.45

Specimen	Cement Kg/M^3	Fly Ash Kg/M^3	F.A Kg/M^3	Quary Dust Kg/M^3	C.A Kg/M^3
S1	340.62	85.15	564.7	62.75	1201.75
S2	319.3	106.4	596.08	31.37	1201.75
S3	361.9	63.86	533.34	94.11	1201.75

Table 3.2: Mix proportion

VIII. EXPERIMENTAL PROGRAM

M25 concrete design mix was made and cubes of size 150 x 150 x 150 mm and cylinders of size 150 x 300 mm and concrete beam of size 100 x 100 x 500 mm and concrete block size 200 x 150 x 100 mm were casted. The specimen details are given in table 4.1.

In this experimental work, a total of 72 numbers of concrete specimens were casted in 27Cubes, 18 cylinders, 18 prisms and 9 concrete blocks. Cubes were tested for compressive strength at 7, 14 and 28 days. Cylinders were tested for split tensile strength at 28 days and flexural strength at 28days.

Specimen ID	Description
CC	Conventional concrete
S1	20% FA + 10% QD
S2	25%FA + 5% QD
S3	15% FA + 15% QD

Table 4.1: Specimen details

A. Compression Strength Test:

For evaluating the compressive, specimens of dimensions 150 x 150 x 150 mm were prepared. They were tested on compressive testing machine as per IS 516-1959. The failure of cubes before and after loading is shown in fig. 4.1 and fig 4.2. The compressive strength is calculated by using the equation,

$$F = P/A$$

Where, F is Force in N/mm2, P is Load in N, A is Area in mm2

B. Split Tensile Strength Test:

For evaluating the tensile strength, cylindrical specimens of diameter 150 mm and length 300mm were prepared. Split tensile test was carried out in compression testing machine as per IS 5816-1999.

The failure of cylinders before and after loading is shown in fig. 4.4. The tensile strength of is calculated using the equation,

$F = 2P/\pi LD$

Where, F is Force in N/mm2,
P is Load in N,
L is Length of the specimen in mm,
D is cross section of dimension or diameter in mm

C. Flexural Strength Test:

The flexural strength was then calculated using the formula below:

Where, p = breaking load (in N)
l = distance between the supporting rollers (in mm)
b = measured width in cm of the specimen (in mm)
d = measured depth in cm of the specimen (in mm)

IX. RESULT & DISCUSSION

A. Compression Test Result:

The Average compressive strength of cube specimens made is shown in table 5.1. Fig. 5.1 shows the average compressive strength of cubes made with various replacement levels of fly ash. shows the comparison of the strength of cubes at various flyash replacement levels for 7, 14 and 28 days respectively.

Specimen ID	Average compression test result (N/mm^2)		
	7 days	14 days	28 days
CC	15.99	23.99	26.66
S1	15.86	23.79	26.44
S2	16.53	24.79	27.55
S3	15.46	23.19	25.77

Table 5.1: Average compression test result

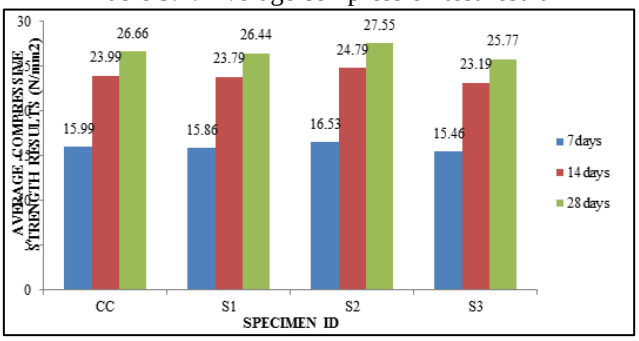

Fig. 5.1: Average compressive strength results of cubes

B. Split Tensile Test Result:

The Average split tensile strength of cube specimens made are shown in table 5.2. Fig. 5.2 shows the average split tensile strength of cylinders made with various replacement levels of fly ash for 28 days respectively.

Specimen ID	Average Split Tensile strength test (N/mm^2)
	28 days
CC	3.5
S1	2.9

S2	3.9
S3	3.1

Table 5.2: Average split tensile strength test

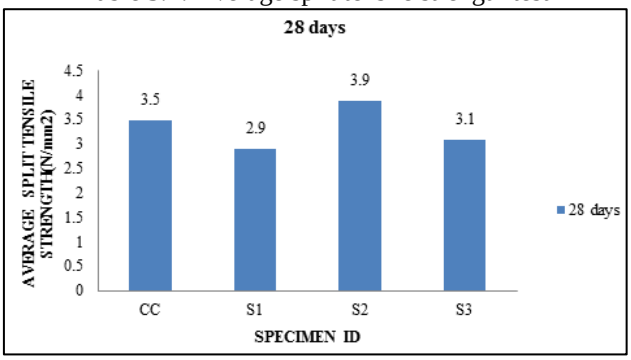

Fig. 5.2: Average split tensile strength of the cylinders

C. Flexural Strength Test Result:

The Average flexural strength of cube specimens made are shown in table 5.3. Fig. 5.3 shows the average flexural strength of beams made with various replacement levels of flyash for 28 days respectively.

Specimen ID	Average Flexural strength test (N/mm^2)
	28 days
CC	3.61
S1	3.59
S2	3.67
S3	3.55

Table 5.3: Average flexural strength results

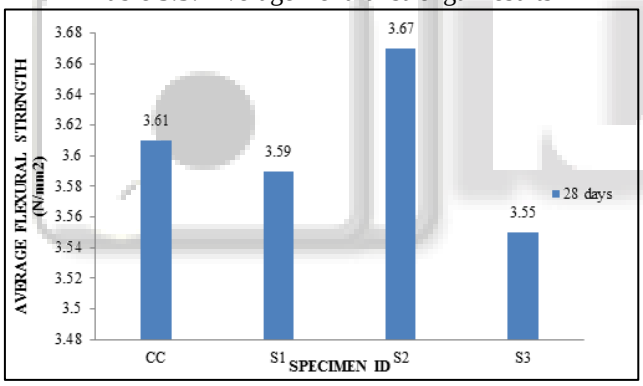

Fig. 5.3: Average Flexural strength of the prism

D. Compressive strength of concrete blocks:

The Average flexural strength of cube specimens made are shown in table 5.4. Fig. 5.4 shows the average compaction of concrete blocks made with various replacement levels of fly ashfor 28 days respectively.

Specimen ID	Average compressive strength of concrete blocks(N/mm^2)
	28 days
CC	15.99
S1	15.33
S2	16.53
S3	15.46

Table 5.4: Average compressive strength of concrete blocks

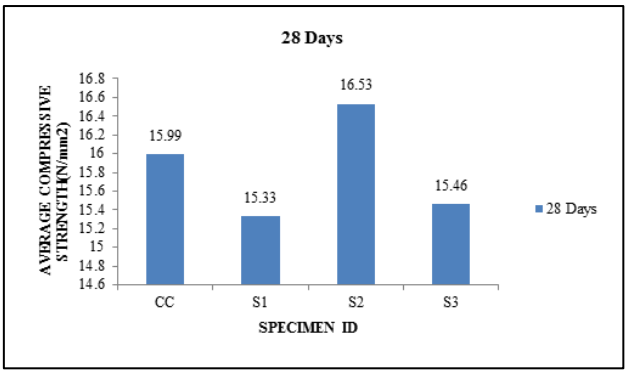

Fig. 5.4: Average compressive strength of concrete blocks

X. Conclusion

Based on experiment study of concrete block by using waste materials with various percentages, the following conclusions have been arrived.

- Generally, the first cracking load absorbed in concrete specimen by using waste materials is less than that of normal concrete.
- So, that the concrete specimen by using waste materials can avoid crack and it provides better elongation property.
- The tensile strength of concrete specimen using waste materials is about 10% higher than that of conventional normal concrete.
- Higher compressive strength and flexural strength was achieved when cement was replaced by proportion of 25% fly ash and 5% quarry dust.
- Concrete blocks are more economical than the conventional concrete. It will give more strength achieved after 28days of testing.

Hence, the Concrete blocks are more strength and low cost products used in construction fields.

References

[1] Joel Santhosh ,RavikantTalluri4, April (2015), "manufacture of interlocking concrete paving blocks with fly ash and glass powder", Volume 6, pp 55-64.

[2] Khandve P. V, Rathi A. S. December (2015), "Concrete Paving Block using Marble Stone Industry Waste", volume 1, number 8, pp 86-91.

[3] SomNathSachdeva, VanitaAggarwal, S. M. Gupta(2014), "High Volume Fly Ash Concrete for Paver Blocks"Vol:8, No:3, pp 242-248.

[4] P.V. Khandve, A. S. Rathi- 2016, "Concrete Paving Block using Kota Stone Industry Waste", pp 1-4.

[5] Ritesh Mall, ShardaShrama,Prof. R.D.Patel, Issue 10, 2014 ,"Studies of the Properties of Paver Block using Fly Ash" , Vol. 2, pp 59-64.

[6] Koli Nishikant, Aiwale Nachiket, Inamdar Avadhut, Abhishek Sangar, 2016,"manufacture of paving block by using waste glass material", International Journal of Scientific and Research Publications, Volume 6 Issue 6, pp 61-77.

[7] DeveshMeena,05 Aug-2015 "a study on behavior of marble dust in concrete pavement", Volume: 02, pp 475-478.

[8] IS: 456-2000, 'Indian standard code for practice for plain and reinforced concrete', Bureau of Indian Standards, New Delhi, India.
[9] IS: 10262-2009, 'Recommended guidelines for concrete mix design', Bureau of Indian Standards, New Delhi, India.
[10] Shetty M.S. (2012) 'Concrete Technology', S Chand and Publications Pvt Ltd, New Delhi, India.

