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EXPERIMENTAL INVESTIGATION ON PAVER BLOCKS BY USING WASTE BOTTLE CAPS AS FIBRE

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ABSTRACT:- India is a developing country so here the construction of roadway and buildings plays on important role. Paver blocks are made from semi dry mixes of concrete with zero slump and stone chips lesser in size as compared to conventional concrete. The presently paver block is used in outdoor versatility application and also it is used in street road and other construction places. Paver block has low maintenance and easily replace with a newer one at the time of breakage. For improving strength and other parameters of paver block this study is necessary. In these project compressive strength, flextural strength and water absorption of paver block were evaluated by adding different proportions (1.5% to 6%) of shredded bottle caps in M40 grade concrete. The main objective of this project is to use waste bottle caps as a fibre for production of paver block which will useful in construction and makes eco-friendly.

KEY WORDS:- Steel Fibre reinforcement, compressive strength, flextural strength, and water absorption.

1. INTRODUCTION

Concrete block pavements are formed from individual solid blocks that fit closely next to one another to form a pavements surface. A typical concrete block pavements is placed on a thin bed of sand overlaying a sub base. Concrete block pavements can be placed with a variety of shapes and patterns. There are joint spaces between blocks. These spaces are filled with sand having suitable grading. The blocks are restrained from two sides by edge restraints. Concrete paver blocks are manufactured from semi-dry mixes. Concrete paver blocks has several advantages they are available in different shapes, sizes. Color and patterns. So we can create beautiful pavements with more strength. Maintenance is very easy, easily replaceable in very short time. Laying of paver blocks pavements has very less time. Before laying of road it gets its own strength by proper curing. Its life span is more. Easy to transport.

2. LITERATURE REVIEW

G.C. Behera[1], R.K, Behera[2] (1) Advances in technology enhance human comforts and in the same time damages the environment. Metals used as cap for containers preserve liquids in the bottles very well, but the disposal of caps particularly soft drink bottle caps is a headache to environmental engineers. On the other hand concrete, the most popular construction material, second highest consumed material after food is very strong in compression. Out of all these drawbacks low tensile strength is the important one and to counteract this problem some fiber like material can be added to concrete to increase its tensile strength. Hence an attempt has been made in the present investigations to study the influence of addition of waste material like soft drink bottle caps from workshop at a dosage of 0.25%, 0.5% and 1.0%, of total weight of concrete as fibres

Shivkumar Hallale[1], Shinde Swapnil[2] (2) The individual cellular structure is narrow and hollow, with thick walls of cellulose. It is pale in colour at immature stage but with age becomes hardened and yellow with deposition of lignin layer. Each cell is about 1mm long with diameter 10-20 µm. lignin content also imparts longevity to outdoor applications. Coir fibre nearly Generally length of fibre is found between 10 to 30 cm. Coconut coir has about 48% of lignin which adds strength and elasticity to the cellulose based fibre walls. Since lignin resists bio-degradation, high takes more than 20 years to decompose.

Sarang Shashikant Pawar[1], Shubhankar[2] (3) Use of concrete paver block is now a day becoming popular, they are used for paving of approaches, paths and parking area and also the pre-engineering building and pavements. This paper discusses the result of an experimental study conducted on fly ash, plastic sag strip and wire plastic. The concrete for paver block which is made up by adding plastic in concrete help to reduce plastic bag and also improve the tensile properties of the paver block. Using this type of the plastic and fly ash will reduce the cost of the paver block.

R. Thirukumara Rajavallapan[1], T. Dhamotharan[2] (4) The main objective of this project is to increase the compressive strength and to avoid the cracks that are developed to impact loading on the pavement blocks and thereby increasing the durability of the pavement blocks. Concrete pavement blocks are manufactured using cement, fine aggregate and coarse aggregate. In this project the steel fiber are added in 0.5%, 1.0%, 1.5% and

2.0% to the pavement block and determining the mechanical properties of the pavement block. The steel fibers are available abundant in nature.

3. USEFULNESS AND OBJECTIVES OBJECTIVE:

1. The objective of the project work is to study the mechanical properties of the pavement block such as, Compressive strength of pavement block, Water absorption test and Flextural strength of pavement block.
2. To uilization the waste materials.
3. To increase the strength of paver block.

USEFULNESS OF THE PROJECT:

1. Waste bottle caps are recycled and used for increase the strength of concrete.
2. To minimize the wastage of materials.
3. The great benefit of recycling waste material is that it plays a big part in protecting Mother Nature in the most balanced way.

4. MATERIALS AND MATERIAL PROPERTIES

a) Cement:

Ordinary Portland cement of 53 grade conforming to IS 12269 is used throughout the experimental program. The specific gravity of cement is 3.15 and its compressive strength after 28 days is found to be a 57mpa.

b) Coarse aggregate:

Crushed hard granite stone of maximum size 10mm is used for concrete. The specific gravity of coarse aggregate is found 2.74.

C) Fine aggregate:

Fine aggregate used for this entire investigation for concrete is river sand. The specific gravity of sand is 2.65.

d) Bottle caps as fibre:

Waste bottle caps were shredded into small pieces and mixed uniformly in concrete. Fig.1 shows bottle cap fibres ready for mixing in concrete

Fig.1 bottle caps as fibre

5. CASTING OF SPECIMEN

Concrete is prepared in the mixture and put in a tray. In these tray required quantity of bottle cap fibres are added and mixed properly. Fresh properties of concrete are determined. The specimens are cast. In the next day, Specimens were demoulded and put in a curing tank.

Fig.2 Casted specimen

6. TESTING

The test results with respect to compressive strength, Flextural strength and water absorption for control concrete and its containing fibres under Different periods are discussed in this chapter.

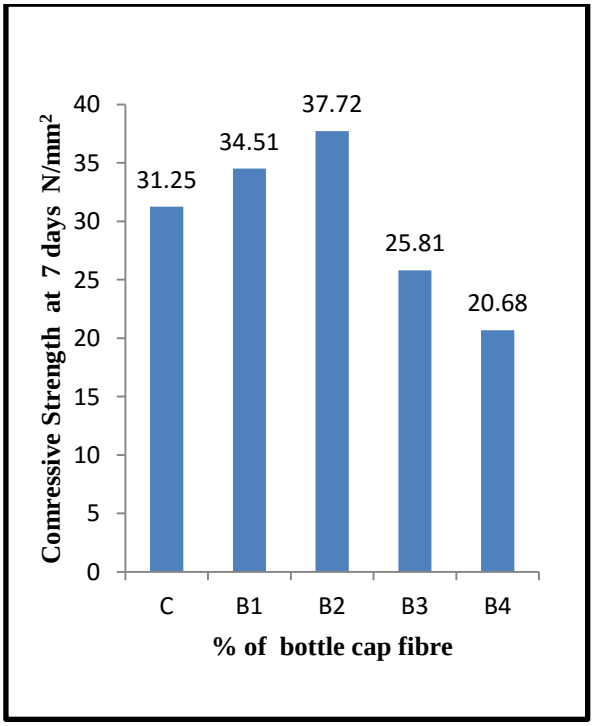
Fig .3 Testing of specimens

6.1 COMPRESSIVE STRENGTH:

The compression test was used to determine the strength of concrete. The strength of a concrete specimen depends upon cement, aggregate, w/c ratio, curing temperature and age and size of specimen. The compressive strength of mixes after different periods (for 7 and 28 days) is presented in Table. Compressive strength(N/mm^2) = p/A .

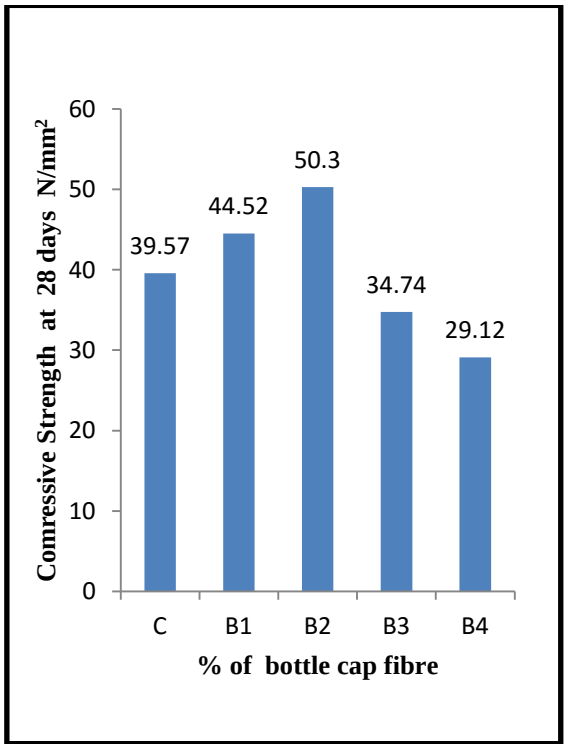
COMPRESSIVE STRENGTH OF PAVER BLOCKS FOR 7 DAYS

S. NO	SPECIMEN	COMPRESSIVE STRENGTH IN mpa	AVERAGE COMPRESSIVE STRENGTH IN mpa
1	C=C.C + 0% F	32.06	31.25
		30.14	
		31.55	
2	B1=C.C + 1.5% F	34.11	34.51
		34.94	
		34.49	
3	B2=C.C + 3% F	38.68	37.72
		37.63	
		36.86	
4	B3=C.C + 4.5% F	26.70	25.81
		25.50	
		25.23	
5	B4=C.C + 6% F	20.86	20.68
		21.53	
		19.66	



COMPRESSIVE STRENGTH OF PAVER BLOCKS FOR 28 DAYS

S. NO	SPECIMEN	COMPRESSIVE STRENGTH IN mpa	AVERAGE COMPRESSIVE STRENGTH IN mpa
1	C=C.C + 0% F	39.17	39.57
		39.46	
		40.09	
2	B1=C.C + 1.5% F	44	44.52
		44.73	
		44.83	
3	B2=C.C + 3% F	48.8	50.3
		50.81	
		51.29	
4	B3=C.C + 4.5% F	33.69	34.74
		35.87	
		34.68	
5	B4=C.C + 6% F	31.48	29.12
		28.28	
		27.61	



6.2 FLEXTURAL STRENGTH:

The load shall be applied from the top of the specimen in the form of a simple beam loading through a roller placed midway between the supporting rollers, as shown in fig. Loading of irregular shaped specimens shall be shown in fig, The load shall be applied without shock and increased continuously at a uniform rate of 6KN/min. The load shall be increased until the specimen fails, and

the maximum load applied shall be recorded to the nearest N.

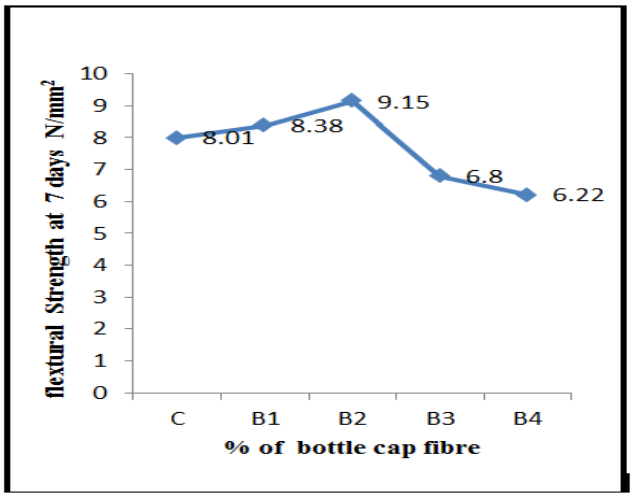
The result of flexural strength at 7 and 28 days was presented. The prism were tested using flexure testing machine of capacity 100kN.The graphical representation shows that in flexural strength test the maximum strength is attained at 3 % of bottle cap fibres shows good results

The flextural strength of the specimen shall be calculated as follows;

$F_b = 3pl/2bd^2$
p-load in specimen
l-length of the specimen
b & d -breath & depth of the specimen

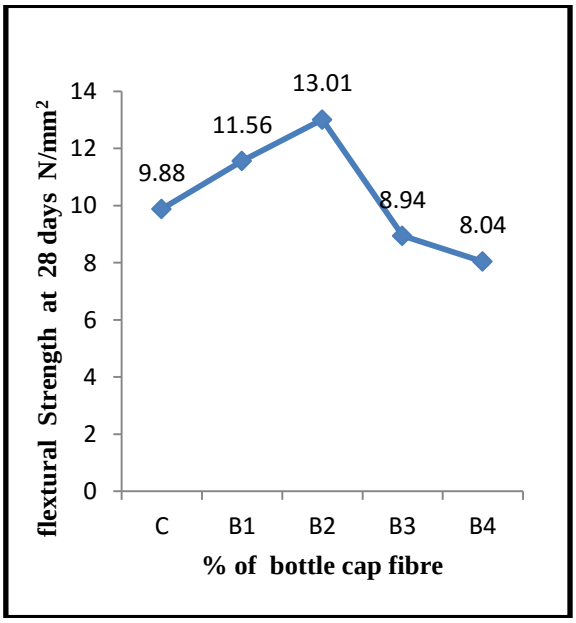
FLEXTURAL STRENGTH OF PAVER BLOCK FOR 7 DAYS

S. NO	SPECIMEN	FLEXTURAL STRENGTH IN mpa	AVERAGE FLEXURAL STRENGTH IN mpa
1	C=C.C + 0% F	8.01	8.01
		7.92	
		8.10	
2	B1=C.C + 1.5% F	8.39	8.38
		8.48	
		8.29	
3	B2=C.C + 3% F	9.18	9.15
		9.28	
		9.00	
4	B3=C.C + 4.5% F	6.84	6.80
		6.65	
		6.93	
5	B4=C.C + 6% F	6.18	6.22
		6.04	
		6.46	



FLEXTURAL STRENGTH OF PAVER BLOCK FOR 28 DAYS

S. NO	SPECIMEN	FLEXTURAL STRENGTH IN mpa	AVERAGE FLEXURAL STRENGTH IN mpa
1	C=C.C + 0% F	9.60	9.88
		10.26	
		9.79	
2	B1=C.C + 1.5% F	11.25	11.56
		11.81	
		11.62	
3	B2=C.C + 3% F	12.75	13.01
		12.56	
		13.73	
4	B3=C.C + 4.5% F	9.04	8.94
		8.95	
		8.85	
5	B4=C.C + 6% F	8.34	8.04
		7.92	
		7.87	



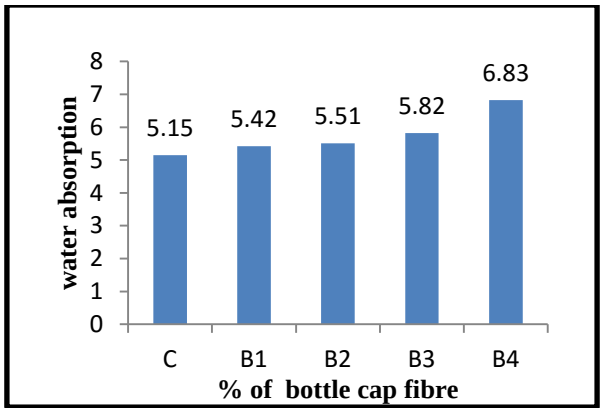
6.3 WATER ABSORPTION TEST:

The test procedures were followed by IS 15658 : 2006 In Annex C. The test specimens were completely immersed in water for 24 hours. Then the specimen is taken out from the water and allowed them to drain for 1 minute. Then the specimen were wiped off and weighted immediately and weight of each specimen was noted. This can be represented as Ww. Then these specimen were dried in a ventilated oven at 107±7°C for 24 hours. The dry weight of each specimen was recorded and cf it is represented by Wd. The percentage of water

absorption could be calculated by, Water absorption % = (Ww-Wd/Wd) x 100

WATER ABSORPTION TEST FOR PAVER BLOCK

S.N0	SPECIMEN	WET WEIGHT Ww	DRY WEIGHT Wd	W%
1	C=C.C+0% F	5.92	5.63	5.15
2	B1=C.C+1.5% F	5.84	5.54	5.42
3	B2=C.C+3% F	5.74	5.44	5.51
4	B3=C.C+4.5% F	5.64	5.33	5.82
5	B4=C.C+6% F	5.94	5.56	6.83



7. CONCLUSIONS

The addition of bottle caps (0, 1.5, 3, 4.5, 6%) to the paver block, gives the result for the compressive strength, flexural strength and water absorption.

It is found that there is a gradual increase in the strength of the concrete on the % of bottle cap as a fiber added till the 3% it decrease gradually on extra addition. Hence it is found than 3% of bottle cap fibre is optimum in all compressive strength, flexural strength.

The experimentation also give a good alternative for an effective use of waste bottle caps rather than to spare extra efforts on their recycling and dumping.

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