ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 4, Special Issue 11, March 2017

EXPERIMENTAL INVESTIGATION ON PAVER BLOCKS WITH PARTIAL REPLACEMENT OF CEMENT WITH SUGARCANE BAGASSE ASH

R.SURESH[1] , L.SUBBIAH, T.TAMILARASAN[3] , S.TAMILSELVAN[4] ,MOHAMED S.SHAHID[5].

[1]Assistant Professor, Department of Civil Engineering, Mahendra College of Engineering, Tamilnadu, India.

[2] B.E. Scholar, Civil Engineering, Mahendra College of Engineering, Tamilnadu, India.

[3] B.E. Scholar, Civil Engineering, Mahendra College of Engineering, Tamilnadu, India.

[4] B.E. Scholar, Civil Engineering, Mahendra College of Engineering, Tamilnadu, India.

[5] B.E. Scholar, Civil Engineering, Mahendra College of Engineering, Tamilnadu, India.

[1]santhoshcivil3@gmail.com

[2]aakashkannan53@gmail.com

Abstract- **Paver blocks are stone building materials in the form of solid rocks which is used in the road platforms and the building parkings.Pavement is a paved path for pedestrians besides the road.The purchase cost of cement is more nowadays and is increasing day by day.In this kind condition,an alternative material which would best suit in replacing cement is sugarcane bagasse ash.**

1.INTRODUCTION TO PAVER BLOCKS:

It is a structure prepared by mixing cement, fine aggregate, and stone chips. There are different shapes of paver blocks used for their purposes. Paver blocks are cost effective when compared to clay or natural stone blocks whereas one paver block costs around 15rs.

1.1: INTRODUCTION TO SUGARCANE BAGASSE ASH:

Sugarcane bagasse ash is obtained by burning the sugarcane bagasse which is abundantly available. The ash which is collected after burning in the specific temperature is tested and observed it has high similarities of the chemical constituents of cement. Hence it is partially replaced with cement.

1.2ADVANTAGES OF POND ASH PAVEMENT BLOCK OVER CONVENTIONAL BLOCK

- Reduction of cost – 20% less than Concrete Pavement Blocks.
- Save construction cost – Due to the uniform shape and size of the pavement block, it saves labor in laying pavement blocks by 15%.
- Reduce storage area –By1 utilizing sugarcane bagasse ash for manufacturing pavement blocks the storage area will be reduced.
- Cleans outdoor air – Using of sugarcane bagasse ash pavement blocks cleans the outdoor air. Due to foregoing, the sugarcane bagasse pavement block is not only a low-cost, high quality pavement block; it is also the “Green pavement block” of the future

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 4, Special Issue 11, March 2017

- The use of green pavement block in the future would contribute not only to lower construction cost for housing but also to a cleaner and healthier environment.

2. CHEMICAL COMPOSITION OF CEMENT:

Table 1 chemical composition of cement

Chemical Composition	% Content
Lime	61.8
Silica	21.2
Alumina	5.3
Iron Oxide	3.4
Magnesium Oxide	0.6
Chloride	0.1
Loss on ignition	2.8

3.CHEMICAL COMPOSITION OF LIME: The chemical composition of lime is given in table 2. Lime is collected from chemplast nearby Pollachi.

Table 2 Chemical composition of lime

S.NO	PROPERTY	% VALUE
1	Silica	2.6
2	Calcium hydroxide	44.9
3	Magnesium hydroxide	Nil
4	Iron oxide	0.21
5	Aluminum oxide	0.36

4.FINE AGGREGATES:

The material which is passed through BIS test sieve no.480 is termed as a fine aggregate. Usually the natural river sand is used as a fine aggregate. Fine aggregate shall be of coarse aggregate consisting of hard, sharp and angular grains and sand shall be of clean and free from dust, dirt and organic matters. Sea sand shall not be used.

5. COMPARISON OF CHEMICAL COMPOSITION OF SUGARCANE BAGASSE ASH:

Table 3: comparison of chemical composition of sugarcane bagasse ash:

	CEMENT	BAGASSE ASH
Silica	20.6	76.16
Alumina	6.3	11.07
Iron oxide	3.6	3.70
Lime	63.1	2.52
LOI	1.58	3.58

6. STANDARD MIX PROPORTION:

The standard mix proportion is given in table 4. The pavement blocks are manufactured by South Indian Corporation (SIC) at Mahendra College of Engineering.

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 4, Special Issue 11, March 2017

Table 4: Standard mix proportions for Concrete Pavement Block

MATERIAL	MIX PROPORTION IN %
Cement	22
Sand	43
Stone chips	35

6.1.MIX PROPORTION OF M_{25} :

SAMPLE	I in %	II in %	III in %	IV in %
MATERIAL				
Cement	14	14.5	15	16
Pond Ash	6	6	5.5	2.5
Lime	2	1.5	1.5	3.5
Sand	43	43	43	43
Stone Chips	35	35	35	35

6.2..MIX PROPORTIONS OF M30:

Table 5: Mix proportions of m30:

SAMPLE / MATERAL	I in %	II in %	III in %	IV in %	V in %
Cement	20	19	18	17	16
Sugarcane bagasseAsh	1	1.5	2	2.5	3
Lime	1	1.5	2	2.5	3
Sand	43	43	43	43	43
Stone Chips	35	35	35	35	35

7.TEST ON PAVER BLOCKS:

There are 5 different tests done on paver blocks

7.1.Compressive strength test on blocks

7.2. Water absorption test

7.3. Shape and size test:

7.4.Efflurescence test

7.5. Weight density test

7.1.Compressive strength test on blocks:

Compressive strength on blocks are tested after 7days and 28days using compressive strength test machine. The compression strength of conventional pavements is $30N/mm^2$.

7.2.Water absorption test:

Water absorption test is done by calculating the weight of wet blocks(w_1) and weight of blocks after drying(w_2).It is calculated by using the formula

$$(w_1 - w_2)/ w_1 = w$$

7.3.Efflurescence test:

Efflurescence is nothing but white deposits on the blocks after curing. It is tested physically by seeing with naked eye. The observations are recorded

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 4, Special Issue 11, March 2017

and the values are compared with area of blocks. The result should be within or less than 10% .

7.4.Shape and size test:

The shape of the blocks are in hexagonal. The size of the blocks is 25×13×5 cm. The size and shape should remains same after curing of 28days

8.RESULT:

8.1. GENERAL:

In this chapter, results and discussions based on the experimental investigations carried out on the compression test, water absorption test, efflorescence test, shape and size test and weight density test are presented.

8.2. RESULTS:

The compression test, water absorption test, weight density test results are given in the tabulations 11, 12, 13, 14. Shape and size test and efflorescence test results are given.

8.2.1. COMPRESSION TEST:

Compressive strength for M25

SAMPLE	**COMPRESSIVE STRENGTH, N/mm^2**	
	7th day	**28th day**
I	14.96	23.28
II	16.52	24.28
III	15.21	23.42
IV	18.26	26.34
V	17.42	27.80

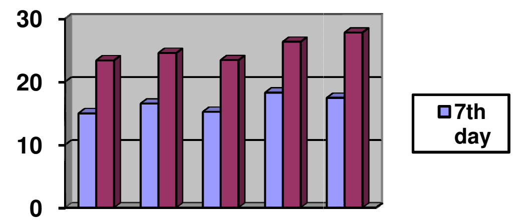

Table **13 Compressive strength for M30**

SAMPLE	**COMPRESSIVE STRENGTH, N/mm^2**	
	7th day	**28th da**
I	21.34	32.26
II	22.68	31.87
III	25.87	30.88
IV	20.29	30.12
V	19.23	29.67

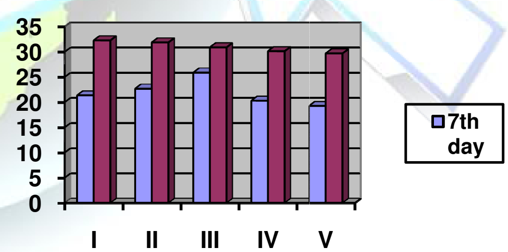

Chart 4: compressive strength for M30

8.2.2. WATER ABSORPTION TEST:

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 4, Special Issue 11, March 2017

Table 14 Water absorption test

SAMPLE	WATER ABSORPTION VALUE IN %	
	M25	M30
I	18	19
II	19.5	18.5
III	22	22.5
IV	19	19
V	18.5	20.5

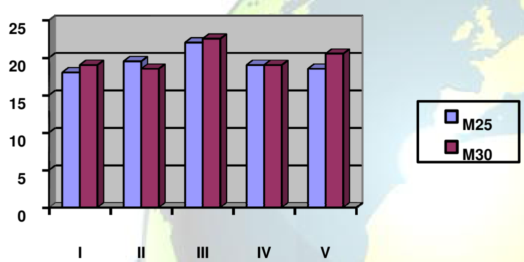

Chart 5: water absorption value

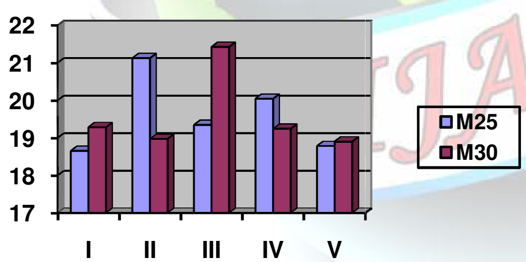

Chart 6: Density value

From compressive strength results, In M25 the strength has been attained in samples 4 and 5 when compared to other samples. Also in M30, the strength has been attained in samples 1, 2 and 3 when compared to other samples. Water absorption and weight density values of all samples are obtained the standard value.

8.2.3SIZE AND SHAPE TEST:

In this test, block is very closely inspected. The mould is found to be Ace shape. Its shape is also found to be Ace and with good finish.

8.2.4. EFFLORESCENCE TEST:

After the immersion of pavement block in water for 24 hours, it is taken out and allowed to dry. The absence of grey or white deposits on its surface indicates the absence of soluble salts. If the efflorescence is said to be slight then it is considered as moderate. The efflorescence in the block is also slight, so it is considered as moderate.

9.COST ANALYSIS

9.1. GENERAL:

We are using sugarcane bagasse ash, lime, Sand, Cement and for manufacturing pavement block. sugarcane bagasse ash and lime is replaced to Cement in order to reduce the cost.

The transportation charges, electricity charges, machinery charges and labour charges are taken into account when calculating the cost of the pavement blocks.

9.2. ANALYSIS OF RATES:

The costs of the materials are collected from various places. The rates of materials (per KG) are given below:

1. Cement = Rs 4.60
2. Pond ash = Rs 0.30
3. Lime = Rs 1.75
4. Sand = Rs 0.30
5. Stone Chips = Rs 0.33

The rate of normal concrete block used in the market is Rs.15. By using Pond Ash and other

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com

International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 4, Special Issue 11, March 2017

materials, the cost of the pavement block is reduced to Rs.11.

9.3. COST COMPARISON:

The cost of the pavement block for M_{25} and M_{30} are given in table 12. By taking in account all the above charges, the cost of the block is calculated.

Table.16 - Rate Analysis

SAMPLE	COST PER BLOCK	
	M_{25}	M_{30}
I	10.51	11.48
II	10.59	11.43
III	10.65	11.35
IV	10.77	11.20
V	10.85	11.12

9.4. CALCULATION OF COST:

Table.17 – Cost Calculation

CONTENT	COST
Material cost	6.51
Labour cost	1.5
Machinery cost	2
Curing cost	0.50
Total	10.51

The conclusion is that, by utilizing sugarcane bagasse Ash, it can able to produce the strength as that of normal pavement blocks and reduce the cost of the block.

10.CONCLUSION

10.1. CONCLUSION:

1. The results obtained shows that Sugarcane bagasse Ash without any processing could replace cement up to 15% by weight. This replacement does not negatively affect the mechanical properties of cement products. Finally, the mix proportion is arrived for $M_{25}$and M_{30} with replacing Sugarcane bagasse Ash and Lime with cement.
2. In addition the content of pond ash in free calcium and sulphates does not seem to affect the strength of the blocks (Up to 15% cement replacement). So by effectively utilizing Sugarcane bagasse ash, the pavement blocks are casted at a reasonable cost when compared to concrete pavers.
3. Sugarcane bagasse ash is waste material. The cost per block is reduced by using Sugarcane bagasse ash and the strength is also increased when compared to other pavement blocks.
4. These blocks can be used for Low, Medium Traffic pavements according to the compressive strength attained.
5. The polluting Sugarcane bagasse ash material is used effectively for manufacturing pavement blocks. The cost of pavement block is reduced by 20% when compared to other blocks.
6. In future, this block is also can be used for high traffic pavements.

11. REFERENCES:

1. A STUDY ON SILICA AND ALUMINA POTENTIAL OF SUGARCANE BAGASSE ASH **S.Affandi,H.Setywan,S.Winardi,A.Purwanto and R.Bagis**,A.Facile method for production of High Purity silica from Bagasse Ash Advanced powder technology,20-200

The following conclusion were drawn

- 1.Burning bagasse leads to production of bagasse ash of up to 12.64% of the mass of the mass of the bagasse at 500c,10.899% at 600c and 9.9485 at 700c 2.Silica content of the bagasse ash on mass percentage basis were found to be 76.168%,76.292% and 77.286% for 500c,600c and 700c
- 3.Aumina contents on mass percentage basis were 11.079%,11.410% and 10.951% for 500c,600c and 700c respectively
- 4.Savannah sugarcane bagasse ash has high total content of silica and alumina and could therefore serve as reinforcement in aluminium matrix composites.

2. PROPERTIES AND REACTIVITY OF SUGARCANE BAGASSE ASH.

Ajay goyal,Mandula Hattori 2003-05.

Ashes obtained after control burning of SCB at 600c/5 hours were reasonably reactive given by the fact that little crystallization of minerals occured.

- Morphological study of the blended pastes confirmed the hydration reaction of SCBA and cement gel.

Compressive and flexural strength tests confirmed the actual behaviour of SCBA blended mortars and it suggested that up to 15% substitution of OPC and SCBA can be made with better strength results than that with pure cement