

An Experimental Investigation of Partial Replacement of Fine Aggregate and Cement by using Plastic Crush and Sugarcane Ash in Pavement Block

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Abstract - An experimental investigation of recycled plastics as fine aggregate and sugar cane ash as cement in pavement block and its advantages are discussed here. The initial questions arising of the bond strength and the heat of hydration regarding plastic and sugarcane ash were solved. As 100% replacement of natural fine aggregate with plastic fine aggregate and sugar cane ash cement is not feasible, partial replacement at various percentage were examined. The percentage substitution that gave higher compressive strength was used for determining the other properties. In this, we study the efficiency of reusing plastic waste and sugarcane ash in pavement block by comparing compressive strength of pavement block whose fine aggregate is partially replaced by plastic(2%,3.5%,5%) and cement is partially replaced by sugarcane ash (2%,3.5%,5%) with control concrete of M20 grade at curing age of 7,14 and 28 days.

Keywords: sugarcane ash, plastic crush, compressive strength, pavement block.

1. INTRODUCTION

Concrete is a composite material consist of mainly water, aggregate, and cement. The physical properties desired for the finished material can be attained by adding additives and reinforcements to the pavement block mixture. Crushed plastic and sugarcane ash are replaced in place of cement and sand by the percentage of 2%, 3.5%, and 5%. The cement and sand were replaced individually by this sugarcane ash and crushed plastic and also in Combinations that is replacement of cement and sand at a time in single mix. For analyzing the suitability of these crushed waste plastic and sugarcane ash in the pavement block mix, workability test was conducted for different mixes having different percentages of these materials. Compressive strength test is also conducted for 7, 14 and 28 days curing periods by casting cubes to analyze the strength variation by different percentage of this waste materials. The waste crushed plastic are used to partially replace sand by 2%, 3.5% and 5%. sugarcane ash is also partial replace cement by 2%, 3.5%, and 5%.it is possible to use sugarcane bagasse ash as cement replacement material to improve the quality of pavement block and reduce the cost of construction materials such as mortar, pavement block. The purpose for the experiment was to determine how best to incorporate

construction waste materials back into pavement block saving both energy and reducing the need to discard plastic waste and sugarcane into landfills used.



2. mix design

2.1 Target Mean Strength Of Pavement Block:

The mean strength, $= f_{ck} + k_s = 26.6 \text{ Mpa}$

2.2 Selection of water-cement ratio:

26.6 Mpa = W/C ratio 0.50.

2.3 Determination Of Cement Content:

Cement $= \frac{191.6}{0.50} = 383 \text{ kg/m}^3$

2.4 Selection Of Water And Sand Content:

for 20mm maximum size aggregate and conforming to grading zone II, water content per cubic meter of pavement block =186 kg and sand content as percentage of total aggregate by absolute volume = 35 percent

Required water content = $186 + 5.58 = 191.61/\text{m}^3$

2.5 Determination Of Coarse And Fine Aggregate Contents

$$W = \left[W + \frac{C}{S_c} + \frac{1}{p} \frac{f_a}{S_{fa}} \right] \times \frac{1}{1000}$$

$$W = \left[W + \frac{C}{S_c} + \frac{1}{1-p} \frac{C_a}{S_{ca}} \right] \times \frac{1}{1000}$$

Fine aggregate = 546kg/m³

Coarse aggregate 1188kg/m³

Material	2%	3.5%	5%
Cement	1.96 kg	1.93 kg	1.9 kg
Fine aggregate	2.94 kg	2.895 kg	2.85 kg
Coarse aggregate	6 kg	6 kg	6 kg
Sugarcane ash	0.04 kg	0.07 kg	0.1 kg
Plastic crush	0.06 kg	0.105 kg	0.15 kg

3. Test on Result

Compressive Strength Test

The capability of pavement block to resist the loads liable to lessen the volume is 0.015m³ is termed as compressive strength for 28days



3.1 Result and Analysis

The pavement block pavement blocks were cast in the mould. The pavement block volumes 0.015m³ were cast for each mixes. The water cement ratio was fixed to 0.5. The conventional pavement block and non conventional pavement block pavement blocks were cast and allowed to curing for 7 days, 14 days and 28 days compressive strength test. The replacement percentages are 2 %, 3.5 % and 5 %.

3.2 compressive strength of normal pavement block

Curing period in days	Compressive strength in N/mm ²
7	23.2
14	24.7
28	26.1

3.3 Compressive strength replacement results of pavement block

S.No	Mix designation	Mix proportion in % (SCA+PC)	7days N/mm ²	14days N/mm ²	28days N/mm ²
1	M1	2+ 2	23.3	26	27.6
2	M2	3.5 + 3.5	23.6	26.3	29.3
3	M3	5 + 5	23.2	24.3	25.1

4. Conclusion

The experimental result shows that the increase in the strength of pavement block with use of sugar cane bagasse ash and plastic crush. Therefore, with the use of sugar cane bagasse ash and plastic crush in partially replacement of cement and fine aggregate in pavement block. We can increase the strength of pavement block with reducing the consumption of cement and fine aggregate. Also it is best use of sugar cane bagasse ash and plastic crush instead of land filling and make environment clean. Replacement of natural river sand by plastic waste and cement by sugarcane ash material in 2%, 3.5% and 5 % increase in the compressive strength of concrete up to acceptable limit. Compressive strength of pavement block with replacement of plastic waste and sugarcane ash gives the satisfactory result up to a 3.5% when a replacement of plastic waste and sugarcane ash in pavement block increases compressive strength 3.5 % than increase sugarcane ash and plastic crush in 5% compressive strength in reduced.

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