Cost Analysis of Concrete Pavement Blocks by Using Fly Ash and Sisal Fiber

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Abstract- *Concrete block pavements have been used in low-speed, heavily-trafficked urban streets, port facility loading terminals and most recently, on airfield taxiways at the Dallas Fort Worth International Airport. The concrete paving block market is still developing in the United States and is expected to expand considerably in the near future.*

The present experimental investigation examines the effect of fly ash, as partial replacement to cement and sisal fiber various properties of pavement block. Investigation is done on M30 mix using fly ash as partial replacement by weight of cement. Experimentation is carried out to find the compressive strength, flexural strength and abrasion resistance of the concrete paving blocks. Experimentation is also carried out analysis the production cost of concrete paving blocks by using Waste Material.

Keywords- Fly Ash, Sisal Fiber, Compressive Strength, Flexure strength, Abrasion Resistance.

I. INTRODUCTION

The Pavement blocks, which are industrial products of pre-fabricated unarmed concrete, having various dimensions and special morphology are used for pavement lying of residential project carrying pedestrian and vehicular traffic. Cement concrete paving block are precast solid products made out of cement concrete. The product is made in various sizes and shapes viz. rectangular, square and round blocks of different dimensions with designs for interlocking of adjacent tiles blocks .The raw materials required for manufacture of the product are Portland cement and aggregates which are available locally in every part of the country. Cement concrete paving blocks find applications in Pavements, footpaths, gardens, passenger waiting sheds, bus-Stops, etc.

The product is commonly used in urban areas for the above applications. Hence, the unit may be set up in urban and semi-urban areas, near the market. A lot of face-lift can be being given to roads, footpaths along the roadside. Concrete paving blocks are ideal materials on the footpaths for easy laying, better look and finish. Whereas the pavement blocks find extensive use outside the large building and houses, lots of these materials are also used in flooring in the open areas of public offices and commercial buildings and residential apartments.

II. OBJECTIVES

The following are the objectives of the research:

1) To observe the environmental impact for concrete by using fly ash, and Sisal fiber.
2) To Analysis the production cost of concrete paving blocks by using Waste Material.
3) To Analysis of solid waste problem.
4) To find the Compressive strength of M30 grade concrete by using fly ash, and Sisal fiber.
5) To obtain the flexural strength of M30 grade concrete by using fly ash, and Sisal fiber.
6) To obtain the abrasion resistance of M30 grade concrete by using fly ash.

III. SCOPE OF WORK

Although certain site conditions may create special benefits for using paving blocks, the following list comprises the major reasons for using paving blocks as a pavement surfacing.

Concrete paving blocks:

1. Provide a flexible pavement surface which is composed of durable, rigid materials.
2. Provide a low-maintenance or zero-maintenance pavement surface.
3. Can support large, concentrated loads and heavy, abrasive traffic.
4. Can support heavy loads over relatively weak sub-grades.
5. Are comparatively high-quality pavement materials as the blocks are centrally manufactured and tested before going to the job site.
6. Are resistant to environmental damage (e.g. freeze-thaw).
7. Are resistant to damage from fuel and oil spillage.
8. Allow for easy access to subsurface for utilities or sub-grade repair.
9. Are reusable (90 to 95 percent) after removing form an existing pavement surface.

10. Negate traffic delays because of curing.

IV. RESULTS AND COST ANALYSIS

Table 1 The 28th day's Compressive strength and Flexural Strength and Abrasion resistance of Concrete Paving Block for 0%, 25%, 35% & 50% of Fly Ash.

% Fly Ash	Mixed Design	Compressive strength (N/mm^2)	Flexural strength (N/mm^2)	Abrasive resistance (mm3)
0	M30	29.92	3.30	-
25% Fly Ash	M30	35.08	4.75	2707.09
35% Fly Ash	M30	38.35	6.99	2824.16
50% Fly Ash	M30	32.08	5.85	2747.42

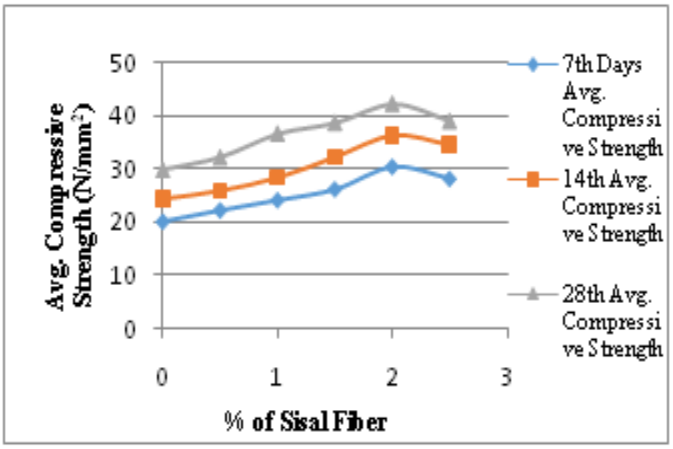

Figure1 Shows the variations of average compressive strength of concrete pavement block for various % of Sisal fiber.

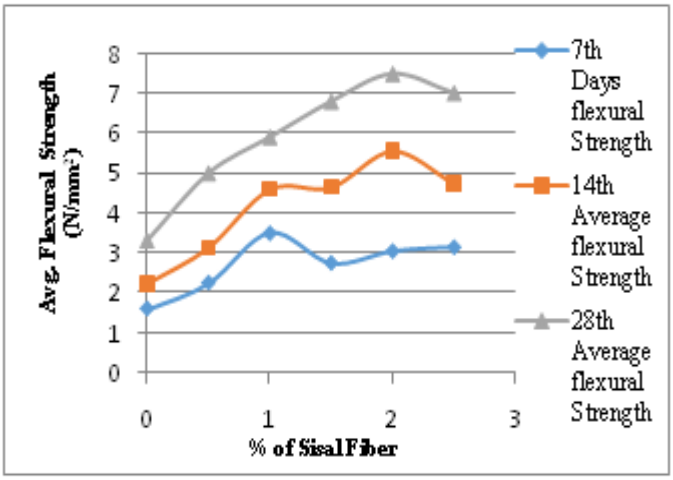

Figure 2 Shows the graphical representation of average flexural strength of concrete pavement block with various % of Sisal fiber.

Table 2 Cost analysis of Fly Ash (F.A.) for M30 grade of project- for 1m3 of concrete.

Material	Rate (Rs.)	Cost of concrete (Rs.)			
		P.C.C	25% F.A. replace Concrete	35% F.A. replace Concrete	50% F.A. replace Concrete
Cement	6.4/kg	2624	1968	1705.6	1312
Fine Aggregate	2800/br	521	521	521	521
Coarse Aggregate	2300/br	318	318	318	318
Fly ash	9.5/Kg	-	57	76	85.5
Admixture	35/Kg	144	144	144	144
	Total (Rs.)	3607/-	3008/-	2764.6/-	2380.5/-
28th days compressive strength N/mm^2		29.92	35.08	38.35	32.08
28th days Flexural strength N/mm^2		3.30	4.75	6.99	5.85

Table 3 Cost analysis of Sisal Fiber for M30 grade of project - for 1m3 of concrete

Material	Rate (Rs.)	Cost of concrete (Rs.)				
		P.C.C.	C.C+1% Sisal fiber	C.C+1.5 % Sisal Fiber	C.C+2% Sisal fiber	C.C+2.5% Sisal Fiber
Cement	6.4/kg	2624	2624	2624	2624	2624
Fine Agg.	2800/ br	521	521	521	521	521
Coarse Agg.	2300/ br	318	318	318	318	318
Sisal Fiber	28/Kg	-	58	66	78	84
Admix.	35/Kg	144	144	144	144	144
	Total (Rs.)	3607 /-	3665/-	3673/-	3685/-	3691/-
28th days comp.strength N/mm^2		29.9 3	36.75	38.82	42.37	39.12
28th days Flexural strength N/mm2		3.31	5.89	6.78	7.47	6.99

IV. ENVIRONMENTAL IMPACT

1. The fly ash saves the raw materials such as limestone,
2. Coal required for manufacture of cement.
3. In the manufacturing of one tone of cement about 1 tone of CO_2 is emitted and goes to atmosphere. Less requirement of cement means less emission of CO_2 result in reduction in green house gas emission.
4. Fly ash improves soil texture and reduces bulk density.
5. Sisal Fiber improved fatigue and impact resistance.
6. Sisal Fiber Enhanced durability.
7. Sisal Fiber Increased toughness and Higher bond strength.
8. Sisal Fiber Increase crack resistance and chemically inert.

IV. CONCLUSIONS

1. The increased use of fly ash in cement and concrete manufacture is beneficial to the environment. A 14% reduction in overall environmental impact for concrete of equal 28 day strength is possible by using 35% FA addition as part of the total cement content.
2. 2. Fly ash as a replacement to the cement will solve two problems with one effort, namely, elimination of solid waste problem on one hand and provision of a needed construction material on other hand. The Sisal Fiber and fly ash reduces the cost production of concrete.
3. Abrasion resistance value obtained for 35% fly ash replacement is more than that of 50% fly ash replacement. Hence, as per IS 15658: 2006 these blocks can be used for Medium Traffic roads.
4. The percentage increase in compressive strength of concrete cubes is 29.36% at 0% to 2 % of Sisal fiber.
5. The percentage increase in flexural strength of concrete beam is 55.76% at 0% to 2 % of Sisal fiber.

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