ISSN XXXX XXXX © 2017 IJESC

Research Article Volume 7 Issue No.7

To Analysis the Effective Use of Sisal Fibers, Fly Ash and Glass Powder in Concrete Paving Block and It's Study on Compressive Strength

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Abstract:
The rapid development in housing and infrastructure from last one decade continuously takes place in India. Along with that naturally the product required to overcome this development produce in mass quantities like Pavement blocks, which are known as industrial products of precast made up by concrete, having various shapes and sizes utilizes in huge quantity in housing and infrastructure construction. The conventional materials to manufacturing these blocks utilizes in large quantity, which may create impact on natural recourses. To overcome this impact we can use different materials such as, Sisal fiber waste glass, fly ashetc which helps to save natural recourses and achieve economy so that buyers and sellers of these type of materials can also get benefited. The present experimental research investigation examines the effect of waste glass, fly ash at partial replacement of fine aggregate and cement respectively, Experiment is done on M30 mix, with 15%, 30% & 45% partial replacement of both sand and cement .Similarly, sisal fiber is also added in the concrete paving block in 0.5%, 1% and 2% of weight of cement, so as to provide compressive strength to the same. After getting optimum percentage of all these, further experimental work is intended over the use of all these three in a single paving block. The replaced ingredients in this research are artificial waste or partially natural waste.Experimentation is carried out to find the compressive strength, abrasion resistance of the concrete paving blocks. Further these studies compare economical aspect of conventional product and new manufactured product

Keywords: Housing and infrastructure development, natural resources, Sisal fibers, glass, fly ash Compressive strength and flexure strength of concrete pavement block, economical aspect

I. INTRODUCTION:

Pavement blocks, which are industrial products of pre-fabricated unarmed concrete, having various dimensions and special morphology are used for pavement lying on 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 tile 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. A concrete paving block is an accurately dimensioned combination of well-graded aggregates and hydrated Portland cement which fits closely together with other paving blocks to form a pavement surface. The blocks are manufactured in wide variety of shapes. The blocks are then compacted with a manually operated vibratory plate compacted which seats the blocks in the sand layer, compacts the sand layer, and forces some sand into the joints between the blocks. Additional sand is then applied to the surface and swept into the joints between the blocks. More passes are made with the vibratory plate compactor to compact and wedge the sand into the joints. A base and sub-base course under the leveling course provides structural support similar to that of a conventional flexible pavement. Concrete block pavements provides low-maintenance, high-strength pavement surface that resists heavy, concentrated or abrasive loads and chemical spills involving fuel, hydraulic fluid, and other materials. Their modular nature and potential for reuse allow easy removal and replacement for access to bury utilities or to correct settlement. A block pavements unique characteristic (strength, abrasion resistance, flexible structure and aesthetics) make it applicable to many pavement uses, including military applications. Cement concrete paving blocks find applications in pavements, footpaths, gardens, passenger waiting sheds, bus-stops, industry and other public places. 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:

I. Study of properties of concrete ingredient (Conventional Concrete)
II. Study of properties of waste material (waste glass, fly ash and Sisal fiber)
III. Comparative Study between conventional concrete pavement block and waste material concrete pavement block with the following Tests (For M 30 Grade of Concrete)
i) Compressive strength

III. PROBLEM STATEMENT :

In Current days the construction of roads and buildings are increasing rapidly in our country. Due to these construction, more consumption of course aggregate and fine aggregate takes place, but for manufacturing of these requires the natural resources, So due to this large amount of natural resources are utilized which causes environmental imbalance, so need of alternative materials essentially require to partially replacement of these ingredients, effective use of waste glass, fly ash and Sisal fiber can be best alternative for course, fine aggregate and cement for manufacturing of concrete pavement blocks.

METHODOLOGY:

The total experimental approach involved in this work has been divided into three different phases. The details of the work in phase are narrated below.

Step 1- Collection of glass, fly ash and Sisal fiber from the adjoining a industry and thermal power plant.
Step 2- Further analysis of the concrete ingredients glass, fly ash and Sisal fiber be carried out, to identify the physical and engineering properties
Step 3: The glass, fly ash and Sisal fibers are added in different proportion to concrete mix design for M 30 of concrete and element like a cube of this concrete are to be casted.
Step 4- Different tests will be carried out on cast elements and test results will be compared with conventional concrete.
Step 5: With the help of this, waste based concrete pavement blocks will be casted and tested, & waste material concrete pavement block will be carried out.

IV. RESULTS AND DISCUSSIONS:

In this phase of work, the experimental work is intended to find out the optimum percentage of all the three wastes (fly ash, waste glass & sisal fiber) that can be utilized in concrete pavement blocks effectively.

The following different tables show the comparison in strengths of normal concrete and that with replacement.

1) Fly ash replacement = (15%, 30%, 45% by weight of cement)
2) Waste glass replacement = (15%, 30%, 45% by weight of fine aggregates)
3) Sisal addition = (0.5%, 1%, 2% by weight of cement)
4) Method of compaction = Hand compaction.

Tests on Concrete cubes:

Table.1. Normal Concrete Without Any Replacement)

Sr No.	Days	Comp. Strength (N/mm²)
1.	3 Days	13.98
2	7 Days	23.13
3	14 Days	29.32
4	21 Days	31.46
5	28 Days	35.21

Table.2. Fly Ash Replacement)

Sr No.	% of Replacement	Days	Comp. Strength (N/mm²)
1	15	3 Days	14.02
2	30		12.19
3	45		10.56
1	15	7 Days	24.01
2	30		22.91
3	45		20.78
1	15	14 Days	29.67
2	30		27.01
3	45		23.65
1	15	21 Days	31.18
2	30		29.41
3	45		27.33
1	15	28 Days	35.01
2	30		33.28
3	45		30.22

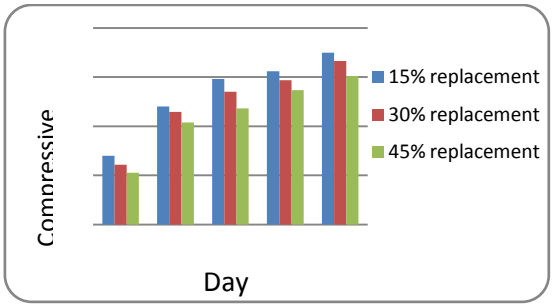

Figure.1. Optimum Result for fly Ash Replacement

Table.3. Waste Glass Replacement

Sr No.	% of Replacement	Days	Comp. Strength (N/mm²)
1	15	3 Days	12.34
2	30		17.42
3	45		15.68
1	15	7 Days	20.34
2	30		24.98
3	45		22.48
1	15	14 Days	24.12
2	30		30.21
3	45		28.36
1	15	21 Days	29.36
2	30		33.82
3	45		31.28
1	15	28 Days	33.28
2	30		35.64
3	45		34.18

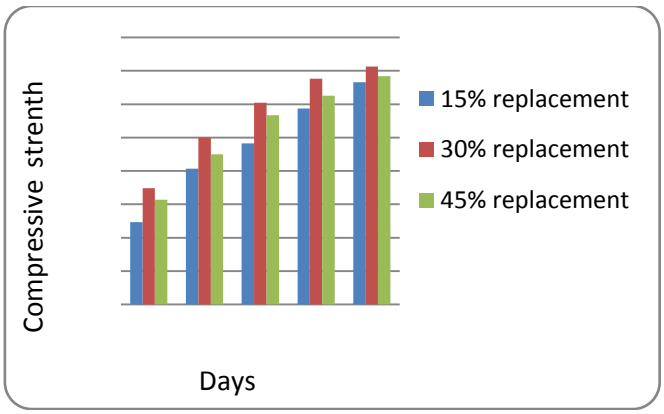

Figure.2. Optimum Result For Glass replacement)

Table.4. Sisal Fibers Replacement

Sr No.	% of Addition	Days	Comp. Strength (N/mm²)
1	**0.5**	**3 Days**	13.88
2	**1.0**		12.23
3	**2.0**		11.19
1	**0.5**	**7 Days**	24.39
2	**1.0**		23.11
3	**2.0**		21.38
1	**0.5**	**14 Days**	29.81
2	**1.0**		27.13
3	**2.0**		26.01
1	**0.5**	**21 Days**	32.41
2	**1.0**		30.13
3	**2.0**		28.64
1	**0.5**	**28 Days**	36.04
2	**1.0**		32.89
3	**2.0**		30.29

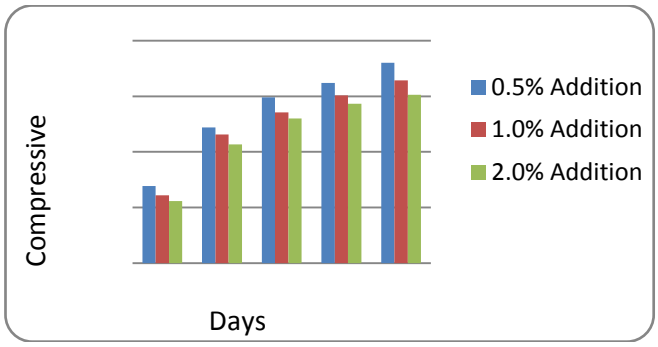

Figure. 3. Optimum Result Sisal Fiber Addition

The above optimization shows that, fly ash, waste glass and sisal fiber can be effectively added in the concrete paving blocks with 15% 30% & 0.5% respectively with their corresponding replacements.

TESTS ON PAVEMENT BLOCKS:

This work will give an idea that all the three waste materials can also be used by mixing all together with their optimum percentage.

1) Fly ash replacement = (15% by weight of cement)
2) Waste glass replacement = (30% by weight of fine aggregates)
3) Sisal addition = (0.5% by weight of cement)
4) Method of compaction = Table vibrator.
5) Method of curing = Dipping into curing tank (full curing), partial curing by spraying water over blocks & without curing

Table.5. Conventional Concrete Blocks Vs Paving block at 3,7,14, 21 & 28 days)

Sr No.	Days	Comp. Strength (N/mm²)	
		Conventional Paving Blocks	**Paving Block with waste materials**
1.	3 Days	14.01	14.89
2.	7 Days	23.32	24.01
3.	14 Days	29.81	31.39
4.	21 Days	31.68	33.23
5.	28 Days	35.83	36.89

V. CONCLUSION:

From the Experimental results we can conclude that,

1) Incorporating 15% Fly ash in place of cement helps to reduce the cost and thereby achieve economy with increase in compressive strength.

2) 30% waste glass in place of fine aggregate, gives acceptable mechanical properties with increased compressive strength at an age of 28 days.

3) Additional sisal fiber (0.5% by weight of cement), will provide compressive strength of concrete pavement block.

4) Based on the experimental investigation the following conclusions have been made:

- Fly ash can replace the cement 15%, which will help to reduce the cost & thereby bring economy.
- If the fly ash is added more than 15%, it will hamper the strength and will made it unacceptable as on 30% & 45% in the present experimental work.
- Density of concrete decreases with increase in waste glass content, thus making concrete blocks light weight in nature.
- The use of waste glass as fine aggregate decreases the unit weight of concrete.
- With increase in waste glass content, percentage of water absorption decreases.
- Workability of concrete mix increases, as well as durability of concrete also increases with waste glass content.
- Compressive strength increases with increasing the glass percentages from 15% to 30%, replacement of glass to the fine aggregate, and after 30%, waste glass replacement onward, the strength is decreases as the internal void of waste glass increases.
- Cost of paving blocks decreases with increase in glass content.
- Sisal fiber will develop the tensile strength in the concrete paving blocks which helps to give a long lasting performance by the paving blocks.
- If sisal fiber is added more than 0.5% it occupies the major volume of concrete, which will results to have honeycombing, and thereby reduces strength as creates voids in the concrete mix.

VI. ACKNOWLEDGEMENT

I would like to thank my Guide Prof. N.N. Morey and Head of Civil Engineering Department, Prof. A.P. Khatri for his vital support and assistance. Dr. D.S. Bilgi, Principal, Bhivarabai Sawant college of Engineering and Research, whose help and understanding point of view at every point during research helped me to work in time.

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