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"Experimental Investigation on Precast Cement Concrete Paver Block Manufactured by Industrial Wastes in Construction Management"

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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 in manufacturing these blocks are utilized in large quantity, which may create impact on natural resources. To overcome these impact we can use different materials such as, Sisal fiber, waste glass, fly ash etc, which helps to save natural resources 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 and sisal fibers 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.

Key Words: **natural resources, Sisal fibers, glass, fly ash, Compressive strength of concrete pavement block, economical aspect.**

1. INTRODUCTION

Concrete block pavements differ from other forms of pavement in that the wearing surface is made from small paving units bedded and jointed in sand rather than continuous paving. Beneath the bedding sand, the substructure is similar to that of a conventional flexible pavement. In concrete block pavement the blocks are a major load-spreading component. The blocks are available in a variety of shapes and are installed in a number of patterns, such as stretcher bond, herringbone bond, etc. A review of existing literature revealed considerable differences in findings regarding the contribution of various block parameters to the structural capacity of pavement. The surface of concrete block paving comprises concrete blocks bedded and jointed in sand. It transfers the traffic loads to the substructure of the pavement.

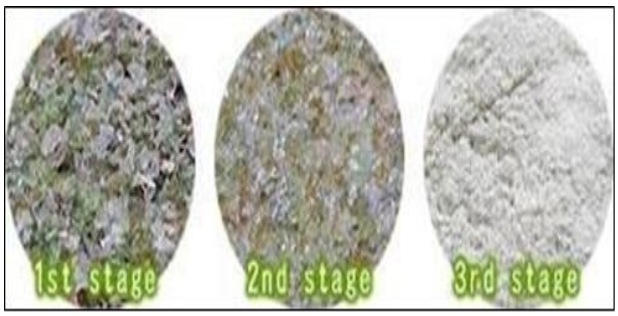
In Current days, the construction of roads and buildings are increasing rapidly in our country. Due to these construction, more consumption of course aggregate and fine aggregate takes place, but for manufacturing of these requires the natural resources, So this large utilization of natural resources 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.

1.1 Fly Ash

Fly ash is a waste produced in coal-fired thermal power stations. It has pozzolonic properties and can therefore be stabilized with either cement or lime to achieve the strength required for use as base courses in pavements. Agencies such as the Electric Power Research Institute (EPRI) have specified criteria and guidelines for the determination of the stabilizer content. This requires carrying out unconfined compression tests on stabilized fly ash specimens prepared and cured as per standard procedures. The stabilizer content is the minimum amount of the stabilizer for which the unconfined compressive strength of the specimens complies with the specified values. The actual curing conditions of the stabilized fly ash bases in the field, however, will differ from those of the laboratory specimens. This will affect the strength development of the bases, their durability, and their performance.

1.2 Waste Glass

As solid waste disposal has received increasing attention, waste glass has been heavily targeted for recycling efforts, with some localities contemplating prohibitions of glass in landfills. Not all waste glass can be recycled into new glass because of impurities, prohibitive shipping costs, or mixed color waste streams that may be difficult to separate into useful raw glass stocks. Use of this waste glass in construction materials is among the most attractive options because of the volume of material involved, the capacity for use of the material in bulk, and the likely ability of construction applications to afford allowances for slight variation in composition or form. Considering waste glass not as waste but as a new resource, we crush, bake and foam it to produce Supersol, an artificial light porous foamed material. It can be used in various areas, such as greening, insulation, horticulture, water purification, architecture and civil engineering, and thus is a highly value-added product indispensible for developing recycling societies.



2. METHODOLOGY

The main steps are elaborated in detail as per IS Code provision.

Phase I: - Testing of materials: -a) Cement: Various properties were evaluated such as fineness of cement, standard consistency, setting time, soundness, compressive strength, specific gravity through IS Code provision such as IS 1489 (Part I) 199112

b) Fine aggregate: Various properties such as specific gravity, fineness modulus as per IS 2386 Part I, III-196311

c) Coarse aggregate: Various properties such as fineness modulus, Impact value as per IS 2386 Part I & III-196311.

Phase II: - Concrete mix is designed for M30 grade considering properties of materials like cement, sand and coarse aggregate. The controlled concrete specimens are cast and tested for compressive strength, abrasion resistance.

Phase III: - In the concrete thus designed, cement is replaced by fly ash in the percentages 15%,30 % 45% (by weight of cement) and fine aggregate is replaced by waste glass. Specimen cast for this concrete for various strength tests and the results are compared with the control concrete. For each fly ash replacement percentage 15% ,30 % 45% and waste glass replacement plasticizer is added as an admixture to the concrete in various percentages like 15% ,30 % 45% (by weight of fine aggregate).

The concrete is prepared and specimens are casted for various strength properties of hardened concrete such as compressive strength, abrasion resistance. In the present study the dosage of Sisal fiber starting 0% then 0.5%, 1%, up to 2 % are added for M30 grade concrete to determining the Compressive strength ,Abrasion resistance of paving block.

3. EXPERIMENTAL ANALYSIS

To effectively research the improvement in the properties of the cement concrete pavement block, preliminary planning, procedures and methods must be wisely chosen. The criteria to assess properties of ingredients of the mix are based on the activities to plan and preparation, which carried out by before the testing of the fresh and hardened properties of cement concrete pavement block. These activities are:

- Cement Testing
- Fine Aggregate Testing
- Coarse Aggregate Testing
- Mix design.
- Preparation of test specimens.
- Concrete mixing.
- Casting of pavement blocks.
- Tests on Pavement block.

Experimentation is an activity required by the majority of the engineering researches, where it comprises all preparation and plan of action to be taken and being situated into operation afterwards. This chapter describes preliminary design and planning such as experimentation of the coarse and fine aggregates, target strength of concrete specimens, mix design and number of mix batches and concrete specimens required to meet the scope of this project.

Mix design is known as the selection of mix ingredients and their proportions required in a concrete mix. In this case, some calculations and knowledge of the proper proportioning of concrete mixes will be desirable. There are several methods of mix design used throughout the world. Eventually, all of these methods follow the same procedure and produce similar results. The mix design involves that amount of cement fine aggregate and coarse aggregate and the relation between water/cement ratio and target strength must be known.

4. RESULTS AND DISCUSSION

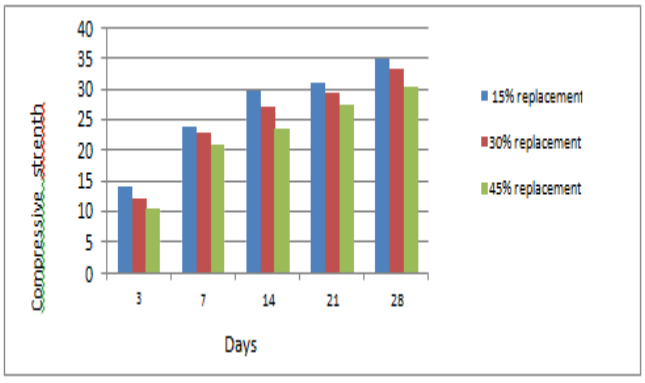
Conventional Concrete: Cubes are casted and tested of M 30 grade of concrete for conventional concrete without any replacement result as follows:

4.1 (Table No 1: Normal Concrete without Any Replacement)

Block No.	Peak Load (KN)	14 Days Comp. Strength	Avg. (N/mm²)
1	658	29.24	29.31
2	659	29.3	
3	662	29.4	
Block No.	**Peak Load (KN)**	**21 Days Comp. Strength**	**Avg. (N/mm²)**
1.	707	31.4	31.50
2.	709	31.5	
3.	711	31.6	
Block No.	**Peak Load (KN)**	**28 Days Comp. Strength**	**Avg. (N/mm²)**
1.	791	35.15	35.21
2.	792	35.2	
3.	794	35.3	

4.2 Determination of Optimum percentage of Fly ash

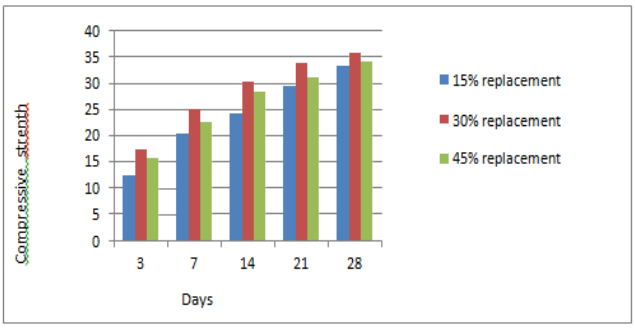
The fly ash added (15%, 30%, and 45% of weight of cement) and cubes are casted and tested to determine optimum percentages of replacement of cement by fly ash. The result as follows



Graph no 1 Optimum Result For fly Ash Replacement

4.3 Determination of Optimum percentage of glass

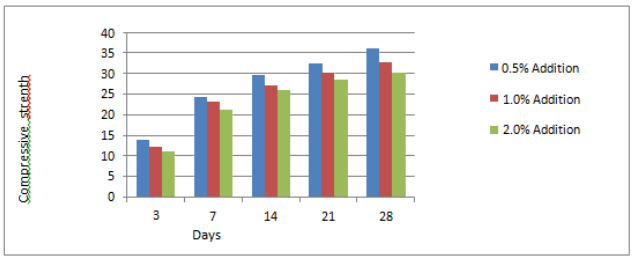
The fly ash added in 15%, 30%, 45% of weight of fine aggregate and cubes are casted and tested to determine optimum percentages of replacement of fine aggregate by glass powder. The result as follows



Graph no 2 Optimum Results For glass Replacement

4.3 Determination of Optimum percentage of Sisal fibers

The sisal Fibers added in 0.5%, 1%, 2% of weight of cement and cubes are casted and tested to determine optimum percentages of addition of sisal fibers. The result as follows,



Graph no 3 Optimum Results for Sisal fibers Replacement

5. CONCLUSIONS

From the Experimental results we can conclude that,

1) The properties of ingredients of concrete which are using for conventional concrete are as per limit of IS code, so it can be used for further process.
2) The properties of fly ash, sisal fibers, and glass powder examined carefully, and then we conclude that due to some similar properties of conventional ingredients these waste materials can be added in concrete.
3) By the comparative study we can conclude that,

i) Incorporating 15% Fly ash in place of cement helps to reduce the cost and thereby achieve economy with increase in compressive strength 30% waste glass in place of fine aggregate, gives acceptable mechanical properties with increased compressive strength at an age of 28 days. Additional sisal fiber (0.5% by weight of cement) increases compressive strength of concrete pavement block.

ii) Compressive strength increases with increasing the glass percentages from 15% to 30%, replacement of glass to the fine aggregate ,which helps to reduce cost and after 30% waste glass replacement onward, the strength decreases as the internal void of waste glass increases.

4) Fly ash can replace the cement up to 15%, which will help to reduce the cost & thereby bring economy. Cost of paving blocks decreases with increase in glass content.

Sisal fiber will develop the strength in the concrete paving blocks which helps to give a long lasting performance by the paving blocks.

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REFERENCES

[1] Anil Vasant Shirgire1, Swati D Ambadkar(2018), "Using Waste Construction Material in Paving Blocks with Coir Fibre" International Journal of Innovative Research in Science, Engineering and Technology

[2] S.Aswin and A.Alex Rajesh, COMPRESSIVE STRENGTH OF CONCRETE AND PAVER BLOCKS USING CERAMIC TILE POWDER, International Journal of Advanced Science and Engineering Research, Volume: 3, Issue: 1, 2018

[3] Basihar Taha& Ghassan Nounu(2009)"Utilizing wastere cycled glass as sand/cement replacement in concrete" ASCE Journal of Materials in Civil Engineering/Vol.21Issue12December-2009.

[4] Anuj Kumar, Sanjay Kumar (2013) "Development of paving blocks from synergistic use of red mud and fly ash using geopolymerization", Construction and Building Materials, Vol.38,pp.865-871.

[5] Ganjian, Jalull, Sadeghi-Pouya (2015) "Using waste materials and by-products to produce concrete paving blocks".Construction and Building Materials, Vol.77, pp.270-275

[6] Giordano Penteado, Carvalho, CeccheLintz (2015) "Reusing ceramic tile polishing waste in paving blocks manufacturing". Journal of Cleaner Production, Vol.30, pp1-7.

[7] K. Lakshmidevi , A.V. Narasimha Rao (2015) "Effect of Fly Ash and Quarry Dust on Properties of Concrete" , International Journal of Innovative Research in Science, Engineering and Technology, Vol. 4 (9), pp.8343-8350.

[8] Darshan Narayana1, Prof. Gireesh Mailar (2015) "Experimental Investigation On The Properties And Durability Of Partially Replaced Recycled," IJREAT International Journal of Research in Engineering & Advanced Technology, Volume 2, (6) pp. 135-141.