A review on combine effect of rice husk ash and silica fume with glass powder on concrete production by cement replacement

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ABSTRACT

Concrete is major civil engineering construction material because the ingredients of concrete are locally available materials. In ordinary concrete, the cement is used as a major binding material. The usage of cement in concrete causes a lot of environmental pollution due to the emission of greenhouse gases. So that it is necessary to reduce usage of cement by introducing new supplementary cementitious materials which are the by-products of industries to reduce debris. The rice husk ash is one of the by-products which is released from paddy. The usage of rice husk ash in concrete leads to the development of high strength concrete and also reduces the self-weight of the structure.

Keywords: Rice husk ash, Silica fume, Glass powder, compressive strength, Splitting tensile strength, Corrosion resistance

1. INTRODUCTION

Pavers are the modern day solution for less cost outdoor application. Paver block is used in various places like in street road and other construction places. Interlocking concrete Pavement has been largely used in a number of countries for quite something as a specialized problem-solving technique for providing pavement in areas where conventional types of construction are less durable due to many operational and environmental constraints. Concrete block pavements have become an attractive engineering and economical alternative to both flexible and rigid pavements. The strength, durability and pleasing surfaces have made paver blocks attractive for many commercial, municipal and industrial places such as parking areas, pedestrian walks, traffic intersections, container yards and roads. Interlocking paver blocks are installed over a compacted stone sub-base and leveling bed of sand. Concrete paver blocks are made with concrete basically consisting of cement, fine aggregates, coarse aggregates (10 mm and below), water, chemical agents etc.

2. PAVER BLOCKS

Tendencies in India in regards to the usage of precast paving blocks have been on lines distinctive from those in some different nations. This is largely because of variations in regard to economics, production strategies and uses. For a few years now, the primary road studies Institute has been engaged in growing one of a kind form of paving blocks for specific uses. The work at C.R.R.I. has been directed toward the subsequent 4 uses.

1. Hollow hexagonal blocks paving for roads in wasteland regions.
2. Square blocks paving for providing avenue get right of entry to too small rural communities.
3. Hexagonal blocks for paving of footpaths add passenger shelters at bus stops.
4. Square blocks for paving of footpaths and passenger shelters at bus stops.

The raw substances require for manufactures of the product are Portland cement and aggregates that are available regionally in every part of the country. Marketplace ability cement concrete paving blocks discover packages in pavements, footpaths, gardens, passengers waiting for sheds, bus stops, enterprise and different public locations. The product is generally used in urban regions for the above applications. As a result, the unit can be an installation in city and semi-urban areas, close to the market. Interlocking Pavers are the cutting-edge day answer for low cost out of doors utility. Paver block is stable, unreinforced pre-forged cement concrete paving units used in the floor route of pavement. They are heavy duty concrete precast elements in numerous shapes, sizes & hues to suit the creativeness of panorama architects & nature's essence. Via improving its compressive power it can be used in heavy visitor's area additionally. Interlocking pavers are synthetic concrete product this is in my view located in a ramification of styles and shapes as in keeping with the requirement. They do not take in water and can be located so
that extra water is taken far from the lawn and patio vicinity in preference to over-saturating it. Coloration, texture and length alternatives provide a really countless array of layout opportunities. Concrete block paving also allows for integrated navigation, threat caution, and zoning information. Commonly used different types of paver blocks are shown in the figure below:

Fig. 1: Commonly used different types of paver blocks

Colour and texture are given to paver block to form it visible and conjointly for skid resistance or to supply friction. Once needed, the color and texture of paver blocks ought to be manually in agreement to between the customer and also the manufacturer.

Paver blocks in our country show some performance issues which will be classified into two: structural style and mechanical deficiencies of concrete blocks. Inadequate sub layers thicknesses and material properties, inadequate voidance, incorrect joint sand gradation and joint spacing area unit things which will be count in structural style deficiencies. Mechanical deficiencies are: compressive strength and indirect strength during this project IS 15658: 2006 is strictly followed.

3. SHAPES AND CLASSIFICATIONS

There are four generic shapes of paver blocks corresponding to the four types of blocks as below and figure 2 shows the different shapes of paving blocks:

a. Type A: Paver blocks with plain vertical faces, which do not key into each other when paved in any pattern,

b. Type B: Paver blocks with alternating plain and curved/corrugated vertical faces, which key into each other along the curve/corrugated faces, when paved in any pattern,

c. Type C: Paver blocks having all faces curved or corrugated, which key into each other along all the vertical faces when paved in any pattern and

d. Type D: ‘L’ and ‘X’ shaped paver blocks which have all faces curved or corrugated and which key into each other along all the vertical faces when paved in any pattern.

Fig. 2: Different Shapes of Paving blocks

4. APPLICATION OF PAVER BLOCK

A. Non-Traffic Areas

Building Premises, Footpaths, Malls, Pedestrian Plaza, Landscapes, Monuments Premises, Premises, Public Gardens/Parks, Shopping Complexes, Bus Terminus Parking ranges and Railway Platform, and so forth

B. Light Traffic

Car Parks, Office Driveway, Housing Colony Roads, Office/Commercial Complexes, Rural Roads, Residential Colony Roads, Farm Houses, and so forth.
5. WASTE MATERIALS
Definition of waste: “Wastes materials are substance or objects, which are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law”
Solid waste is the unwanted or useless solid materials generated from combined residential, industrial and commercial activities in a given area. It may be categorized according to its origin (domestic, industrial, commercial, construction or institutional); according to its contents (organic material, glass, metal, plastic paper etc. or according to hazard potential (toxic, non-toxic, flammable, radioactive, infections etc.
Waste is any substance which is discarded after primary use, or it is worthless, defective and of no use. If a large number of waste materials generated were used instead of natural materials in the construction industry there would be three benefits:
- Conserving natural resources
- Disposing of waste materials (which are often unsightly)
- Freeing up valuable land for other uses

6. LITERATURE REVIEW
Kalingarani. K et al (2010) produced interlocking concrete paving blocks of industrial waste. By using industrial waste, it can reduce the landfill problem and also can be used to control the depletion of available natural resources. To this end, various industrial wastes were selected and their physical and chemical properties examined. Prior to application, different mixtures with different quantities of these industrial wastes were cast and tested according to the standards included in the Indian standards for prefabricated concrete blocks for paving (IS: 15658: 2006). Experimental results are then compared with the results of the conventional paving blocks. Kalingarani et al. (2012) concluded that Interlocking concrete paver block (ICPB) is having advantages in the exterior flooring. His aim of the study is making ICPB by using a maximum amount of industrial waste like fly ash and copper slag. Raval et al. (2013) noticed that ceramic industries waste 15% to 30% of total production, there is a pressure on ceramic industries to find a solution for its disposal, so ceramic waste use in construction so the Strength in compression of M20 grade Concrete increases when the replacement of Cement with Ceramic Powder up to 30% replaces by the mass of Cement. Yeole et al. (2014) states that Concrete paving blocks are suitable materials for the linings of footpaths and sub roads for easy laying, high resistance impact strength, attractive with good strength so use rubber pads and adding various percentages of waste steel aggregates in paver blocks gives up to 50% more impact strength than ordinary paver blocks. Sarkar et al. (2014) found that Interlocking concrete block pavement that is laid over a subbase of grouted single size aggregate with stone dust and confined by plastic cell made from thin polyethylene. It was shown that the sub-base material undergoes compression before it actually takes the stresses from the applied load. The use of jointing sand in the space between the blocks helps in distributing the load and reduces the deflection of concrete block pavement by about 14%. Navya et al. (2014) concluded that Property of PB with the direct inclusion of nature available fiber like coconut fiber in top 20mm layer added a different percentage and the result is a 0.3% coconut Fiber attends maximum compression strength. Ganjani et al. (2015) found that use of cement in the production of conventional paver block is approximate 210kg/m3. Portland cement is production is it impacts negatively on the environment due to carbon dioxide emissions. So alternative waste product used in space of cement, alternative material like such as run-of-station ash (ROSA), basic oxygen slag (BOS), ground granulated blast-furnace slag (GGBS), plasterboard gypsum (PG), and cement bypass dust (BPD) to reduce the amount of cement in paving blocks. So used of ROSA up to 60%, GGBS up to 55%, BPD up to 25%, and plasterboard gypsum PG up to 5% by weight can replace Portland cement without having any substantial impact on the strength or durability of the blocks. So used on the different alternative material can reduce cement content by up to 30% in comparison to the percent of cement used in factories. Neekhra et al. (2015) concluded that fibers of Nylon are kept to evaluate hardness of PB. Nylon fiber is high tensile fibers, nylon fibers are generally used in manufacturing and Nylon fiber is also thermoplastic polymer. After performing a different percentage of nylon fiber in the CPB it is observed that addition of nylon fiber 0.3% with the percentage of cement in concrete generally generates a maximum toughness of 7.14, and 21 days of age. B. Kaviya (2016) studied for manufacturing paving blocks with crusher dust is studied. Paving blocks replaced with crusher dust by various percentages and its properties have also been studied. The results show that replacing sand with crusher dust has a minimal reduction in weight and also it leads to the economy. Since the availability of sand is reducing nowadays using crusher dust will reduce polluting the environment since it is being dumped in many places. Koli Nishikant et al (2016) looked at the feasibility of waste glass inclusion as partial FA replacement systems. Properties of concrete incorporating waste glass as a partial substitution for FA amounts of 15%, 30%, and 45% were investigated. The waste glass material used was obtained by waste collectors. The results obtained show clearly that glass enhances the compressive strength properties of the final concrete product. The study indicated that waste glass can effectively be used as a fine aggregate replacement (up to 45%) without substantial change in strength. Nivetha C et al. (2016) studied the possibility of using plastic waste as a binding material instead of cement in the manufacturing of paver blocks. The study bears on plastics with a Polyethylene terephthalate basis. Plastic waste is carried to melt and mixed with a varying proportion of solid waste fly ash and quarry dust (PET 25-35 % fly ash 25 % and quarry dust 40-50% in weight). The measurements of physical and mechanical properties show that plastic waste paver blocks and these proportion in plastic give’s better results than concrete paver blocks. Darshan Pokharkar et al. (2017) show that combination of using rubber pads and adding various percentages of waste steel aggregates in paver blocks gives up to 50% more impact strength than ordinary paver blocks. Paver block is used in various applications like in street road and other construction places.
cement generates large amounts of carbon dioxide (CO2) which is responsible for global warming hence it is a greenhouse gas. Solid unreinforced pre-cast cement concrete paver blocks is a versatile, aesthetically attractive, functional, cost-effective and require little or no maintenance if correctly manufactured and paver blocks can be used for different traffic categories. Atul Thakur et al (2017) studied partial replacement (by weight) of cement with RHA in pavement blocks to determine the change in compressive strength, water absorption and abrasion resistance of paver blocks. Partial replacement of cement in different percentages such as 0%, 15%, 20%, 25%, 30%, 35% and 45% has been done. The compressive strength is determined at the end of 7, 28 and 56 days, the water absorption test and abrasion resistance are tested at 28 days.

7. LITERATURE SURVEYED
The major findings of literature survey are as follows:
1. There are various types of waste material like stone crusher dust, Recycled plastic or plastic waste, Fly ash, Copper slug, marble waste, coal waste, foundry sand, brick kiln are used to replaced material aggregate or cement in the manufacture of paver block for reduction of cost.
2. There are various types of mix design with different material like Geopolymer concrete is used instead of OPC, iron ore tailing from the mining industry, rubber pad is used for improving the compressive strength of Paver Block.
3. There are various types of fiber used in The Paver Block like nylon Fiber, polypropylene fiber, coconut fiber, polyester fiber for improving compressive strength, abrasion resistance and flexural strength of Paver block.
4. Different size, Different shape and Different strength Paver block used in the different area.
5. The compressive strength of Paver block depends on a water-cement ration of mix proportions.
6. There is the various waste material used in the manufacture of Paver block like a ceramic waste, rice husk ash, fly ash, glass powder for improving the strength of Paver block.

These alternatives are generally termed as Supplementary cementitious materials (SCMs). The use of these materials not only helps in reducing the consumption of cement but also serves as an efficient method for their safe disposal. This work reviews the effect of using the various alternatives that can be used in concrete as partial replacement of cement in the manufacturing of paver blocks. The literature review of various researchers reveals that a single alternative cannot provide all the benefits that cement does. Rather, a suitable combination of these products can be incorporated in concrete to provide properties similar to or better than that of Portland cement concrete.

8. PROBLEM STATEMENT
In current days, the construction of roads and buildings are increasing rapidly in our country. Due to these constructions, 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 partial replacement of these ingredients, effective utilization of RHA could be the best alternative for cement in the manufacturing of concrete pavement blocks.

9. REFERENCES
