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A REVIEW PAPER ON DESIGN OF PAVEMENT BLOCK

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ABSTRACT

Paver block is used in various applications like in street road and other construction places. Portlandcement 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 requires little or no maintenance if correctly manufactured and laid. Paver blocks can be used for different traffic categories. Test results show that combination of using rubber pads and adding various percentages of waste steel aggregates in paver blocks gives upto 50% more impact strength than ordinary paver blocks.

Keywords*: waste steel aggregates, compressive strength, flexural strength, Concrete interlocking paving blocks, Impact test.*

I. INTRODUCTION

Pavers are the modern day solution for less cost outdoor application. Paver block is used in variousplaces like in street road and other construction places. Interlocking concrete Pavement has been larglyused 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 environment 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.

We all know for pavement of paver block required high compressive strength and to increase the compressive strength of paver blocks various efforts have been taken. In this particular study M50 rectangular 800X500 paver blocks have been crates of 100 mm thickness for heavy traffic and to increase its compressive strength Nylon fiber is added to concrete.Interlocking concrete paving blocks has various advantages over bitumen and concrete pavements in their structural, aesthetics, construction and maintenance, operational and economical characteristics. Like other pavement surfaces, the design of concrete paving blocks is based upon environmental, traffic, sub grade support and pavement materials conditions and their interactive effect.

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II. LITERATURE REVIEW

Rajendra Kumar Neekhra[et al] Nylon fiber is used to evaluate the compressive strength of paving blocks. Blocks are alternative material used in place of asphalt or concrete. Concrete paving blocks are largly used in variety of outdoor applications, street and construction places as well as in industrial applications.

KoliNishikant[etal]There is now a significant world-wide interest to solve the environmental problems caused by industrial waste and other materials by including such materials in the manufacture of concrete. This technology has been introduced in India in construction, a decade ago, for specific requirement namely footpaths, parking areas etc. but now being adopted extensively in different uses where the conventional construction of pavement using bituminous mix or cement concrete technology is not feasible or desirable.

Joel Santosh[etal]Problems associated with construction site have been known for many years. Construction industry has to support a world of continuing population growth and economic development. Interlocking concrete paving blocks are ideal materials on the footpaths, parking areas, gardens, etc. for easy laying, better look and finish. But now being adopted extensively in different uses where the conventional construction of pavement using hot bituminous mix or cement concrete technology is not feasible or desirable.

III. MATERIALS

Cement

Cement basically acts as a binding material that holds all the other components of the block. for making paver block ordinary portland cement is used. it also imparts strength necessary to the blocks. Cement is added to semi grit, sand and sand dust in the required ratio and the final mixture is thus made and water is added only for the wetness of mixture.

Foundry sand

Foundry sand is high-quality uniform silica sand that is used to make moulds and cores for ferrous and nonferrous metal castings. Foundry sand consists primarily of silica sand, coated with a thin film of burnt carbon, residue and dust. Foundry Sand can be used as a partialreplacement of cement or as a partial replacement of fine aggregates or total replacement of fine aggregate and as a supplementary addition to achieve different properties of concrete Foundry sand can be used in concrete to improve its strength and other durability factors. The foundry sand is a mixture of several elements that combine features of giving perfect workability of the mixture that comprises the molding box.

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Fine Aggregate
Fine Aggregate Is A Naturally Occurring Granular Material Composed Of Finely Divided Rock And Mineral Particles. Those Fractions From 4.75 Mm To 150 Microns Are Termed As Fine Aggregate. The River Sand Is Used As Fine Aggregate Conforming To The Requirements Of Is: 383.

Semi Grit
Semi grit is the heavier sand than normal sand and is very versatile sand used for many different tasks and jobs. semi grit is ideal for water logged areas or finely brushing beneath flag stones during flag laying it is also ideal for building and it is one of the building sands that building companies use, mainly as bedding material for paving. the size of the semi grit is less than 9.5 mm.

Quarry Dust
Quarry rock dust can be defined as residue, tailing or other non-voluble waste material after the extraction and processing of rocks to form fine particles less than 4.75mm. usually, quarry rock dust is used in large scale as a surface finishing material in the highways and also used for manufacturing of hollow blocks and lightweight concrete prefabricated elements.

Dolomite Powder
Dolomite is one mineral with specific gravity of 2.84 to 2.86. The main use of dolomite is to impart the particular red or yellow color to the surface of paver blocks. Dolomite is mixed with cement and color in a mixer drum and is rotated for a fixed period of time to get a proper mixture. It is then put in the mould initially to impart the color of the blocks. Dolomite may be locally available or may be sometimes transported and it is cheap too.

IV. Mix Proportion
Based on base proportion of OPC mix, the geopolymer mix of fly ash, fine aggregate and courseaggregate was taken. Ratio of alkaline liquid to fly ash was taken as 0.35. Ratio of sodium silicate to sodium hydroxidewas taken as 2.5. The concentration of sodium hydroxide was 10M. For good casting slump values need to be between 0to 10cm or 100mm.

V. TESTING PROGRAM
In this experimental study, following properties of concrete were tested as per relevant standards.

- Fresh properties: As per IS 15658:2006, concrete paving blocks should be a stiff mix with zero slump
- Compressive Strength Test: Compressive strength of paver blocks was determined at 1 day, 3 days, 7 days, and 28 days in accordance to IS 15658:2006.
- Flexural Strength Test: Flexural strength is express in term of flexural stress or in form of breaking load. IS 15658:2006.
- Abrasion Resistance Test: Abrasion test for paving was done in accordance to IS 15658:2006 .The abrasion resistance of paver block at 28 days
- Water absorption Test: As per IS 15658:2006, 24 hour water absorption
- Density Test: The key for strong paver blocks is the density

Compressive Strength Test
Compressive strength of paver blocks were determined at 1 day, 3 days, 7 days, and 28 days in accordance to IS 15658:2006 are as shown in table 6.2 and the compressive strength versus age as shown in fig.2. The compressive strength is measured using paver blocks specimens selected as per the IS 15658-2006 on compression testing machine.

The size of the paver specimens used was 125mm x 125mm x 80mm. 9paver specimens were casted for each concrete mix proportions. The compressive strength of three paver specimen was measured and an average was taken after 3, 7 and 28 days

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Fig. 1 Compressive Test

Abrasion Resistance Test

GPC paver blocks were found to have superior abrasion resistance than OPC pavers. As per IS 15658:2006, Annex E –abrasion value should be less than 2 mm for 80 mm block and 3 mm for 60 mm blocks. OPC paver blocks have lower abrasion resistance than specified by the standards. The abrasion resistance of paver block at 28 days is higher in GPC than OPC. In abrasion resistance is also increased up to adding 0.2% by weight of polypropylene fibre in paver block.

Water Absorption

Water absorption of concrete paving block is determined as per IS: 15658: 2006. As per IS: 15658: 2006 water absorption of individual concrete paving block should be less than 7% or maximum 6% by mass (i.e., Average of 3 units). But maximum water absorption among all groups was found to be 2.58% in MFG (40) which is much less than the permissible.

Impact Test

It consists of aggregate impact testing machine. The weight of hammer in aggregate impact testing machine is 14 kg. During testing, a steel ball of 2.1 cm was used at center of paver blocks from top surface. Blows are applied on each paver blocks till failure occurs.

Fig. 2 Impact Test

VI. CONCLUSION

Based on experimental observations, the following conclusions are drawn:

Higher compressive strength and flexural strength was achieved when 20% cement was replaced by equal proportion of fly ash and glass powder. The characteristic tensile strength are seems to be satisfactory. It was found that wearing depth decreases with increasing replacement of cement with fly ash and glass powder up to 30%.

Hence abrasion resistance are seems to be satisfactory. Water absorption is well below the permissible limit. All the samples satisfy the requirement given in IS 15658: 2006 for concrete paving blocks to be used in non-traffic, light traffic and medium-heavy traffic areas. There is a saving in cost of cement if cement is replaced by fly ash and glass powder. The percentage of saving is highly beneficial for mass production of paving blocks. This also reduces the burden of dumping fly ash and waste glass on earth which is eco-friendly. It is concluded that the use of fly ash and glass powder in concrete paving blocks as partial cement replacement is possible.

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