EXPERIMENTAL STUDY OF UTILIZATION OF WASTE PLASTIC BAGS IN PAVEMENT BLOCKS

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Abstract: ***plastics are rapidly growing segment of the municipal solid waste .In order to overcome this issue ,we have to use it in effective way. This project is about recycle waste plastics into pavement blocks and study their characteristics. It will be a boon to modern society and environment. The main aim is to use the plastic nature in construction fields with limited additions. It is definitely a cost economical and can be applied in different forms.***

Keywords: cement, quarry dust, 6mm coarse aggregate ,plastics ,waste material ,pavement blocks ,properties of material ;workability ,compressive strength

INTRODUCTION

Paver block technology has been introduced in India in construction a decade ago for a specific requirement namely footpath and parking areas etc. Now paver block is being adopted extensively in different use. In this investigation various properties such as compressive strength, split tensile strength and water absorption of paver blocks consisting of plastic wastes, unconventional materials such as coarse aggregate and fine aggregate of various percentage replacement are used. Cement concrete tiles and paving blocks are precast solid products made out of cement concrete. The product is made and round blocks of different dimensions with designs for inter locking 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. This pavement are less susceptible to rutting, it is wall ,road, building ,garden, 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 setup in urban and semi-urban areas, near the market .A lot of face-lift is 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 tiles 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.

1. MATERIALS USED

Following are the materials use in our Pavement block production. They are as follows,

a) PLASTIC BAGS

A plastic bag, poly bag, or pouch is a type of container made of thin, flexible, plastic film, nonwoven fabric, or plastic textile. Plastic bags are used for containing and transporting goods such as foods, produce, powders, ice, magazines, chemicals, and waste. It is a common form of packaging. Open bags with carrying handles are used in large numbers. Stores often provide them as a

convenience to shoppers. Some stores charge a nominal fee for a bag .Heavy duty reusable shopping bags are often considered environmentally better than single use paper or plastic shopping bags. Because of environmental and litter problems, some locations are working towards a phase out of light weight plastic bags. Looking to the global issue of environmental pollution by post consumer plastic waste, research efforts have been focused on consuming this waste on massive scale in efficient and environmental friendly manner .Researchers planned to use plastic waste in form of concrete ingredient as the pavement is second most sought material by human beings after water.

b) QUARRY DUST

A quarry is a place from which dimension stone, rock, construction aggregate, riprap, sand, gravel, or slate has been excavated from the ground. A quarry is the same thing as an open pit mine from which minerals are extracted. The only nontrivial difference between the two is that open pit mines that 12 produce building materials and dimension stone are commonly referred to as quarries. It can be used as substitute to sand fully or partially. It offers a comparatively good strength compared to sand with or without admixtures in pavement. The advantages of quarry dust are cost effective, easily available consumption reduces the pollution in environment and effectively used as a replacement material for river sand.

c) FINE AGGREGATE

Fine aggregate are basically sand own from the land or the marine environment. Fine aggregate generally consists of natural sand or crushed stone with most particles passing through a 9.5mm sieve. Fine aggregate are inter granular materials such as sand, gravel or crushed stone that are an end product in the own right. They are also the raw materials that are an essential ingredient in concrete. For a good concrete mix, aggregate need to be clean, hard, strong particles free of absorbed chemical or coating of clay and another fine materials that could case the deterioration of concrete.

d) CEMENT

A cement is a binder, a substance used for construction that sets, hardens, and adheres to other materials to bind them together. Cement is seldom used on its own, but rather to bind sand and gravel together. Cement mixed with fine aggregate produces mortar for masonry, or with sand and gravel, produces concrete.

2. MIX DESIGN

DEFINITION

Mix design can be defined as the process of selecting suitable ingredients of mix and determine the relative proportion with the objective of producing concrete of certain minimum strength and durability as economically as possible. There are many methods are available for mix design. In this paper the mix design followed based upon trial and error results up to which the design steps are adopted.

3. DESIGN PROCEDURE

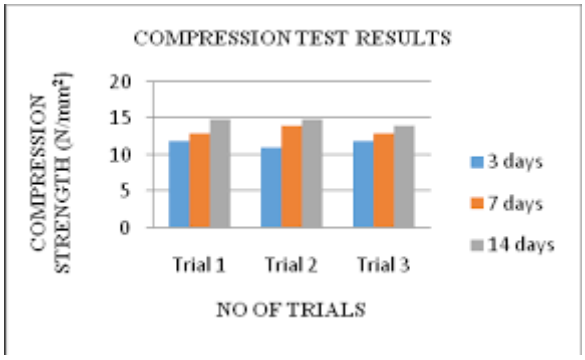
Types of plastic bags = PE, PP, PS,
Temperature of heating = 14 F -16 F 00 00
Exposure condition = Moderate
Degree of supervision = Good
Size of fine aggregate = 1.7mm
Specific gravity of fine aggregate = 2.65
Specific gravity of PS = 1.05
Specific gravity of PB = 0.6
Specific gravity of PP = 0.9-0.92
Specific gravity of LDPE = 0.91-0.93
Specific gravity of HDPE = 0.96-0.97

4. PLASTIC PROPORTION

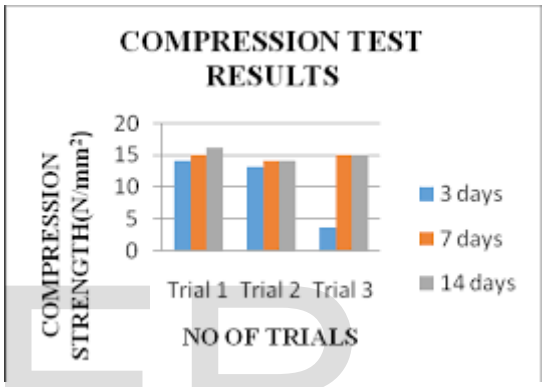
when plastic is heated at 14 to 16 F it is melted 00 00 into a liquid form and this liquid is calculated into a ml. if 1/2 kg of plastic bags is heated up to a 450ml of liquid is obtained. similarly the mix proportion of plastic ratio is denoted by liquid(ml).

5. DESIGN MIX PROPORTION

In order to check the workability of the plastic mix we made a trail and error method. After some trails it is found that by fixing plastic liquid quantity constant and the quantity of fine aggregate keeps altering. Finally, a designed mix of excellent workability is obtained. Then a pavement block is casted and the compressive strength is found From the table below the stress of various mix is tabulated.



Pavement blocks Ratio of mix with quarry dust of 30% (P : F.A) = 1 : 3



6. Design mix tabulation

Table

a) Normal mix possessing plastic and fine Aggregate

S.NO	RATIO (P : F.A)	WORKABILITY	STRESS N/mm2
1	1/2:1	Poor	6
2	1/2:2	Fair	7
3	1:2	Good	10
4	1:3	Excellent	12

Table

b) Mix possessing Quarry dust added in %

S.NO	RATIO (P : F.A)	QUARRY DUST In %	STRESS N/mm2
1	1:3	10	12
2	1:3	20	13
3	1:3	30	15

7. TESTS AND RESULTS

8.1 COMPRESSIVE STRENGTH OF PAVEMENT BLOCK

The tests are required to determine the strength of Specimen and there fore its suitability for the job. Out of many test applied to the Paver, this is the utmost important which gives an idea about all the characteristics of specimen. By this single test one judge that whether specimen has been done properly or not. Size of pavement Ratio of mix without quarry dust (P : F.A) = 1 : 3

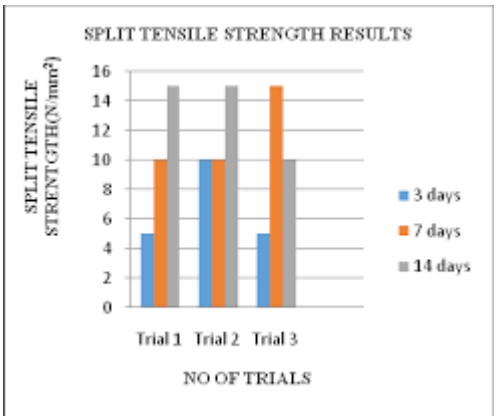
8.2 SPLIT TENSILE STRENGTH TEST

S.NO	TRIALS	COMPRESSIVE STRENGTH N/mm²		
		3days	7days	14days
1	Trial 1	9	10	14
2	Trial 2	12	14	15
3	Trial 3	14	13	14

The tensile strength of Paver block is one of the basic and important properties. This is a method to determine the tensile strength of paver block. The Paver block is very weak in tension due to its brittle nature and is not expected to resist the direct tension. The Paver block develops cracks when subjected to tensile forces. Thus, it is necessary to determine the tensile strength of specimen to determine the load at which the Paver block members may crack. Size of the pavement block Ratio of mix without quarry dust

(P : F.A) = 1 : 3

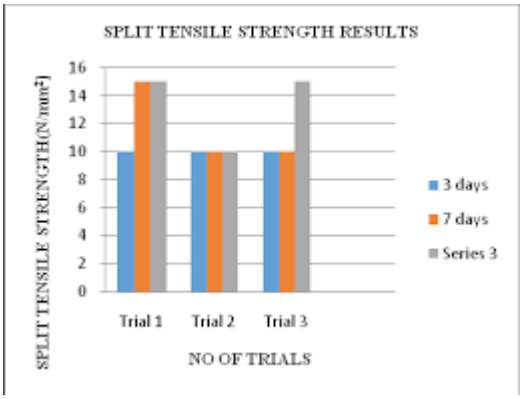
S.NO	TRIALS	SPLIT TENSILE STRENGTH N/mm²		
		3days	7days	14days
1	Trial 1	5	10	10
2	Trial 2	10	10	14
3	Trial 3	5	14	10



Pavement blocks Ratio of mix with quarry dust of 30%

(P : F.A) = 1 : 3

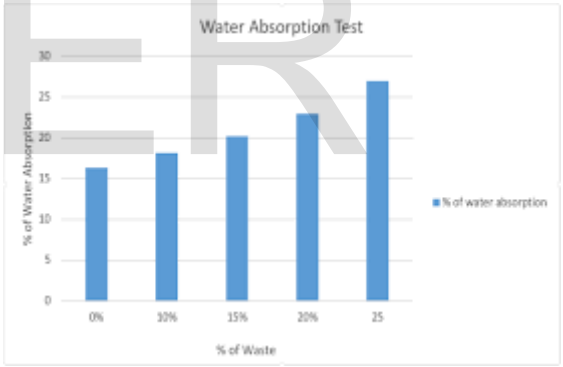
S.NO	TRIALS	SPLIT TENSILE STRENGTH N/mm²		
		3days	7days	14days
1	Trial 1	10	15	15
2	Trial 2	10	10	10
3	Trial 3	10	10	15



8. WATER ABSORPTION TEST

The casted specimen was subjected to a water absorption test, to study the character of plastic block. After the drying period is completed, the specimen was immersed in water tank is left for 24 hours. The blocks shall then be removed from the water and allowed to drain for one minute by placing them on a 10 mm , visible surface water being removed with a damp cloth, the saturated and surface dry blocks immediately weighed. After weighing all blocks shall be dried in a ventilated oven at 100 to 1150C for not less than 24 hours and until two successive weighing at intervals of 2 hours show an increment of loss not greater than 0.2 percent of the last previously determined mass of the specimen.

S.NO	SPECIMEN	DRY WEIGHT	WET WEIGHT	% OF WATER ABSORPTION
1	A	710	710	1.4
2	B	705	712	1.0
3	C	708	715	0.98



9. ACID RESISTANCE TEST

10.1 HYDROCHLORIC ACID (HCL)

Chloride attack is particularly important because its primarily causes corrosion of reinforcement. The BIS earlier specified the max chloride content in binder as 0.05%. But it has been revised that the allowable chloride content in binder to be 0.1%. The plastic pavement were cast and kept at a room temperature. After 5days the pavement were removed from the mould and kept in the oven at 1200C for 7days. In pavement blocks after 24hrs the pavement block were removed and cured 28days in normal water. Then the pavement block are immersed in a 1% and 2% concentric HCL acid, measurement of weight and compressive strength of block and calculation of

durability factors were completed.

10.2 PERCENTAGE OF LOSS OF WEIGHT(WITHOUT Q.D)

S.NO	SPECIMEN	INITIAL WEIGHT (gm)	FINAL WEIGHT (gm)	% OF LOSS OF WEIGHT
1	A	750	720	4
2	B	745	723	2.95
3	C	748	730	2.4

CONCLUSION

From the above study, the analysis concluded that the waste plastics can be used in the pavement block production. This modified pavement block is applicable in the construction of rigid pavements. The block consists of quarry dust ,coarse aggregate, fine aggregate, plastics out of which the fine aggregate and quarry dust percentage is 60 to 70 and from the above observation it is computed to use 20% recycled plastics, which does not affect the properties of block.

(a) The compressive strength of modified pavement block are as equal as conventional block.

(b) The cost of construction will be reduced and also helps to avoid the general disposal technique of waste plastics namely, land filling and incineration which have certain burden on ecology.

(c) By using the plastics in pavement block, reduces the weight up to 15%.

(d) We also find that plastic pavement block is economical and has several advantages when compared to the concrete pavement block.

(e) Lastly the strongly conclude the use of recycled plastics in pavement block is the best option for the disposal of plastic and ultimately reduces plastic pollution in the environment.

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