

A Study on Partial Replacement of Plastics in Paver Blocks

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ABSTRACT

The use of plastics in the current busy world has increased multiple times in the past few years. Many forthcoming industries and enterprises (business companies and organizations) produce more varieties of plastic. The inappropriate way of disposing these plastics will result these detrimental compounds to pollute and degrade the environment by getting mixed with it. The intermolecular bonds that constitute plastics are designed in such a way that it can neither get corroded nor decomposed. In order to succeed this issue we have to find an effective way to dispose plastics. In this project we have used recycled plastic wastes to construct paver blocks. This material also has few advantages like they are extremely durable and hard to reject (them last for a long period of time), it doesn't have rusting properties and are non-soluble in water. These properties together makes plastic highly durable. The main aim of this project is to reduce the dependency level of construction materials on natural resources which are on verge of getting exhausted and also to diminish the environmental degradation caused by the utilization of plastics. We also used IOT sensors in this project to detect the temperature and alert the users regarding the condition of plastics used inside the paver blocks. This will allow the users to take proper measures and repair it accordingly.

Keywords: recycled plastics, environmental degradation, durable, paver blocks, IOT.

1. INTRODUCTION

The use of plastics has been increasing tremendously nowadays. These materials (plastics) are polymers which cannot be destroyed neither naturally nor artificially. The usage of plastics has both advantages as well as disadvantages. Few advantages are they are light weighted, non-corrosive in nature, chemical resistant, water resistant, durable, etc. In the present contemporary world the usage of plastic has been playing a vital role in our day to day life. This material makes things easier, better and faster. In our country about 56 tons of plastics are been dumped currently and these wastes which are been dumped causes pollution and degrades the environment. From this we can conclude that plastics should be disposed properly as per the terms and conditions (regulations) provided by our government. It provides potential environment as well as economic benefits for the replacement of plastic waste for cement. As per the journals referred there are three replacement levels of 10%, 20% and 30% by the weight of concrete. The fly ash and waste glass powder can be used effectively for the replacement of cement without substantial change in strength.

Paver blocks are versatile structures which improves the aesthetic view of a particular location. The blocks are easy to maintain i.e., maintenance work can be done easily without disturbing the other area. These are cost effective as only the area to be reconstructed will be

removed. Hence introducing the usage of plastics in paver blocks will help us to maintain and utilize our natural resources cautiously and sustainably. It prevents the natural resources from getting depleted.

MATERIALS REQUIRED:

I. Coarse Aggregate:

Aggregates passing through 12mm sieve and retraining on 10mm sieve as per Indian standard specification are used. It helps in the reduction of shrinkage which can be caused by the movement of moisture content.

II. Fine Aggregate

1. M Sand: It's manufacturing sand and obtained by crushing down the rocks into fine particles by artificial methods. It sieved by 4.75 mm sieve is used .The purpose of using m sand is reduce and alternative to the river sand .M sand may also be referred as quarry dust as a crushed sand under 4.75 mm are used and categorized under the quarry dust .whose water absorption capacity is 1.80 under the zone 2 .Its specific gravity is 2.62 .The finesse modulus is 2.95 which is almost equal to that of normal river sand.

III. Plastic Wastes:

The wastes to be used in the manufacturing Process of paver blocks were collected from the surroundings. Plastics of different types are used in this project.

1. LDPE:

Low density polyethylene plastics belonging to resin number 4 are used in this. Wastes of 50 microns are used. It has a tensile strength of 0.20-0.40N/mm². The thermal coefficient of expansion is about 200X10⁶.the melting point is 150 degree. LDPE has its density varying between 0.9102-0.940.

2. PVC plastics:

Polyvinyl chloride is one among the widely used and produced synthetic plastic polymer. In this method PVC plastics are crushed into powders and are replaced with sand with percentage of 10%, 20% and 30%. (Note: This plastic requires water and Cement for binding the constituents. The pH value of water should vary between 6-8)

IV. Red oxide:

It is also known as ferric oxide. It occurs naturally as mineral magnetite. This acts as a coloring agent to the paver blocks.

PREPARATION OF MIX



Figure 1. Paver block molds

CRITICAL REVIEW

1. TITLE : Utilization of Waste Plastic In Manufacturing Of Bricks And Paver Blocks

AUTHOR : Dinesh A

COMMENT: In this journal it observed that the materials used in this project are waste plastic, river sand, red oxide or ferric oxide. The plastic soil bricks are mixed with various mixed proportion in the ratio of 1:2, 1:3, 1:4, 1:5 and 1:6 which represents plastic and river sand respectively. In this method the waste plastics are been burnt and melted to which the sand and red oxide is added and mixed thoroughly using rod or trowel before is hardens. This procedure should not take more time as it as a very short setting time. Further on this mixture is been casted and molded. These bricks were subjected to compressive test, water absorption test, efflorescence test, fire resistance test, hardness test. It is concluded stating that plastic sand brick have more advantages than conventional concrete bricks with respect to cost and greenhouse effect. This also produces a better way for the disposal of plastic for the countries which face difficulties in disposing.

2. TITLE: Reuse of Plastic Waste In Paver Blocks:

AUTHOR: Shanmugavalli B

They aim of this project was to replace cement with plastic waste in paver blocks and to reduce its cost when compare with conventional concrete paver blocks. Currently about 56 lakhs tons of plastic waste are generated in the country per year. The degradation process of plastic waste is very slow. Hence the project was very useful in utilizing the plastic waste in a useful way. The materials used in this project are low density polyethylene (plastic waste), quarry dust, coarse aggregate and ceramic waste. Three blocks with different mix proportions were used. The mix ratios used in this project are

| Material | Plastic wastes | Quarry dust | Aggregate | Gravel | Ceramic waste |
|------------------|-----------------------|--------------------|------------------|---------------|----------------------|
| Block I | 1 | 0.75 | 0.75 | - | - |
| Block II | 1 | 1.5 | 2 | - | 0.5 |
| Block III | 1 | 1.75 | - | 2 | 0.75 |

3. TITLE: Use of Waste Plastic in Concrete Mixture As Aggregate Replacement

AUTHOR: Zainab Z Ismail

COMMENT: This project is associated with the industrial activities which generates non-biodegradable solid waste in Iraq. The project involves 86 experiments, 254 test to determine the efficiency of reusing waste plastic in concrete production. The waste plastics were partially replaced with sand by 0%, 10%, 15% and 20%. These concrete mixtures were tested at room temperatures. The tests conducted were slump test, fresh density, dried density, compressive strength, and flexural strength and toughness indices. 70 cubes were tested under compressive strength and dried density. 54 prisms were casted for flexural strength and toughness indices. The specimens were curried for about 28 days. This result proved the arrest of the formation of micro cracks by introducing waste plastic of fabric-form shapes to concrete mixtures. From this study it can be concluded reusing of plastic waste as a partial replacement of a sand in concrete is a good

step involve to reduce the cost of materials and to resolve conflicts related to solid waste cost by plastic.

PURPOSE OF ALTERNATIVE

The major reason for an alternative source is to reduce the over utilization of natural resources. This also helps in the limited usage of cement which has few disadvantages like poor resistance against deformation; cracks can be penetrated easily due to which it is brittle in nature. It makes the structure heavy and has the ability to cause shrinkage in concrete. It is ductile in nature. It may contain soluble salts which causes efflorescence. Paver blocks mad out of conventional concrete requires a long curing time. It requires skilled labor and strict quality control during mixing, placing and curing of concrete. Such type of conflicts can be overwhelmed by using plastics. It is highly deformable, requires less maintenance, highly durable which does not encourage crack formation on the surface. It is highly versatile and provides a good finish.

CONCLUSION

From these journals it is observed that recycling and reuse plastics in such a way will help us to maintain a better and sustainable environment. This can also be considered to be one of the best and productive methods of disposing non-degradable plastic wastes. The blocks made from this plastic concrete were subjected to laboratory tests like compressive strength test, flexural strength test, slump cone test, water absorption test, dry density test, etc. Which more or less showed the same result as that of blocks made of conventional concrete. This is a cheap and best way of manufacturing paver blocks using waste plastic. The workability of this mixture has a very good and broad range of applications in various fields i.e. from small scale works to large scale works considering its mix proportions.

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