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# PLASTIC WASTE UTILIZATION IN PAVER BLOCK

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## ABSTRACT

The goal of this research is to substitute cement in paver blocks with plastic waste in order to minimise paver block costs. In comparison to a traditional concrete paver block. In India, over 56 million metric tonnes of plastic trash are produced each year. Plastic decomposition is likewise a long and gradual process. As a result, the project is extremely beneficial in terms of reducing plastic trash in a practical manner. In this research, we combined plastic trash with sand and coarse material in various proportions..

**Keywords:** Plastic Waste, LDPE, Compressive Strength.

## I. INTRODUCTION

Concrete is widely utilised as a construction material across the world. Cement, sand, and coarse aggregate are common concrete ingredients that are used all around the world. Because of the high usefulness of concrete, it is becoming deficient with each passing day, necessitating the search for alternatives. It is, of course, a major worry for civil engineers who are looking for a suitable material that can totally or partially replace traditional concrete materials.

### Objective

The major goal of this research proposal was to see if shredded plastic waste might be used as a partial replacement for cement as a binding agent. Also, through minimising waste and recycling plastic waste, as well as protecting the environment from the harmful effects of plastic, a new binding material will be introduced.

## II. LITERATURE REVIEW

**YoucefGhernouti et al. [1] :** The study shows how plastic fine aggregate obtained from the crushing of waste plastic bags can be used to partially replace fine aggregate in concrete. Plastic bags garbage was heated, then cooled and crushed to produce plastic sand with a finesse modulus of 4.7. Fine aggregate was replaced with plastic bag waste sand in the concrete mix proportions of 10%, 20%, 30%, and 40%, respectively, while other concrete components remained the same for all four mixes.The findings of the slump test showed that the workability of 3 PK concrete increased as the waste content increased. JETIR, Volume 2, Issue 6, June 2015, Mehta "Concrete Microstructure, Properties, and Materials" third edition, chapter 1, p-3 (ISSN-2349-5162) www.jetir.org JETIR1506020 Journal of Emerging Technologies and Innovative Research (JETIR) Because plastic cannot absorb water, excess water is accessible, 1801 concrete increases, which is beneficial to concrete. As the amount of plastic bags garbage increases, the bulk density drops. Flexural and compressive strength were measured at 28 days in the hardened condition, with declines in both strengths as the percentage of plastic bag waste sand in the concrete mix increased. Plastic waste increases the volume of cavities in concrete, lowering its compactness and lowering the speed of sound in concrete. The loss of strength in the concrete mix was a major issue; nonetheless, they recommend replacing fine aggregate with plastic aggregate by 10 to 20%. The use of admixtures to remedy the strength loss of concrete due to the addition of plastic aggregate is not stressed.

**RaghatateAtul M. [2] :** The experimental results of a concrete sample cast with plastic bag pieces to explore compressive and split tensile strength are presented in this work. He employed a concrete mix that included Ordinary Portland Cement, Natural River Sand as fine aggregate, and Crushed Granite Stones as coarse aggregate, as well as purified portable water and variable percentages of waste plastic bags (0 percent , 0.2 percent , 0.4 percent , 0.6 percent 0.8 percent and 1.0 percent ). The addition of plastic bags to a concrete specimen reduces the compressive strength, and as the percentage of plastic bag pieces increases, the compressive strength decreases (20 percent decrease in compressive strength with 1 percent of addition of plastic bag pieces).On the other hand, adding up to 0.8 percent of plastic bag pieces to the concrete mix increased tensile strength; however, adding more than 0.8 percent of plastic bag pieces decreased tensile strength. He came to the conclusion that the utility of plastic bag parts may be employed to improve split tensile strength. This is merely a preliminary investigation into the usage of plastic bags in concrete. By altering the shape and size of plastic bags to be used in concrete mixes, more emphasis was required.

**Praveen Mathew et al. [3] [2013]** :They looked at the suitability of recycled plastic as a partial replacement for coarse aggregate in concrete mixes to see how it affected the concrete's compressive strength, modulus of elasticity, split tensile strength, and flexural strength. Plastic pieces were heated to the desired temperature and then crushed to the required size of aggregate after cooling to obtain coarse aggregate. In comparison to Natural coarse aggregate, their experimental results showed that plastic aggregate has lower crushing (2.0 vs. 28 for Natural aggregate), lower specific gravity (0.9 vs. 2.74 for Natural aggregate), and lower density (0.81 vs. 3.14 for Natural aggregate).The findings of their tests were based on a 20% substitution of natural coarse aggregate for plastic aggregate. When a slump test for a sample was performed, it resulted in an increase in workability. In comparison to grade substitution, volumetric substitution of natural aggregate with plastic aggregate was chosen as the best option. Plastic coarse aggregate showed a significant reduction in strength at 400 degrees Celsius as compared to regular concrete. Compressive strength increased by 28%, however split tensile strength and modulus of elasticity decreased. They suggested that using an appropriate admixture @0.4% by weight of cement will improve the bonding between matrix and plastic aggregate; however, more research is needed to address the tensile behaviour of concrete with 20% plastic aggregate.

**R L Ramesh et al. [4]:** They employed low density poly ethylene waste plastic as a coarse aggregate replacement to establish its viability in the construction sector and to investigate the behaviour of fresh and hardened concrete characteristics. Different concrete mixes were made with varying proportions of recycle plastic aggregate generated through heat treatment of plastic waste (160-200 degrees Celsius) in a plastic granular recycling machine (0 percent, 20%, 30%, and 40%). With a 0.5 water/cement ratio and various volumes of plastic aggregate as replacement for crushed stone, a concrete mix design with 1: 1.5: 3 proportions was adopted. A proper mixing procedure was followed, and a homogeneous mixture was created. At 7, 14, and 28 days after casting, a noticeable loss in compressive strength was seen when the fraction of plastic aggregate replaced with crushed aggregate was increased (80 percent strength achieved by replacing waste plastic up to 30 percent ). Plastic aggregate has the potential to be used in light weight aggregate, according to the study. Their study focused solely on concrete's compressive strength, with no consideration given to the material's flexural qualities. They propose that future study on plastic aggregate be focused on its split tensile strength in order to determine its tensile behaviour and endurance for beams and columns.

**Pramod S. Patil.et al [5]:** This research examines the usage of plastic recycled aggregate as a concrete alternative for coarse aggregate. They employed 48 specimens and six beams/cylinders cast from different plastic percentages (0, 10, 20, 30, 40, and 50%) as coarse aggregate replacement in concrete mixes. They ran several tests and found that as the amount of aggregate replaced with recycled plastic concrete increased, the density of the concrete decreased. They also discovered a decline in compressive strength after increasing the percentage of coarse aggregate replaced with recycled plastic aggregate for 7 and 28 days. They have suggested that replacing 20% of the original material will satisfy the permitted strength limits. Again, these researchers focused solely on compressive strength, with little effort made to investigate the other crucial qualities of concrete. In addition, their research does not include the usage of various admixtures in concrete to compensate for the loss of strength.

## III. MATERIAL USED

### Sand and Aggregate

River sand is a fine aggregate made up of particles with a diameter of 600 m or less. The most frequent aggregate used in concrete to give volume at a reasonable cost is river. Aggregates include sand and gravel. Both aggregate types should be present in a good concrete mix.

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**Figure 1:** Sand

**Coarse Aggregate**

MSA 10 and 20 mm coarse aggregate and solid plastics were utilised, according to IS 383-1970. To determine the characteristics of the materials, IS techniques were used.

**Figure 2:** Coarse Aggregate

**Plastic:**

The plastic garbage used in blocking came from a nearby neighbourhood and was identified as LDPE (resin number 4). Plastic bags are used, and the plastic bag used is around 50 microns thick.

**Figure 3:** Plastic

## IV. REQUREMENTS OF EQUIPMENTS

**Barrel :**

Cut a simple oil drum in half and attach three rebar legs to create the melting barrel. The appropriate height and width of the barrel with the legs attached are 50 cm and 80 cm, respectively. Make the burner large enough to hold a large amount of liquid plastic but not so tall that mixing it will be difficult. The legs can be sunk into the ground to make the barrel more stable for mixing..

**Figure 4:** Barrel

**Mould :**

The mould can be whatever shape you choose; they're made in the same manner that concrete floor tile moulds are. However, if the mold's walls are more than 4 cm thick, the material will stick to the sides and will not come out properly.

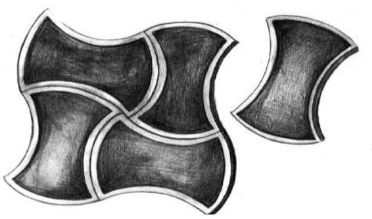


**Figure 5:** Mould

**Self Safety Equipment:**

Overalls, gloves, masks, covered shoes or boots.

**Stirring equipment:**

Equipment for stirring (a spade with a metal shaft, or metal reinforcing rods with a metal paddle welded to the end)

**Trowel :**

It's used in the plastic industry to blend sand. It can also be used as a plastic molter. Transport from one location to another

It's critical to just use the right kinds of plastic and to understand what you're mixing. You must check that there is no PVC present. Furriness caused by other types of plastic can be quite hazardous.

## V. SAFETY PRECAUTION

It's critical to just use the right kinds of plastic and to understand what you're mixing. You must check that there is no PVC present. Other forms of plastic might cause a lot of itchiness.

## VI. METHODOLOGY

**Selection Of Right Plastic:**

It is critical to choose the appropriate plastic. Food wrap film, food bags, water bags, water bottles, ice bags, milk bags, storage bags, agricultural film, and stretch wrap are all examples of LDPE used in this procedure. Other types of plastic, such as foam or PVC, should not be used.

**Figure 6:** Sort your plastics carefully

**Hint:**: Choosing the appropriate plastic is critical. Food wrap film, food bags, water bags, water bottles, ice bags, milk bags, storage bags, agricultural film, and stretch wrap are all examples of LDPE used in this procedure. Other types of plastic, such as foam or PVC, should not be used.

**Melt of plastic**

Under the metal drum, light a tiny fire and gently beat it while adding the plastic garbage. It will shrink in size as it warms up. To assist it melt down, light the plastic at the top with a little flame. Make sure the fire doesn't grow too hot, and keep adding plastic to the side of the melted plastic unit until it turns into a black liquid. Continue to add plastic until you have a 20cm depth of melted plastic. Avoid inhaling any vapours from the fire, and use caution while using hot instruments.

**Figure 7:** Melting of Plastic

**Mixing of materials:**

a) Plastic, b) Aggregate or Sand

Continue to carefully mix until all of the plastic has melted and a thick black liquid has formed. Even at very high temperatures, LDPE lumps can form. Because they impact the material's strength, continue stirring and heating until all lumps are removed and a homogeneous paste is created. It may take up to 20 minutes to complete this task. Allowing the liquid to become too heated to the point of burning will render it useless as a building material. The presence of a few flames from the liquid is allowed. To make the needed mixture, add the sand unit and keep mixing until the plastic, which works as a binder, is thoroughly combined and resembles grey cement.

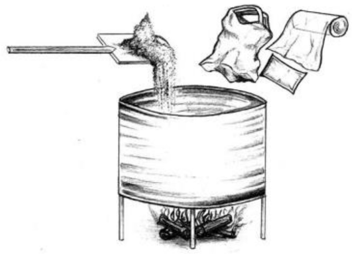


**Figure 8:** Experiment with different quantities of LDPE, HDPE and sand

**Filling of Mould**

Make sure the mould is clean and properly lubricated, with no pieces of plastic on it to prevent mould from sticking.

Using the spade and the metal shaft trowel, quickly remove the slurry. Because the combination is extremely hot, use caution and use gloves.

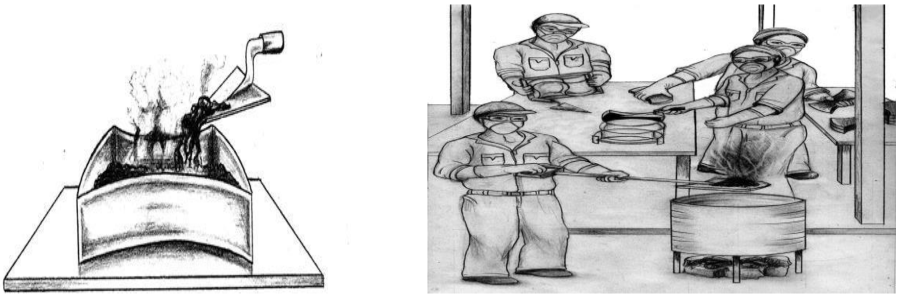


**Figure 9:** Take care when you transfer the mix from the barrel to the table

**Press and work the mixture into the mould so there are no air gaps.**

**Setting of Plastic Cube :**

Allow a few minutes for the hot mixture in the mould to solidify before shaking it to free the edges (a rocking motion works well). Continue to attempt to remove the mould. Remove the mould and leave when the mixture has solidified enough to prevent the slab from collapsing. In about 2 hours, it should have hardened. Experiment with various amounts of sand and LPDE; different amounts can be used for different applications, such as slabs, tiles, or interlocking blocks, and road pavement.

**Figure 10:** With practice you will be able to make a consistently high quality product.

## VII. STEPWISE PROCEDURES

**Stepwise Procedure**

1. Thermoplastic binder is cleaned and dried.
2. Shredded thermoplastic binder is heated on hot barrel.
3. Sand is dried.

4. Sand sieved and required amount measured
5. Melting thermoplastic is stirred to distribute the heat
6. Sieved sand is added while stirring continues
7. Homogeneous plastic bonded sand mortar is formed
8. Plastic bonded sand mortar is transferred into moulds and compacted
9. Samples are allowed to set and harden
10. Samples removed from molds to produce plastic bonded sand sample

## VIII. TEST RESULT

**Test Result**

The amount of plastic to sand in the paver block determines its strength. According to laboratory testing, the best blend is 3 parts sand to 1 part LDPE (3:1 sand:plastic). To see what works best, I started with a 50:40 sand:plastic ratio and gradually increased the quantity of sand to 60:40 and 70:30. A 75:25 combination produces a good floor paving block that may be used in a variety of locations. Because the plastic acts as a binding agent to keep the sand together, the tiles usually include more sand than plastic.

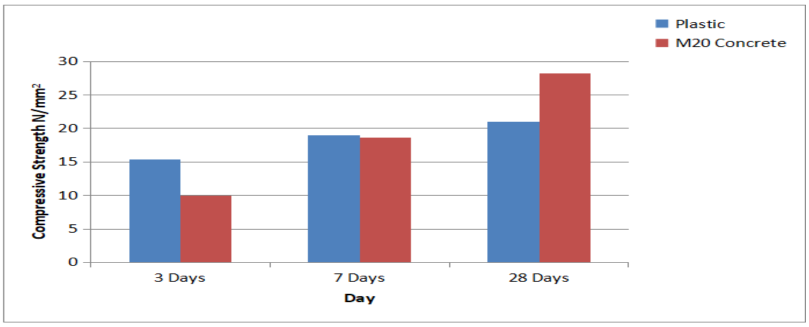
**Compressive strength for Plastic-Sand**

| Sr.No. | Different Proportion | Compressive strength N/mm2 |
|---|---|---|
| 1 | 50%-50% sand:plastic | 6.62 |
| 2 | 60%-40% sand:plastic | 7.22 |
| 3 | 70%-30%sand:plastic | 15.05 |
| 4 | 75%-25% sand:plastic | 23.54 |
| 5 | 80%-20%sand:plastic | 16.85 |

**Compressive strength for Plastic: sand: Aggregate**

| Sr. No. | Different Proportion | Compressive stre -ngth N/mm2 |
|---|---|---|
| 1 | 1:2:4 (Plastic: sand: Aggregate) | 14 |
| 2 | 1:1.5:3 (Plastic: sand: Aggregate) | 21.06 |

**Compressive strength of Plastic and M20 Concrete**




## IX. CONCLUSION

According to the findings of the investigation and analysis, waste plastics can be used in the construction of paving blocks. This redesigned pavement block can be used in rigid pavement construction. Quarry dust, fine aggregate, and plastics make up the block, with fine aggregate and quarry dust accounting for 60 to 70% of the total weight.

(a) Modified pavement block compressive strength is roughly equal to regular block.

(b) Construction costs will be lowered, and it will also help to avoid the common waste plastics disposal methods of land filling and cremation, both of which have environmental consequences.

(c) The use of polymers in pavement blocks decreases weight by up to 15%.

(d) We also discovered that plastic pavement block is less expensive and has a number of advantages over concrete pavement block.

(e) The greatest method for disposing of plastic is to employ recycled plastics in pavement blocks, which lowers plastic pollution in the environment.

## X. REFERENCES

[1] Miss Apurva J Chavan, "Use of plastic waste in flexible pavements" in the year 2013.

[2] Bahia Rabehi, Brahim Safi, and Rabahchaid,"Use of Recycled plastic bag waste in construction field" in the year 2014.

[3] Dr. R. Kumutha and Dr.K.Vijai, "Use of waste material in paver blocks" in the year 2015.

[4] Satish Parihar, Pramod Patil, Hemraj R Kumavat, "Recycled plastic used in concrete paver block" in the year 2010.

[5] C K Subramania Prasad, Benny Mathews Abraham, "Plastic fibre reinforced soil block as a sustainable building material" in the year 2012.

[6] Vishal kumar, Dr. A.K. Mishra, "Utilization of waste material in pavement blocks" in the year 2016.

[7] S.Vanitha, V.Natarajan and M.Praba, "Utilization of waste plastics as a partial replacement of coarse aggregate in concrete blocks" in the year 2015.

[8] S F Wong, "Use of recycled plastic in a pavement system" in the year 2010.

[9] P.Turgut and E.S. Yahlizade conduct a parametric trial study for reducing paver blocks utilizing fine and coarse waste glass.

[10] Nivetha, C. Rubiya, M. Shobana, S. Vaijayanathi, G. (2016). Production of Plastic Paver Block from the Solid Waste. ARPN Journal of Engineering and Applied Science.