Preparation of Brick by Using Plastic Waste

Rohan Prabhakar More
student
Department of civil engineering
SKN Sinhgad College of Engineering, Korti, Pandharpur
Solapur, India
rohanmore2223@gmail.com

Sujay Hanumant Deshmukh
student
Department of civil engineering
SKN Sinhgad College of Engineering, Korti, Pandharpur
Solapur,india
sujaydeshmukh08@gmail.com

Sahil Hanumant Deshmukh student
Department of civil engineering
SKN Sinhgad College of Engineering, Korti, Pandharpur
Solapur,india
sahilkolawale72@gmail.com

M. V. Tondase Guide
Department of civil engineering
SKN Sinhgad College of Engineering, Korti, Pandharpur
Solapur, India milind.tondase@sknscoe.ac.in

Abstract
Plastic pollution has become a critical environmental issue worldwide. Materials such as high-density polyethylene (HDPE), polyethylene terephthalate (PET), and plastics under 50 microns in thickness are particularly harmful. When these plastics enter the soil, they degrade its fertility, and when they reach water bodies, they disrupt marine ecosystems and degrade water quality. In response to this challenge, our project investigates a practical solution by incorporating plastic waste into the production of construction bricks. This method not only helps reduce the volume of plastic waste but also presents a cost-effective and eco-friendly alternative for the construction industry. The resulting bricks are evaluated for key properties including compressive strength, water absorption, and surface hardness to ensure structural viability.

Keywords: Plastic pollution, eco-bricks, construction material, strength testing, sustainable solution

I. Introduction

General Overview
This work explores the use of waste materials—specifically plastic and over-burnt brick fragments—as aggregates in the production of pavement blocks. Crushed sand is also included as a key component in the mix.

1.1 Plastic in Pavement Block Production
Plastic waste is repurposed in this project to manufacture paving blocks that are not only functional and visually appealing but also affordable and low-maintenance when properly designed and installed. Although concrete paving blocks are widely used in India and have generally shown reliable performance, issues like uneven block strength and surface wear still arise in some cases.
As the demand for construction materials continues to grow, the depletion of natural resources becomes a significant concern. Simultaneously, the volume of waste produced by industrial and residential sectors is rising rapidly. Sustainable construction aims to tackle these challenges by promoting the use of innovative and alternative materials, including recycled waste, to preserve natural resources and reduce environmental impact.
The plastic waste used in this study was collected from nearby sources. India generates around 5.6 million tons of plastic waste each year. Improper disposal of this waste severely pollutes the environment, harming both humans and animals. Therefore, managing plastic waste responsibly is essential and must follow the regulatory guidelines set by government authorities. Replacing cement with plastic waste in construction materials presents a viable solution, offering benefits for both the environment and the economy.

Material Properties of Plastic Used in Paver Blocks

The plastic material selected for use in this project exhibits properties that make it suitable for construction applications such as paver blocks. Its melting point, expansion behavior under heat, density, and tensile strength are key parameters that influence its performance when subjected to external loads and temperature variations.

Table: Key Physical Properties of Plastic

Sr. No.	Property	Range/Value
1	Melting Point	Approximately 150°C
2	Thermal Expansion Coefficient	(100–200) × 10^{-6} /°C
3	Density	0.910–0.940 g/cm³
4	Tensile Strength	0.20–0.40 N/mm²

These properties indicate that the plastic is lightweight, has moderate strength, and can withstand thermal changes, making it a suitable material for use in eco-friendly construction components.

1 Objectives:

The main objectives of this project are as follows:

i) To find an effective and practical method for utilizing plastic waste in construction.
ii) To decrease the dependence on cement in the production of pavement blocks.
iii) To prevent environmental degradation by reducing plastic waste accumulation on land and in water bodies.
iv) To create construction materials that are affordable for the general population.
v) To help conserve natural and non-renewable resources by diverting plastic from the waste stream.

1.2 Significance of Using Plastic Waste:

Plastic is a man-made material that does not naturally decompose and remains in the environment for hundreds of years, leading to serious land and water pollution. The volume of plastic found in municipal solid waste is growing rapidly and is expected to double every decade. This increase is particularly evident in household waste, where single-use plastic bags and packaging materials are common.

Disposal of such waste has become a major concern in many parts of the world. Despite differences in income levels or waste management systems, plastic waste remains a large component of household garbage across nations. Addressing this issue requires creative reuse. This project aims to tackle the problem by converting plastic waste into useful construction components like pavement blocks, turning a pollution threat into a building resource.

1.2 Use of Over-Burnt Bricks:

a) 1.2.1 Objectives

i) To reduce the cost of producing pavement blocks.
ii) To repurpose over-burnt bricks in a meaningful and productive way.
iii) To decrease the use of natural aggregates in pavement block production.

b) 1.2.2 Importance of Reusing Over-Burnt Bricks

In traditional brick-making methods, especially in countries like India and Bangladesh, a portion of bricks gets overexposed to heat due to uneven kiln temperatures. Roughly 13% of the total output becomes over-burnt. These bricks are often misshaped, overly hardened, and unfit for conventional building use.

Rather than discarding these damaged bricks, this project proposes their use as a substitute for conventional aggregates in the pavement block mix. This approach not only helps in managing industrial brick waste but also reduces overall production costs.

1.3 Crushed Sand (Artificial Sand):

Crushed sand, also referred to as artificial sand, is produced by mechanically breaking down rocks in specialized crushing equipment. The sand used in this project consists of particles smaller than 4.75 mm. It is used as a fine aggregate in the production of pavement blocks, contributing to their structural strength and durability.

II. LITERATURE REVIEW

[1]M. Bhushan et al. (2020):

The study by M. Bhushan et al. (2020) investigates the integration of recyclable materials—including glass fragments, crumb rubber, and plastic waste—into the development of concrete paver blocks. The primary aim was to examine how these alternative materials can support sustainable construction practices while reducing environmental impact. The research highlights that using recycled content in paving materials not only helps manage waste but also contributes to the creation of new, viable products for the construction industry.

The study outlines that combining various waste materials, such as industrial byproducts and construction debris, can serve as a practical replacement for conventional concrete components. These alternatives reduce the need for virgin resources and help lower landfill dependency. Notably, materials like fly ash—a byproduct of coal combustion—can be used effectively as a fine aggregate substitute, provided the replacement ratio does not exceed certain limits (typically around 25%).

The researchers also explored the role of plastic waste in concrete. They observed that plastics could be used as partial substitutes for cement or aggregates, and when used appropriately, they do not significantly degrade the performance of the final product. However, the selection of waste materials must be carefully evaluated, as not all types are suitable for structural use.

In addition to material composition, the paper reviewed the design and shape evolution of paver blocks over time. Early rectangular blocks have gradually been replaced or complemented by interlocking designs that improve performance under varying traffic conditions. Shapes like 'L', 'X', and 'Y' offer better mechanical interlock and surface stability, especially in areas exposed to heavy loading and harsh environmental factors.

Different types of paver blocks were categorized in the study based on their edge profiles and interlocking mechanisms:

- **Type A**: Straight-edged blocks without interlocking features.
- **Type B**: Blocks with alternating straight and curved sides, offering partial interlock.
- **Type C**: Fully interlocking blocks with curved or corrugated sides.
- **Type D**: Complex interlocking blocks in shapes like 'L' or 'X' that offer enhanced grip and skid resistance.

The authors noted that these blocks are especially useful in non-traffic areas such as public parks, shopping areas, pedestrian zones, bus terminals, and railway platforms. Their structural durability and minimal maintenance needs make them ideal for such applications.

[2] Lillian Gungat et al. (2021):

Lillian Gungat et al. (2021) investigated the potential of using recycled plastic (RP) in the creation of concrete paver blocks, focusing on mitigating plastic waste through sustainable construction practices. Plastic is widely used across the globe, and the rapid urbanization seen today has significantly increased plastic waste generation. Malaysia, ranking as one of the largest producers of mismanaged plastic waste, highlights the urgent need for effective recycling and waste management solutions. The study utilized polyethylene terephthalate (PET) plastic from discarded mineral water bottles, which were manually shredded to ease the subsequent melting process.

The research examined two different methods for producing paver blocks: the **heating method** and the **compression method**. In the heating method, shredded PET plastic was mixed with quarry dust and sand, and the mixture was heated at temperatures between 250°C and 300°C. After heating, the mixture

was stirred, poured into molds, and left to cool for 24 hours to solidify. The second approach, the compression method, involved grinding the shredded PET plastic into fine particles that replaced sand in a mixture of quarry dust, soil, cement, and water. This mixture was then subjected to compression using a machine to form the paver blocks.
Two different mix designs were applied in the study:

- **Heating Method**: The proportion of PET plastic to sand varied, with ratios of 1:1, 1:2, 1:3, 1:4, and 1:5 by weight.

- **Compression Method**: The mix ratios for cement, sand, and soil were 1:2:3 (Mixture A) and 1:1:2 (Mixture B). In this method, PET plastic was added as a replacement for sand at varying percentages (0%, 5%, 10%, 15%, 20%, 25%, and 30%).

Various tests were performed to assess the quality of the produced paver blocks, including soil sieve analysis, Atterberg limits, compressive strength, water absorption, and skid resistance. The soil used in the study was analyzed to determine its type and characteristics, and the Atterberg limit values were obtained using the fall cone and hand-rolling methods.
The **compressive strength test** was conducted at different curing intervals (0, 7, 14, and 28 days) to assess the strength development of the paver blocks. Water absorption tests were carried out to evaluate the porosity of the blocks, and the **skid resistance test** was performed to ensure that the paver blocks would provide adequate safety for pedestrians under both dry and wet conditions.
The outcomes of these tests were used to identify the most effective mix design for the paver blocks. The selected mix design aimed to optimize the use of recycled plastic, ensuring that the blocks would be both cost-effective and environmentally sustainable. The optimal design was then used to produce a prototype, which was employed in the construction of a pedestrian path at the University Malaysia Sabah, illustrating the practical application of the developed paver blocks.

[3] Sahani K et al. (2022) :

This research by Sahani et al. (2022) investigates the potential use of waste polyethylene plastic for the production of plastic-sand bricks. The study uses plastic waste sourced from local garbage, industrial waste, dumping sites, and discarded food containers. Several testing methods were employed to assess the material properties and the quality of the bricks.

1. **Plastic Penetration Test**: To measure the consistency of the molten plastic, a plastic penetration test was conducted according to the IS 1203:1958 standard. This test helped determine the plastic's setting time, which is important for the manufacturing process of the bricks.

2. **Specific Gravity Test**: The specific gravity of both the plastic and the sand was determined. The plastic's specific gravity was found to be 0.89, measured using a pycnometer with a 1-liter capacity. Meanwhile, the sand's specific gravity was calculated as 2.67.

3. **FTIR Spectroscopy**: Fourier Transform Infrared (FTIR) spectroscopy was utilized to analyze the chemical composition of the plastic. FTIR involves passing infrared radiation through the material, and based on the absorption of light, it generates a spectrum that identifies functional groups and molecular structures such as alkanes, ketones, and acid chlorides.

4. **Sand Characteristics**: Additional tests on the sand's particle distribution were conducted. The coefficient of curvature (Cc) was found to be between 1 and 3, and the coefficient of uniformity (Cu) was less than 6, which indicates good uniformity in the sand sample.

Mix Proportions:

To find the ideal mixture of plastic and sand, several ratios were tested: 1:3, 1:4, and 1:5. These proportions were tested in a Universal Testing Machine (UTM) to assess their strength and durability.

Casting Procedure:

1. **Batching and Drying**: The collected plastic waste was cleaned and oven-dried at temperatures between 20°C and 25°C to remove any moisture. After sorting and drying, the components were measured for the brick preparation.

2. **Melting**: The plastic was then melted at a temperature of 105°C to 115°C, with 8 kg of plastic

melted in two minutes.

3. **Mixing**: Once melted, the plastic was mixed with river sand manually until the mixture became uniform and homogeneous in both color and consistency.

4. **Molding**: The final mixture was poured into molds, and pressure was applied using a tamping rod to ensure proper compaction. To aid in easy removal, the walls of the molds were coated with oil. The bricks were left in the molds for 6 hours before being removed.

Results:

1. **Compressive and Tensile Strength**: The study found that reducing the percentage of plastic from 25% to 20% improved both the compressive and split tensile strength of the bricks. However, lowering the plastic content further led to a decline in strength, although the thermal resistance of the bricks improved.

2. **Water Absorption and Efflorescence**: The plastic-sand bricks passed the water absorption test with zero absorption, and there was no evidence of efflorescence, making the bricks suitable for practical applications.

3. **Thermal Resistance**: Bricks containing a higher proportion of sand exhibited better resistance to thermal variations, making them more suitable for thermal insulation.

4. **Optimal Mix**: The most effective ratio for maximizing both compressive and split tensile strength was found to be 1:4 (plastic: sand).

5. **Temperature Resistance**: A significant limitation of these plastic-sand bricks is their poor resistance to high temperatures, which restricts their use in extreme conditions.

Conclusion:

The study demonstrates that waste plastic, particularly polyethylene, can be effectively repurposed in the production of plastic-sand bricks. The 1:4 ratio of plastic to sand yields the highest strength, though the bricks are not suited for high-temperature environments. This approach offers an innovative solution to recycling plastic waste while producing durable and sustainable building materials.

[4] Supriya M et al. (2021) :

Bricks are widely used in construction as one of the most common masonry units. However, traditional building materials like bricks, tiles, and concrete blocks have become increasingly expensive, making them harder to afford, especially due to the rising demand for construction materials driven by a growing global population. This surge has led to a noticeable shortage of building materials in recent years. As plastic waste continues to accumulate globally, it offers a potential alternative in construction as a raw material. Plastic, being non-biodegradable, is harmful to the environment, contributing to soil and water pollution. The rising issue of plastic waste necessitates finding sustainable methods for its disposal, and repurposing it for construction could be a viable solution.

The primary focus of this research is to explore the use of plastic waste in construction materials, particularly in producing bricks. The objectives of this study include:

- Identifying effective methods to incorporate plastic waste into construction materials.
- Producing low-cost building materials.
- Promoting recycling practices in the construction industry.
- Reducing the consumption of natural resources like clay for brick manufacturing.
- Minimizing land pollution by preventing plastic waste accumulation in landfills.
- Lowering water and land pollution, contributing to a cleaner environment.

For brick manufacturing, handmade wooden molds were created with dimensions of 23 cm x 10 cm x 8 cm, slightly larger than the standard brick size of 19 cm x 9 cm x 9 cm as outlined by the Bureau of

Indian Standards (BIS).

Sand Properties:

Natural river sand was used as a fine aggregate in the production of plastic-sand bricks. The following properties were determined based on tests conducted according to IS: 2386 (Part-1):

- **Specific Gravity**: 2.68
- **Bulk Density**: 1631 kg/m³
- **Fineness Modulus**: 2.92

Plastic Properties:

Plastic is a versatile material made from various synthetic or semi-synthetic compounds, known for its ability to be molded into solid forms. Most plastics are derived from petrochemical products, but bioplastics, which are produced from renewable plant-based materials like cellulose and starch, are gaining popularity. Plastics are primarily used for packaging, containers, and disposable goods, but they are also found in durable products like furniture and tires. Managing the end-of-life disposal of plastics is becoming increasingly crucial as their accumulation poses environmental challenges.

The properties of plastic used in this study, based on data from the Chennai Central Institute of Plastic Engineering and Technology, are as follows:

- **Density at 23°C**: 0.958
- **Elastic Modulus**: 9
- **Tensile Strength at 23°C**: 2 MPa
- **Elongation at Break**: > 600%
- **Thermal Conductivity**: 0

Types of Plastics:

Plastics are classified into two main categories:

- **Thermoplastics**: These are linear polymers that soften when heated and harden when cooled. They can be repeatedly molded without undergoing chemical changes. Examples include polyethylene, PVC, and polystyrene.

- **Thermosetting Plastics**: These are cross-linked polymers that harden permanently after the first heating and pressure, undergoing a chemical change. Examples include epoxy resins and phenolic resins.

Mix Proportions:

In the study, various ratios of plastic to sand were tested, including 1:2, 1:3, and 1:4, to evaluate the compressive strength of the resulting bricks. The tests followed the guidelines in IS 3495 (1992) for common burnt clay building bricks. The following tests were conducted: compressive strength, water absorption, and efflorescence tests.

The results showed that as the ratio of plastic to sand increased, the compressive strength of the bricks decreased. The results were as follows:

- **Conventional Brick**: A maximum load of 32 kN resulted in a compressive strength of 1.27 N/mm².

- **Plastic-Sand Bricks**:
  - 1:2 ratio: 9.17 N/mm²
  - 1:3 ratio: 6.2 N/mm²
  - 1:4 ratio: 3.5 N/mm²

The water absorption tests revealed that plastic-sand bricks exhibited significantly lower water absorption compared to conventional bricks. Furthermore, these bricks showed no presence of alkali, unlike conventional bricks, which demonstrated improved resistance to alkali reactions.

Durability and Bonding:
The plastic-sand bricks demonstrated improved durability and quality compared to conventional bricks. The bonding between plastic and sand was enhanced by using a general-purpose resin, which contributed to better performance in terms of strength and durability. Additionally, these bricks were lighter than traditional clay bricks.
Economic Considerations:
While the 1:2 mix ratio exhibited the highest strength, making it ideal for strength-critical applications, the 1:4 ratio offered a better cost-performance balance. The 1:4 mix was more economical, with lower production costs, making it a suitable alternative to traditional bricks for general construction purposes.
Applications:
Plastic-sand bricks have potential applications in various civil engineering projects, including precast bricks, partition walls, and canal linings. These eco-friendly bricks provide a sustainable solution to both plastic waste disposal and the need for affordable building materials.

[5] Loganayagan et al. (2021) :
Pavements, commonly used for covering surfaces like footpaths and parking areas, are traditionally constructed using concrete and natural stones such as flagstone and cobblestone. In India, pavement construction technology has evolved over the decades, initially focused on footpaths and parking spaces, and now expanding to broader applications. The conventional raw materials for paver blocks generally include cement and aggregates, which are easy to source. However, recent innovations in the construction industry have introduced the use of recycled materials like PET (Polyethylene Terephthalate) waste and quarry dust, which are more affordable and environmentally sustainable.

This research investigates the use of PET waste in combination with quarry dust to manufacture paver blocks. The study focused on evaluating the compressive strength and durability of these blocks. The results showed that PET can be effectively used alongside 50% quarry dust and 25% fly ash to produce plastic paver blocks. These blocks are ideal for locations where they will not be subject to heavy load-bearing since their compressive strength is relatively low compared to traditional paver blocks.
Environmental Benefits of Recycling PET and Quarry Dust
PET is a major contributor to plastic waste, particularly due to its widespread use in consumer products like beverage bottles. By recycling PET waste, it can be incorporated into construction materials like paver blocks, providing a solution to the growing plastic pollution problem. PET's desirable properties, such as low density, ease of processing, mechanical strength, and resistance to chemicals, make it an attractive material for construction applications. However, PET is non-biodegradable, and improper disposal contributes significantly to environmental degradation. Recycling this material helps conserve non-renewable resources like oil and gas, while also contributing to a reduction in greenhouse gas emissions.
Incorporating PET into construction also supports sustainable practices. For example, using waste plastic in building materials like paving blocks can help save up to 60 million barrels of oil per year, according to the U.S. Department of Energy. In India, the use of plastic in road construction has been proven effective, with plastic-based roads lasting up to 10 years and reducing maintenance costs.
Properties of PET and Quarry Dust in Construction
PET is a polyester plastic that is commonly used in packaging, particularly in beverage bottles. It is known for its high tensile strength, transparency, resistance to chemicals, and fireproof qualities. These properties make PET highly valuable in construction, even though it is non-biodegradable. PET can be processed into thermoplastic materials, which can be molded into various forms, including paver blocks.
Quarry dust, which is a byproduct of stone crushing, is another valuable material for construction. It consists of fine particles smaller than 4.75 mm and is an effective substitute for river sand. Quarry dust is widely available, cost-effective, and offers comparable properties to natural sand.
Process of Manufacturing Plastic Paver Blocks
The plastic paver blocks in this study were made by shredding PET waste, specifically from discarded plastic bottles, into small strips. These strips were then heated to temperatures above 150°C until they melted. After the plastic melted, quarry dust was mixed in according to the specified ratio. The molten mixture was poured into molds (measuring 70 x 70 x 70 mm) and allowed to cool for 24 hours, during which time it solidified into a hardened form.
Once cooled, the paver blocks were removed from the molds and tested for compressive strength. The

results revealed that the blocks made with equal parts PET and quarry dust exhibited stronger compressive strength than other mixtures. However, these blocks were not suitable for areas with heavy traffic due to their lower compressive strength compared to conventional paver blocks.

Conclusion and Potential Uses

The study demonstrates that using recycled PET waste in paver blocks can be a cost-effective and environmentally beneficial solution for construction. While the compressive strength of these blocks is lower than that of traditional concrete pavers, they can still be used in low-traffic areas such as footpaths and pedestrian zones. Moreover, this recycling process provides an effective way to manage plastic waste, reducing environmental pollution and conserving natural resources.

By utilizing PET waste and quarry dust in the production of paver blocks, this approach offers a sustainable alternative to conventional construction materials, contributing to both cost savings and environmental protection.

[6] Al-Sinan, M.A. (2022) :

The circular economy model offers a sustainable alternative to the traditional linear approach of "take, make, use, dispose." It aims to keep resources in circulation for as long as possible, maximize their utility during their lifecycle, and regenerate products after they reach the end of their use. The development of plastic sand bricks and blocks serves as an innovative example of this circular economy concept.

Plastic waste, including materials like bottles, bags, and sheets, is non-biodegradable and contributes significantly to environmental pollution. The world produces over 25 million tons of plastic waste each year, but only a small fraction—about 10%—is recycled. The remainder ends up in landfills or pollutes natural ecosystems. According to the United Nations Development Program (2019), improper disposal practices could lead to 12 billion tons of plastic waste in landfills and the environment by 2050 if current consumption and waste management trends continue.

In response, there has been growing interest globally in converting plastic waste into useful products, especially in developed nations. One area with substantial potential is the construction industry, which relies heavily on raw materials and consumes a significant portion of global resources. Recycling plastic waste into construction materials offers a promising solution to both the plastic pollution problem and resource depletion in the building sector.

A key advantage of using plastic in construction materials, such as plastic sand bricks and blocks, is that it reduces the need for traditional building materials like concrete. The cement industry is responsible for a considerable portion of global CO_2 emissions, producing around 8–10% of the world's total emissions. Replacing conventional cement bricks with plastic-based alternatives could significantly decrease CO_2 emissions associated with construction activities, contributing to efforts to mitigate climate change.

III. MATERIALS

Preparation of the Mixture and Casting of Pavement Blocks Using Waste Materials The following materials are utilized for making pavement blocks from waste materials:

1. **Plastic**
2. **Artificial sand**
3. **Crushed over-burnt brick pieces**

c) **4.5.1 Melting Process for Plastic:**

Plastic waste, such as plastic bags, is collected and placed into a melting drum. The process begins with setting up stones to support the drum, and firewood is arranged around the stones. Once the firewood is ignited, the drum is heated to facilitate the removal of moisture from the plastic. After the plastic has melted completely, river sand is added to the molten plastic. It is essential to ensure that the mixing process is quick to achieve a consistent and homogeneous mixture.

IV. METHODOLOGY

d) 1. Preparation of Mould

- The first step is to prepare the mould that will shape the plastic paver blocks. The size and dimensions of the mould must be appropriate for the desired block size (e.g., 1900mm x 90mm x 90mm).
- Ensure the mould is clean and free from any dirt or contaminants that could affect the block's shape and surface finish.

e) 2. Collection of Waste Materials

- Gather various waste materials such as discarded plastic (e.g., PET bottles, plastic bags), quarry dust, and river sand. These materials should be cleaned and sorted to ensure purity and consistency in the final product.

f) 3. Preparation of the Mixture

- The collected plastic waste is shredded into smaller pieces to prepare it for mixing.
- The shredded plastic is then heated until it melts. Once molten, it is mixed with river sand and quarry dust in the appropriate proportions.
- If needed, other additives, such as fly ash, are incorporated to enhance the block's properties.

g) 4. Casting the Block

- Once the mixture is ready, it is poured into the prepared mould.
- Care is taken to fill the mould evenly and compact the mixture to avoid air pockets, ensuring a uniform density in the block.

h) 5. Curing the Block

- After casting, the block is removed from the mould and placed in water for curing. Curing allows the block to harden and strengthen over time.
- Water is replaced periodically to maintain optimal curing conditions, and the block is left to dry in the shade, allowing it to shrink and harden completely.

i) 6. Testing of the Block

- The hardened blocks undergo various tests to assess their performance:
  - **Compressive Strength Test**: Measures the block's ability to withstand pressure.
  - **Water Absorption Test**: Evaluates how much water the block can absorb.
  - **Efflorescence Test**: (optional) Determines the presence of salts on the block's surface.

j) 7. Result Evaluation

- After conducting the tests, the results are carefully analyzed. This data is then used to assess the block's quality and performance, particularly in comparison to conventional blocks.

k) 8. Conclusion

- Based on the results, a conclusion is drawn regarding the viability of plastic paver blocks for construction purposes.
- Any necessary improvements or modifications are suggested for future production of the blocks.

A) MIX DESIGN:

Plastic Block Proportions

Below is the breakdown of the proportions used for making plastic blocks of various grades, including the amounts of plastic, over burnt brick small pieces, and artificial sand:

Sr. No.	Grade	Plastic (kg)	Over burnt Brick Small Pieces (kg)	Artificial Sand (kg)
1	M10	1	3	6
2	M15	1	2	4
3	M20	1	1.5	3
4	M25	1	1	2

Fig No.1: Casting of cube, vibration by machine and curing of cube.

IV. TESTS AND RESULTS

Compressive Strength of Paver Blocks:

Compressive strength is a crucial and practical property of concrete. To determine this, a compression testing machine was employed, following the procedures outlined in Annex D of IS 15658: 2006. The machine includes two steel bearing blocks used to hold the specimen. The specimen is positioned between these steel plates during testing. The dimensions and cross-sectional area of the specimen were determined according to the guidelines specified in Annex B.

After drying, the specimen was placed on the testing machine, and the load was gradually applied until the specimen failed. The maximum load applied at the point of failure is recorded as *N*.

1. The plastic paver blocks, with dimensions of 200x100x100 mm, were cast for the experiment. The maximum load at failure was noted, and the average compressive strength was calculated using the following formula:

2. **Compressive Strength (N/mm^2)** = (Maximum Load in N) / (Cross-sectional Area in mm^2)

Weight of Plastic Blocks

Serial No.	Plastic Block (Weight in kg)	
	M 20	**M 25**
1	1.510	1.988
2	1.577	1.981
3	1.562	1.872
4	1.610	1.951
5	1.537	1.895
6	1.598	1.932

Compressive Strength of Plastic Blocks (in N/mm^2)

Serial No.	Plastic Block (Compressive Strength in N/mm²)	
	M 20	M 25
1	4.53	5.23
2	4.00	5.84
3	4.12	5.73
4	3.45	5.97
5	4.67	4.86
6	4.23	5.13

Curing:

After molding, plastic paver blocks can be used right away. However, concrete paver blocks require a curing process. These blocks are submerged in water for approximately 20 days to allow the cement to properly set. The water is usually replaced every three days during this period. After curing, the blocks are left to dry in a shaded area, which helps with the initial shrinkage process. Typically, this drying phase lasts for about 15 days before the blocks are ready for use.

Water Absorption Test:

A water absorption test was conducted to assess the performance of the plastic blocks. Initially, after drying, the blocks were submerged in water for 24 hours. Once the immersion period was over, the blocks were taken out and allowed to drain for one minute on a wire mesh with openings of at least 10 mm. The blocks were then wiped with a damp cloth to remove any excess water from the surface. Immediately after this, both the wet and surface-dry weights were recorded.

Following the initial weighing, the blocks were placed in an oven set to a temperature range of 100°C to 115°C. They remained in the oven for at least 24 hours or until the weight change between two consecutive measurements, taken two hours apart, was less than 0.2% of the previous reading.

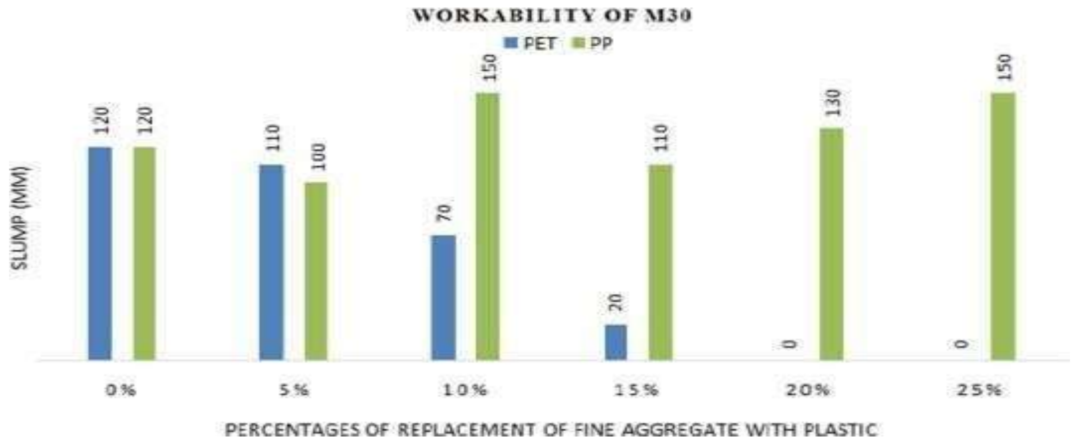
The blocks were first weighed when dry, and then again after being immersed in water for 24 hours. The difference between the wet and dry weights was used to calculate the water absorbed by the blocks.

The percentage of water absorption was determined using this formula:

Water Absorption (%) = {[W2 – W1] / W1} x 100

Where:
W1 = Weight of the dry block (kg)
W2 = Weight of the wet block (kg)

Result:
{[1.510 – 1.510] / 1.510} x 100 = 0



V. CONCLUSION

Plastic remains in the environment for a long time, causing significant harm, which necessitates its degradation. One solution to this issue is creating paver blocks from plastic waste.

These plastic-based paver blocks can be applied in the following ways:

- Gardens, pedestrian paths, and cycle ways.
- Low-traffic roads or areas with minimal vehicular movement.
- The study found that paver blocks made from construction waste materials had a higher water absorption rate compared to those made from river sand.
- The incorporation of waste materials gradually enhances the key features of pavers. The composition and ratio of waste materials vary, depending on the type of plastic or byproduct used.
- The compressive strength of these blocks is suitable for use, falling within the required range of 7 N/mm^2.
- Furthermore, paver blocks made with plastic in the concrete mixture are approximately 15% lighter than traditional concrete blocks.

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