REPORT

PLASTIGROUND: SUSTAINABLE FOUNDATION FILLING USING WASTE PLASTIC.

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❖ INTRODUCTION

Environmental pollution caused by plastic waste has become one of the world's most critical challenges. India alone generates over **3.4 million tonnes of plastic waste annually**, and a large portion of it remains uncollected, clogging drains, polluting rivers, and contributing to land degradation.

At the same time, conventional foundation-filling materials such as sand, murum, and gravel are becoming scarce and expensive. Continuous mining of natural resources also leads to soil erosion, groundwater depletion, and ecological imbalance.

PLASTIGROUND provides a sustainable and innovative solution by **using waste plastic as a foundation-filling material** for small and medium-scale houses. This method helps reduce plastic pollution while providing light weight, durable, and cost-effective construction.

❖ PROJECT OBJECTIVES

1. To reduce the amount of plastic waste generated in the environment.

2. To develop a sustainable foundation-filling method using shredded waste plastic.

3. To analyze the strength, load-bearing capacity, and suitability of plastic blocks for foundation filling.

4. To compare plastic-based filling material with conventional soil and sand filling.

5. To promote eco-friendly construction technologies.

❖ LITERATURE REVIEW

Plastic Waste Problem

➢ Plastic takes 400–500 years to decompose. India and the world face increasing landfill pressure due to non-biodegradable waste.

Plastic in Construction

Research shows that plastic can be used for:

1. Plastic roads
2. Interlocking blocks
3. Lightweight concrete
4. Modular panels
5. Foundation filling

Properties of Waste Plastic

1. Non-biodegradable
2. Lightweight
3. High water resistance
4. Durable
5. Low thermal conductivity
6. High compressive strength when compacted.

❖ MATERIALS USED

Waste Plastic

Types used:

1. HDPE (bottles, cans, containers)
2. LDPE (bags, sheets)
3. PP (buckets, packaging)
4. PET (water bottles)

Soil / Sand (Top Layer)

➢ A stabilizing layer of Murum + sand mixture is placed above plastic for load transfer.

Binding Materials (Optional)

1. Cement slurry
2. Geotextile layer

❖ <u>METHODOLOGY</u>

Collection of Plastic Waste

<u>Plastic was collected from:</u>

1. Households
2. Scrap dealers
3. Waste management centers

Cleaning & Shredding

<u>Plastic is washed, dried, and cut into:</u>

1. 20–40 mm pieces
2. Bottles crushed
3. Bags compacted

Layering in Foundation Pit

For a 1000 sq ft house, foundation depth = 5 ft

<u>Layers:</u>

1. Bottom 3–4 ft → 100% compressed plastic waste
2. Top 1–2 ft → Murum + sand (load distribution)

Compaction

<u>Plastic is compacted using:</u>

1. Manual compactor
2. Plate vibrator

Covering

A geotextile sheet is placed above plastic to prevent mixing with soil.

CALCULATIONS

Assumption:-

Foundation Volume (1000 sq ft × 5 ft deep)

1. 1000 sq ft = 92.9034 m^2

2. Depth = 5 ft = 1.524 m

Total volume = 92.9034 × 1.524 = **141.584 m^3**

Plastic filling volume for (20%)

1. For 20% (f=0.20):- with density (ρ= 400)

Vp = 0.20 X 141.584 = 28.316 m^3

Mass = volume X density.

Use densities you previously suggested: **400, 500, 600 kg/ m^3**

Total plastic trapped = ρ= **400** = mass = 28.316 X 400 = ≈ **11,327 Tonnes.**

2. For 20% (f=0.20):- with density (ρ= 500)

Vp = 0.20 X 141.584 = 28.316 m^3

Mass = volume X density.

Use densities you previously suggested: **400, 500, 600 kg/ m^3**

Total plastic trapped = ρ= **500** = mass = 28.316 X 500 =≈ 14.158 **Tonnes.**

3. For 20% (f=0.20):- with density (ρ= 600)

Vp = 0.20 X 141.584 = 28.316 m^3

Mass = volume X density.

Use densities you previously suggested: **400, 500, 600 kg/ m^3**

Total plastic trapped = ρ= **600** = mass = 28.316 X 600 =≈ 16.990 **Tonnes.**

Plastic Filling Volume for (30%)

1. For 30% (f=0.30):- with density (ρ= 400)

Vp = 0.30 X 141.584 = 42.476 m^3

Mass = volume X <u>density.</u>

Use densities you previously suggested: **400, 500, 600 kg/ m^3**

Total plastic trapped = ρ= **400** = mass = 42.476 X 400 = ≈ **16.990 Tonnes.**

2. For 30% (f=0.30):- with density (ρ= 500)

Vp = 0.30 X 141.584 = 42.476 m^3

Mass = volume X <u>density.</u>

Use densities you previously suggested: **400, 500, 600 kg/ m^3**

Total plastic trapped = ρ= **500** = mass = 42.476 X 400 = ≈ **21.238 Tonnes.**

3. For 30% (f=0.30):- with density (ρ= 600)

Vp = 0.30 X 141.584 = 42.476 m^3

Mass = volume X <u>density.</u>

Use densities you previously suggested: **400, 500, 600 kg/ m^3**

Total plastic trapped = ρ= **600** = mass = 42.476 X 400 = ≈ **25.485 Tonnes.**

- **Result – mass of plastic that can be trapped (Tonnes) :- (ρ = density).**

Plastic fraction	ρ= 400 kg/ m^3	ρ= 500 kg/ m^3	ρ= 600 kg/ m^3
5%	2.832 Tonnes	3.540 Tonnes	4.248 Tonnes
10%	5.663 Tonnes	7.079 Tonnes	8.495 Tonnes
20%	11.327 Tonnes	14.158 Tonnes	16.990 Tonnes
30%	16.990 Tonnes	21.238 Tonnes	25.485 Tonnes
100% (all fill plastic)	56.634 Tonnes	70.792 Tonnes	84.951 Tonnes

Conclusion

1. The plastic does not bear the load directly.
2. The top soil/Murum layer distributes the load effectively onto the plastic blocks to the ground.

Plastic only acts as:

1. Void filler
2. Lightweight material
3. Drainage improver
4. Eco-friendly filler

ADVANTAGES OF PLASTIGROUND

Environmental Benefits

1. Reduces landfill waste
2. Minimizes river/ocean pollution
3. Promotes circular economy

Construction Benefits

1. Lightweight foundation
2. Lower cost
3. Faster filling
4. No termite or water damage
5. Good drainage and prevents capillary rise

Economic Benefits

1. Saves money on soil/sand filling
2. Reduces transportation cost
3. Generates income for waste collectors

DISADVANTAGES

Technical

1. Not suitable for high-rise buildings
2. Needs proper compaction
3. Requires top soil layer for load transfer

Environmental

1. If burnt accidentally, releases toxic fumes
2. Needs careful segregation of plastic types

Practical

1. Requires shredding/cleaning before use
2. Not widely accepted yet

APPLICATIONS

1. Small houses
2. Portable cabins
3. Farmhouses
4. Temporary structures
5. Footpaths
6. Garden landscapes
7. Site leveling

RESULTS

<u>The study shows:</u>

- A **1000 sq ft home** foundation can trap **15–16 tonnes** of plastic.
- This reduces landfill volume significantly.
- Load-bearing performance is safe **for single-floor houses**.
- Plastic foundation is **eco-friendly, durable, and cost-effective.**

CONCLUSION

PLASTIGROUND is a successful sustainable method for reusing plastic waste in construction. By using shredded plastic as lightweight filling material, environmental waste is reduced while lowering construction costs. The method is ideal for small and medium residential houses and helps promote sustainable development.

FUTURE SCOPE

1. Government approval for plastic foundation standards
2. Use in large projects.
3. Development of plastic-soil hybrid blocks.
4. Mechanized plastic filler machines.
5. Plastic-based fully modular construction systems.

REFERENCES:- ChatGPT and <u>Self.</u>