

Construction of open air dias by using waste plastic bottles

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ABSTRACT

The research aims at studying the potential of reusing plastic water bottles as a building material and an alternative to traditional bricks, in a way that can minimize waste and hence reduce ecological imbalance. The research compares the performance of building with traditional bricks and building with plastic bottle blocks. One of the main disadvantages in constructing houses is high cost of the building. High cost is primary requirement for constructing the house in places where people are below poverty line, is becoming one of the most significant problem of peoples. Eco friendly architectural principles are being incorporated into more buildings every day in the world but they are still out of reach of many people due to lack of knowledge and awareness. We implemented strategies and systems based on Eco-friendly environment that could still be built at very low costs, with waste materials that is plastic bottle. The researchers-built (open air dias) with both materials. Then they took on-site measurements for performance of the walls. Results showed that building with plastic water bottles has some environmental benefits other than reuse of a material. At the end, it concluded that in different factors such as time of execution, load capacity, flexibility, reducing waste, cost and energy efficiency, plastic bottles can be more effective compared to some conventional building materials such as brick, concrete and ceramic blocks.

KEYWORDS: Plastic waste PETE bottle, Construction material, Ecofriendly construction, Compressive strength, Economical, Durable

I. INTRODUCTION

In recent times, a human, on the one hand, is always seeking broader sources with lower prices and on the other hand, is following the way to get rid of the plastic wastes. This paper introduces the improvement and low-cost housing in India. The generation of plastic waste is one of the fastest industrial-wise. It is estimated that the rate of expansion is doubled every year. Plastics constitute 30% of total waste produced most of which is from discarded plastic bottles. The plastic waste cannot be disposed of off by dumping or burning, as they produce uncontrolled fire or contaminate the soil and vegetation. Compared to other materials such as plastic bottles have lower cost, higher strength-to-weight ratio more durable, resistant to collapse, easy to work and shape, and have low density. The only way to reduce the hazards of plastic is reduce and reuse. Plastic bottles are increasing in the environment due to manufacturing the chemicals and their improper use and disposal. Major cause of solid waste disposal is waste plastic bottle. Plastics are produced from the oil that is considered as non-renewable resource. The objective of this project is to investigate the key and positive characteristics of this product and the benefits obtained by using it in building. Today the technology developed in great scale that the utilization of renewable resources is made possible which protect the global environment. Also, if technology permits bottles in construction, the carbon emission happens during of an ordinary Indian standard brick can be reduced.

i. OBJECTIVES OF THE STUDY

The objectives of this research are: -

1. Introducing plastic bricks in the construction in replacement of normal bricks usage.
2. To introducing a low-cost housing technique.
3. To promote eco-friendly housing by reducing the environmental waste and also the impacts in normal brick preparation.
4. To compare the strength properties of the plastic bottle construction and as well the normal brick construction
5. To study proposed method of construction.
6. To evaluate the possibility of recycling waste PET bottles.
7. To know applications of plastic waste in the construction industry.
8. To make construction economical if possible.
9. Study about cost comparison between conventional material and bottle mud brick.
10. To use plastic waste which is generated by human use.

II. LITERATURE REVIEW

1. Mojtaba et al. Concluded that using the plastic bottles as the building materials can have substantial effects on saving the building embodied energy by using them instead of bricks in walls and reducing the CO₂ excretion in manufacturing the cement by reducing the % of cement used.

2. **Seltzer et al.** revealed that the first example of known structures built with bottles are the William F. Peck's Bottle House located in Nevada (USA). It was built around 1902, and it required 10,000 beer bottles to be built.

3. **Vikram Pakrashi et al.** examined Eco-brick as a viable resource for construction purposes with several possible applications. The weight of Eco-brick was observed to hold a near relationship with load at failure and with specific strength. Eco-bricks have a relatively good a specific strength.

III.MATERIALS

Basic main materials in this project below

- Soil
- cement
- Aggregates
- Chicken mesh
- Plastic bottle
- Water

1.Soil

Soil is the basic element in any construction project so before using it in our project we have to study the basic properties of the soil and go through different tests, to check whether the soil sample selected is suitable for the given project.



Figure 1: Soil

2.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 (aggregate) together. Cement mixed with fine aggregate produces mortar for masonry, or with sand and gravel, produces concrete. Concrete is the most widely used material in existence and is behind only water as the planet's most-consumed resource.



Figure 2: Cement

3.Aggregates

There are various types of mineral aggregates used to manufacture bituminous mixes can be obtained from different natural sources such as glacial deposits or mines and can be used with or without further processing. The aggregates can be further processed and finished to achieve good performance characteristics. Industrial by-products such as steel slag, blast furnace slag, fly ash etc. sometimes used by replacing natural aggregates to enhance the performance characteristics of the mix. Aggregate contributes up to 90-95 % of the mixture weight and contributes to most of the load bearing & strength characteristics of the mixture. Hence, the quality and physical properties of the aggregates should be controlled to ensure a good pavement.

Two types of aggregates

- Coarse aggregate
- Fine aggregate

1.Coarse aggregates

The aggregates retained on 4.75 mm sieve are called as coarse aggregates. Coarse aggregate should be screened crushed rock, angular in shape, free from dust particles, clay, vegetations and organic matters which offer compressive and shear strength and shows good interlocking properties. In present study, the coarse aggregate with specific gravity 2.75 is used.



Figure 3: Coarse aggregate

2.Fine aggregates

Fine aggregate should be clean screened quarry dusts and should be free from clay, loam, vegetation or organic matter. Fine aggregates, consisting of stone crusher dusts were collected from a local crusher with fractions passing 4.75 mm and retained on 0.075 mm IS sieve. It fills the voids in the coarse aggregate and stiffens the binder.



Figure 4: Fine aggregate

4.Chicken mesh

Chicken mesh as there is difference in coefficient of thermal expansion of both concrete and bricks as thus to avoid cracks at their joints it is provided to strengthen the plaster

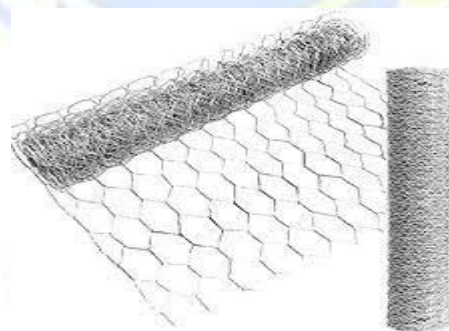


Figure 5: Chicken mesh

5.Plastic bottle

PET PLASTIC Full form of PET is Polyethylene Terephthalate and molecular formula is $C_{10}H_8O_4$. Structure Composition is Polyester of Terephthalic acid and ethylene glycol.

Introduction of PET is used for high impact resistant container for packaging of soda, edible oils and Peanut butter. Used for cereal box liners, Microwave food trays. Used in medicine for plastic vessels and for Implantation. Plastic is heat resistant and chemically stable. PET is resistant to acid, base, some solvents, oils, fats. PET is difficult to melt and transparent and other properties are Colour, White or light cream material. Density of plastic.

More than 20,000 plastic bottles are needed to obtain one ton of plastic. It is estimated that 100 million tons of plastic are produced each year. The average European throws away 36 kg. of plastics each year. Some plastic waste sacks are made from 64% recycled plastic. Plastics packaging totals 42% of total consumption and every year little of this is recycled.

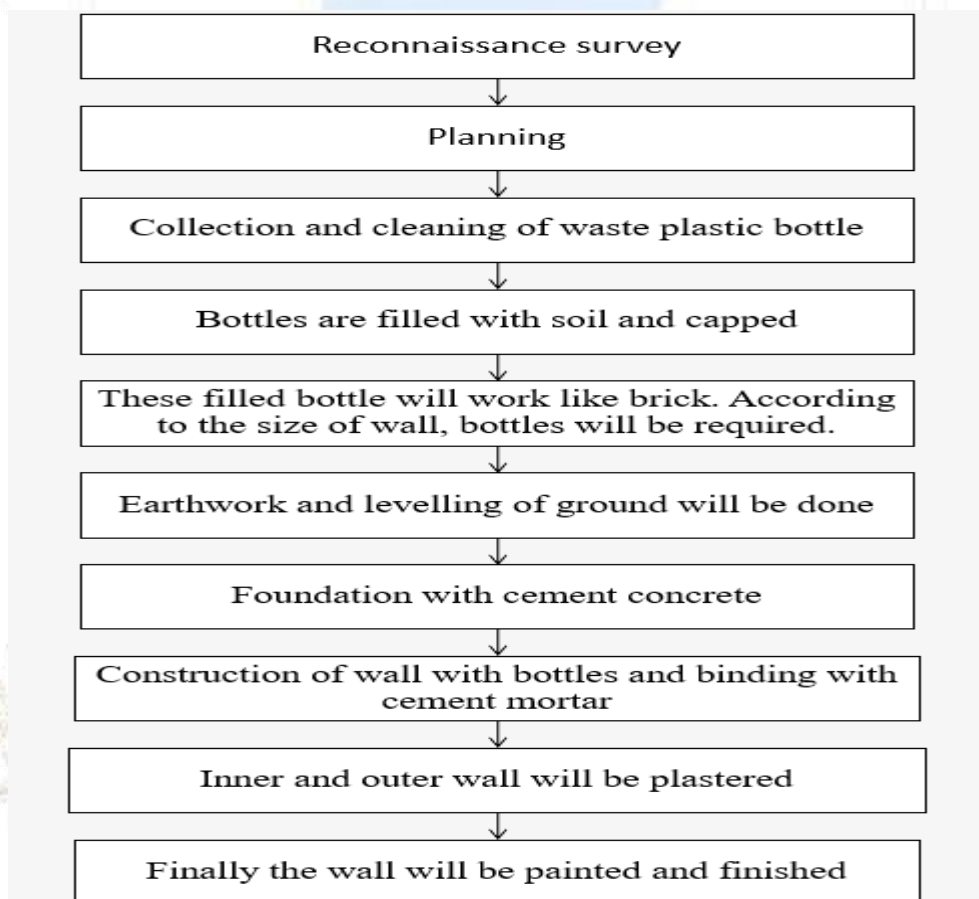


Figure 6: Plastic bottle

6. Water

Water is similarly way to cement, an active component in mortar. The quality of water uses as a direct impact on the strength of the mortar and cement in the construction work. 20% of the overall weight of the cement and soil was used to determine the quantity of water to be used in the mix. A slump test and a flow test were conducted to evaluate the consistency of the fresh mortar.

IV. METHODOLOGY



V.PLAN

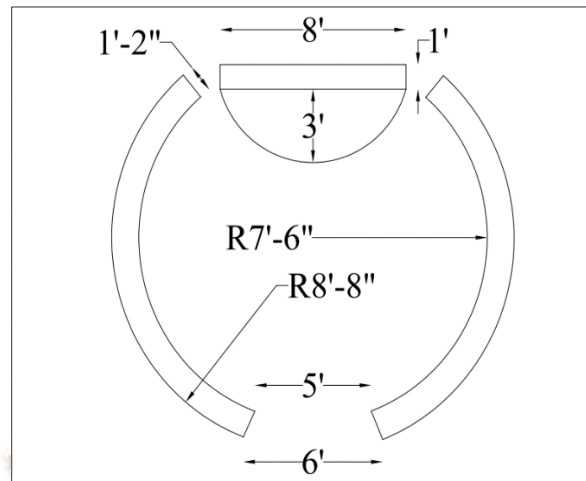


Figure 7 : Top view plan in autocad



Figure 8: Output

VI.COST COMPARISON BETWEEN BRICK MASONRY WALL AND PLASTIC BOTTLE MASONRY WALL

- The cost of plastic bottle masonry wall is economical compared to brick masonry wall. The cost of construction of plastic bottle masonry wall is Rs.70671 and the cost of brick masonry wall is Rs.72338.
- The number of bricks used for volume 3.12m^3 is 1545.
- The number of plastic bottles used for volume 3.12m^3 is 750ml – 616, 2250ml – 628.
- The cost per each brick is Rs.8 the bottles are available freely the construction is decreases by 17%.

VII. EXPERIMENTAL TEST

Load bearing capacity for each bottle was determined on compression testing machine and the average value was considered for analysis. Weight of empty PET bottles and completely filled PET bottles were noted and amount of soil used was calculated for the same. Similarly, load bearing of brick was calculated by taking the average value and the results were compared and analysed



Figure 9: Load bearing test (bottle bricks)

VIII. CONCLUSION

- From the above experimental observations, we can that no curing time is required if waste plastic bottles are used as building material as compared to bricks which required 28 days of curing time also while making of brick of bricks there is a major issue of carbon emission which is negligible by using this plastic bottles.
- Cost of construction of plastic bottle is nearly same the standard brick.
- Generally, the bottle houses are bioclimatic in design, which means that when it is cold outside is warm inside and when it is warm it is cold inside.
- Thus, we can conclude that using the concept of plastic bottle construction is less cost, energy efficient and commercially feasible.

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