

REUSE OF NON-DEGRADABLE WASTE PET BOTTLES FOR GROUND IMPROVEMENT

Tanmay Gosavi ¹, Prof. Nagaraj Patil²

¹ Student, Department of Civil Engineering, TSSM'S Bhivarabai Sawant College of Engineering and Research, Narhe, Pune 411041, Maharashtra, India

² Prof. Nagaraj Patil Professor, Department of Civil Engineering, TSSM'S Bhivarabai Sawant College of Engineering and Research, Narhe, Pune 411041, Maharashtra, India

ABSTRACT

This proposal proposes replacing uniform bricks with waste plastic PET bottles as a construction unit. Plastic disposal has long been a challenge because it is non-biodegradable. Solid waste disposal is dominated by waste plastic bottles. For carbonated beverage and water bottles, polyethylene terephthalate is frequently used. This is a problem for the environment because used plastic bottles are difficult to biodegrade and require recycling or reuse techniques. The building industry is in desperate need of low-cost materials to improve the structural strength of their chevaliers. This research investigates the possibility of partially substituting trash PET bottles. It can be concluded that the advantages of using PET bottles include increased ductility over raw blocks and the prevention of fracture propagation after the first creation of a crack. The project's solution is one of the solutions to the long-standing waste disposal problem. Plastics' lightness, durability, and chemical resistance have increased their use in everyday life, but their careless littering and haphazard disposal have thrown off our environment's ecological balance in recent years. Due to government legislation, we have seen a significant decline in the use of plastic bags in recent days. However, the packaging industry has increased its use of plastics because to their compactness and ease of handling. Using plastic raw bottles as cellular confinements, this experimental investigation attempts to provide a strategy for increasing soil bearing capacity. In addition, these bottles can be used to make wall compound.

Keyword: - Environmental Benefits, Non Degradable Waste, and PET Bottles for Ground Improvement, Advantages of pet bottles.

1. INTRODUCTION

Plastics are made from oil, which is a nonrenewable resource. Plastic is regarded a sustainable trash and environmental pollutant since it has an insolubility of roughly 300 years in nature. As a result, reusing or recycling it can help to mitigate its environmental effects. It will be uneconomical for the country to establish sustainable development if society is affected. Because of the rapid expansion of infrastructure and the shortage of resources, it is necessary to create and employ alternative/waste materials for construction or to improve the engineering features of existing materials. The most basic element is soil, which serves as the foundation for all sorts of construction. Soil stabilization entails the use of controlled compaction, proportioning, and/or the use of appropriate admixtures or stabilizers to improve the soil's stability or bearing power. Geo-cells are interconnected 3D honeycomb structures that provide cellular confinement to the soil. These cells completely encase weak materials like soil, stones, and

provide all-around confinement due to their three-dimensional structure, which prevents the material from lateral spreading, resulting in a much stiffer mat-like structure that distributes the overcoming load over a much larger area. Nowadays, humans use all of their resources to consume more. Unless the beginning resources are reduced and the landfill is expanded, the result of this huge consumption is nothing. In recent years, humans have been on the lookout for more diverse supplies at reduced prices while also following the path to eliminate waste. Waste can now be produced anywhere humans have left their tracks, reminding him that they have not selected the best strategy for exploiting nature. By bridging the gap between the rich and the disadvantaged in society, plastic bottles can help to achieve social fairness. With today's world's population development, the demand for buildings has increased, and to meet this demand, countries opt to employ industrial building materials rather than indigenous and traditional materials. These variables, while raising energy consumption in the industrial sector, can also raise the cost of housing and be seen as a barrier to consumers obtaining essential life necessities. At this time, we have more options than ever before for harnessing renewable resources such as solar, wind, and geothermal, and this science is progressing. However, instead of using fossil fuels, which are cheap and have little environmental impact, those energies can be used as one of the renewable and alternative energies. With a severe housing shortage but plenty of plastic bottles littering the streets, the Development Association for Renewable Energies, a Nigerian non-governmental organization, decided to construct an incredible two-bedroom bungalow made entirely of plastic bottles that is bullet and fireproof, earthquake resistant, and maintains a comfortable interior temperature of 64 degrees Fahrenheit all year. Hundreds of plastic bottles were filled with sand before being strung together at the neck. The bottles were then properly placed and compacted down with a mix of mud and cement, resulting in a stronger building material than blocks. So far, numerous researchers have undertaken a variety of tests.

2. OBJECTIVES

This project's goals are as follows:

Conduct CBR experiments on quarry dust in the laboratory and look into the following:

1. Evaluate the performance of waste PET bottle embedded sections in comparison to plain parts.
2. Look at the impact of bottle aspect ratio on performance.
3. Investigate the impact of various bottle configurations on section bearing resistance.
4. Calculate and compare the improvement factors for reducing pavement thickness by embedding plastic bottles in quarry dust.

3. METHODOLOGY

1. Gather PET bottles and quarry dust that have been discarded.
2. Assess the index and engineering qualities of quarry dust.
3. Using CBR tests, investigate the efficacy of used PET bottles in increasing bearing capacity.
4. The California Bearing Ratio test was carried out on various configurations by arranging the bottles in various patterns such as triangle (3 bottles), diamond (4 bottles), and circular (5 bottles) at various heights (cut bottles at 11.6cm, 9.3cm, and 6.6cm) to achieve the desired optimum aspect ratio i.e. height and diameter ratio. The bottles were buried 5 mm beneath the plunger.

Figure 1 shows the various test configurations generated in the CBR mould.



Figure -1: Test Configurations Within CBR Moulds.

4. RESULTS

The following comparisons were done to investigate the performance of waste PET bottle embedded portions.

1. Determine the section with the highest CBR value by comparing CBR values.
2. Study performance improvement with respect to bottle configuration and height by comparing load vs. settlement / pressure vs. settlement.
3. Estimate the range of penetration at which maximal benefit is observed by comparing improvement factors.

According to the results of the experiments, a four-bottle design with a height of 6.3 cm performed best and produced the highest CBR value. At low penetration levels, the improvement factor is highest.

5. CONCLUSIONS

The following conclusions can be taken from the conducted experiments:

- When the load is delivered directly at the connections, as in the 3 bottle and 4 bottle configurations, the benefit of the plastic geocell is substantial.
- Though the 5 bottle structure provides a larger area of confinement, the pressure maintained is determined on the strength of the joints at which the load is applied.
- Because the improvement factor is best at 2-4 mm, using waste PET bottles increases the elasticity of the model parts.
- Because the walls of plastic bottles are weak, they buckle when the height of the bottle is increased.
- The use of plastic geocell can result in a 50% reduction in overall pavement thickness.

6. REFERENCES

- [1]. Aditya Singh Rawat¹, R. Kansal. "PET Bottles as Sustainable Building Material: A Step towards Green Building Construction", Journal of Civil Engineering and Environmental Technology Print ISSN: 2349-8404; Online ISSN: 2349-879X; Volume 1, Number 6

- [2]. Jayaprakash M C1, Deeksha I M2 and Soumya M R, “PET Bottles for Eco-friendly Building in Sustainable Development”, International Journal of Current Trends in Engineering & Research (IJCTER)e-ISSN 2455–1392 Volume 2 Issue 5
- [3]. Mardiha Mokhtar1, Suhaila Sahat1, Baizura Hamid1, Masiri Kaamin1, M. Jahaya Kesot1, Law Chia Wen 1, LooYong Xin1, Ng Pei Ling1, Vivian SimJia “Lei APPLICATION OF PLASTIC BOTTLE AS A WALL STRUCTURE FOR GREEN HOUSE ARPN” Journal of Engineering and Applied Sciences, (IJCTER)e-ISSN 2455–1392 Volume 2 2006-2015
- [4]. Z Muyen, TN Barna, MN Hoque, “Strength properties of plastic bottle bricks and their suitability as construction materials” in Bangladesh, ISSN: 1017 – 8139. Volume 1 Issue 5 May 2018
- [5]. Aditya Singh Rawat1, R. Kansal, “PET Bottles as Sustainable Building Material: A Step towards Green Building Construction”, Journal of Civil Engineering and Environmental Technology Print ISSN: 2349-8404; Online ISSN: 2349-879X; Volume 1, Number 6; August, 2014
- [6]. Jayaprakash M C1, Deeksha I M2 and Soumya M R, “PET Bottles for Eco friendly Building in Sustainable Development”, International Journal of Current Trends in Engineering & Research (IJCTER)e-ISSN 2455–1392 Volume 2 Issue 5, May 2016
- [7]. Mardiha Mokhtar1, Suhaila Sahat1, Baizura Hamid1, Masiri Kaamin1, M. Jahaya Kesot1, Law Chia Wen 1, LooYong Xin1, Ng Pei Ling1, Vivian SimJia Lei “APPLICATION OF PLASTIC BOTTLE AS A WALL STRUCTURE FOR GREEN HOUSE ARPN” Journal of Engineering and Applied Sciences, 2006-2015
- [8]. A.M. Nair, A.Singh, D.Singh “Honeycomb interconnected structures which are used to provide cellular confinements to the soil.” ISSN: 1017 – 8139. Online ISSN: 2349-879X; Volume 1, Number 6; August, 2014
- [9].S. Peddaiah, A. Burman, S. Sreedeeep “Experimental Study on Effect of Waste Plastic Bottle Strips in Soil Improvement” Geotechnical and Geological Engineering | Issue 5/2018

