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Plastic Waste Bottle in Mortar Block for River Bank Protection Work

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ABSTRACT

Bangladesh is a land of rivers, and there are more than 230 rivers. Bank protection of rivers is an important thing all over the country because river banks are damaged by water flow and natural disasters every year. This paper's purpose is the make Mortar blocks with used plastic to protect the Riverbank erosion. Plastic is one of the most significant innovations of the 20th century, and there is a lot of waste after use. Only 1 to 2% of waste plastic is used for various purposes in America, and there are10.5 million tons of plastic waste released every year. Plastic waste is now a serious environmental threat to modern civilization, so, the reuse of plastic waste in the mortar blocks minimizes the environmental threat. The plastic bottles are filled with Course sand with cement and a water-cement ratio of 35%. In the project, the cement-sand ratio is 1:3. In this study, five types of percentages of replacement waste plastic bottles are used to determine the exact percentage of replacement waste plastic bottles. For 6 "×6" ×6" mortar block, the required strength of 12 MPa occurred at 11% of bottle content. But the compressive strength of the mortar block decrease with the increase of the size of the mortar block.

Keywords: **River Bank protection, Concrete blocks, plastic bottles, recycled materials**

1. INTRODUCTION

Plastic, one of the most significant creations of the 20th century, is a ubiquitous material. Substantial growth in the consumption of plastic has been observed all over the world in recent days, which also increases the yield of plastic-related waste [1]. Plastic waste is now a serious environmental danger to ultramodern civilization. Plastic is composed of several poisonous chemicals, and thus plastic pollutes soil, air, and water. Since plastic is a non-biodegradable material, landfilling using plastic would mean conserving the dangerous material forever. The hazards that plastics pose are multitudinous. They may block the drainage system of towns [2]. The blocked conduits give excellent parentage grounds for complication-causing mosquitoes and water-borne diseases besides causing flooding [3]. Plastic debris can reduce the rate of rainwater bleeding and deteriorate soil fertility if it's mixed with soil. Plastic waste dumped into canals, gutters, rivers, and seas contaminates the water and marine life. Some animals can consume plastic waste, which can damage their health. Some marine life has been found in plastic pieces in the bellies and plastic crumbs in their muscles [4]. The "Great Pacific Garbage Patch" substantially consists of plastic waste, and it's believed to constitute 90% of all rubbish floating in the gulfs. Every square Kilometer of ocean contains 46,000 pieces of floating plastic, which was estimated by the UN Environment Program in 2006. Every year more than one million ocean birds and one million ocean mammals die from plastic debris entangled [1]. The harmful effects of plastic waste seem to be rising every day. Numerous

countries have confined the use of plastic bags, and numerous are in the process of doing so. Land-stuffing of plastic is also dangerous due to its slow degradation rate and big nature. The plastic waste may be harmful to groundwater inflow, and it can also block the movement of water in roots. Colorful poisonous elements like cadmium and lead exist in the waste plastic, which can mix with rainwater and contaminate soil and water. Recycling plastics is a possible option to protect the plastic waste pollution. As plastic is an organic hydrocarbon material, its high racy value can be used for incineration or in the processes of other high-temperature. But the burning of plastics releases a variety of toxic chemicals into the air, including dioxins, one of the most poisonous substances. Plastic waste can also be used to produce new plastic-grounded products after processing [5]. Still, it isn't a provident process as recycled plastic degrades in quality and necessitates new plastic to make the original product. Although these options are doable except for land-padding, recovering plastic waste to produce new materials, like, cement composites, appears as one of the stylish results of disposing of plastic waste due to its profitable and ecological advantages. A vast amount of work has formerly been done on the use of plastic waste. In this design, a thorough review of the use of plastic waste as a partial cover of the total volume of a cubic block [1]. Experimental analysis conducted by several investigators has shown that plastic incorporated concrete has asked strength, and it's a feasible result for ecological problems created by plastic waste [6]. By pertaining to numerous journals, we concluded that the optimum chance of the plastic aggregate for the partial replacement of cement mortar gives maximum compressive strength. Despite being the world's most habituated construction material, the sustainability of concrete is a major concern defying the global construction assiduity [7]. The exploitation of aggregates for construction results in negative consequences like noise pollution, air pollution and the destruction of the territories of foliage and fauna, damages to geography, loss of land, reduction in water quality, and relegation of occupants [7]. To alleviate these negative impacts, research efforts have been directed towards indispensable materials, especially those that can potentially contribute to the reduction of negative impacts on the environment [8]. The advantages of replacing natural stone aggregates with materials that would impact negatively on the environment include reduction of the cost of construction, sustainability of concrete products, and reduction of negative environmental impacts. Plastics are extensively used for domestic, artificial, and marketable purposes throughout the world. Their advantages include durability, properties, high strength to weight ratio, frugality, etc. The main problem associated with the use of plastics is their disposal [9]. Plastics degrade at a veritably slow rate, so their disposal creates a lot of environmental problems leading to what can be appertained to as the plastic threat. Recycling has been adopted as a good result to waste management issues related to plastics. Lakshmi and Dist Found the impact of e-plastic waste on the feature of concrete and located out that a significant decrease in compressive strength occurred once the plastic content was over 20%. They recommended that 20% of e-waste particles can be incorporated as a replacement for plastic particles in concrete without any long-term harmful impact [10]. Mathew et al established that at a replacement of 20% of conventional coarse aggregates by recycled plastic, the compressive strength of concrete rose by about 27.4% compared to the control concrete, while at a temperature of 400 0C, the compressive strengths of traditional aggregate concrete a recycled plastics concrete reduced by 33% and 75% respectively [11]. Soroushian et al established a relationship between plastic waste and high efficient concrete, and it was found to be more economical than normal concrete [12]. Rahman et al reported that the incorporation of expanded polystyrene in concrete decreased water absorption while the compressive strength decreased with an increase in polymer content due to the lower strength of polystyrene [13]. Raghatate in 2012 found 20% reduction in compressive strength of concrete after 28 days of curing due to 1% of waste plastic in concrete and worked on concrete made with plastic aggregates [14]. Nodehi and Taghvaei worked on fiber concrete, and they got a result showing an increase in compression strength, and it reduced the weight of blocks [15]. Park and Lee Studies on expansion properties in a mortar containing waste glass & fiber, Novel Approach to Improve Road Quality by Utilizing Plastic Waste in Road Construction [16].

2. MATERIALS AND METHODS

2.1. METHODOLOGY

The aim of the project is to recycle plastic as a coarse aggregate for the production of concrete blocks for the protection of the riverbank. It is necessary to know the process of making concrete blocks where replacement of plastic Aggregate (PA) in cement mortar and natural river sand used as a fine aggregate and sieve analysis, specific gravity, and & bulk density test is done for the quality check of fine aggregate. A mix design is made as per the properties obtained from concrete test results. Concrete block is produced with replacement of 6%, 12%, 18%, 24% and 30% of the plastic aggregate (PA) as a coarse particle for the same mix proportion.

2.2. OBJECTIVES

- To reuse the waste plastic for construction work.
- To study the effect of plastic aggregates on the compressive strength of mortar blocks.
- To compare compressive strength as well as other properties of plastic incorporated concrete blocks with ordinary mortar blocks.
- To study the compressive strength of mortar block by partial replacement of waste plastic

This project utilized plastic waste materials to produce a structural cubic block. The following materials were used in this investigation.

2.3. CEMENT

Cement is one of the major elements of concrete and is called binding material even that role is very important in this project. Cement is an important building material in the construction world at present. Portland composite cement (PCC) was used as per I.Q.S No.5/1984 in all types of aggregate content mixtures. The chemical and physical properties of the cement are presented in Tables 1 to 3.

Table1. Chemical properties of cement

Compounds	Abbreviation	% Weight	Limit of I.Q.S No.5/1984
Lime	CaO	64.43	–
Silica	SiO2	21.14	–
Alumina	Al2O2	5.78	–
Iron oxide	Fe2O3	3.59	–
Sulfite	SO3	2.35	≤2.85%
Magnesia	MgO	1.52	≤5%
Loss of ignition	L.O.I	0.89	≤4%
Lime saturation factor	L.S.F	0.92	0.66–1.02
Insoluble residue	I.R	0.34	<2.85%

Table 2. Main compounds (Bogue's equation) % by weight

Compounds	Abbreviation	% Weight
Tricalcium silicate	C_3S	50.83
Dicalcium silicate	C_2S	22.3
Tricalcium aluminate	C_3A	9.25
Tetra calcium aluminoferrite	C_4AF	10.9

Table 3. Physical properties of cement

Description of test	Test results obtained	Requirements of IS: 8112 1989
Initial setting time	145 minutes	Min. 30minutes
Final setting time	180 minutes	Max. 600minutes
Compressive strength at 7 days	25 MPa	-
Compressive strength at 28 days	31.6 MPa	-

2.4. PLASTIC WASTE

Plastic pollution can unfavorably affect water, sea, and ocean Figure 1. Living organisms, particularly marine mammals, can also be affected through the trap, direct ingestion of plastic waste, or exposure to chemicals within plastics that beget interruptions in natural functions. Around fifty billion bottles of water are bought each year, 80% end up in the land, even though recycling programs live [17]. 17 million barrels of oils are used in producing bottled water each year. Bottled water costs one thousand times more than valve water. Two Liters of Drinking water a day only costs 50 cents per year. Americans use 2.5 million plastic bottles every hour [18] .10.5 million tons of plastic waste are found a year in America but reused only 1% to 2% of it. An estimated 14 billion pounds of trash, much of it plastic, is dumped into the world's oceans every year. One of the most innovative ways to attack the issue of redundant plastic waste is the development of the Plastic Bottle Village in Panama, where homes are erected using revolutionary ways in eco-building – recycled plastic bottles are repurposed as a core structure material [19]. As the bottles are tightly secured in place within concrete-covered mesh cages, they are not exposed to direct sunlight or heat, keeping them cool. Natural gravity ventilation within the walls allows a constant flow of fresh air to circulate through the panels, avoiding a build-up of mould, mildew, and fumes [20]. This ensures that the insulation is non-carcinogenic. Countries with extensive coastlines and islands are at a higher risk of natural disasters, such as a tsunami or rising sea levels. A useful property of a plastic bottle home is its metal walls filled with PET plastic, which can double as an aft should a tsunami occur. The Plastic Bottle village project is spearheaded by its Canadian founder, Robert Bezeau, who has plans for 120 homes to be constructed over three phases of development, along with an eco-lodge that will be sophisticated with the community's fruit, vegetable, and herb garden [21]. Bezeau is strongly supporting the reuse of plastic bottles for various purposes and other applications, such as swimming pools, water catchment tanks, rapid temporary shelters, farm buildings, agriculture waterways, commercial warehouse construction, and roads. However, this is not the first-time plastic bottles have been repurposed for construction [22].

Figure 1. Plastic bottles

2.5. FINE AGGREGATE

Fine aggregate is basically sands won from the land or the river, marine, and ocean. Fine aggregates generally exist of natural sand or crushed stone elements, with most particles passing through a 9.5 mm sieve. As with coarse aggregates, these can be from Primary, Secondary, or Recycled sources. In this project, we used coarse sand, whose properties were given below

2.5.1. FINENESS MODULUS

The fineness modulus of sand (fine aggregate) is an index number that represents the average size of the particles in sand**.** The Fineness modulus (FM) is an empirical figure obtained by adding the total percentage of the sample of an aggregate retained on each of a specified series of sieves and dividing the sum by 100.

2.5.2. BULK SPECIFIC GRAVITY

Bulk specific gravity is defined as the ratio of the weight of a given volume of aggregate, including the permeable and impermeable voids in the particles, to the weight of an equal volume of water.

2.5.3 UNIT WEIGHT

The specific weight (also known as the unit weight) is the weight per unit volume of a material.

2.6. WATER

Water is an important ingredient of paper crates as it actively participates in the chemical reaction with cement. It should be free from organic matter, and the pH value should be between 6 to 7.

2.7. CHEMICAL ADMIXTURE

2.7.1 WATER PROOFING ADMIXTURE

White in color, liquid to paste-like mass depending on temperature, dispersed in water; works as a water proofer, plasticizer, retarder, rust, and scale remover in R.C.C, concrete and mosaic lubricant, partially auto curer. Figure 2 shows the Chemical admixture, Con- Lub.

Advantages

- Stop carbonation processes and saline corrosion permanently.
- Reduces the raising of the heat of hydration.
- During casting, it reduces water-cement ratio.

It is used in pilling concrete, all reinforced cement concrete, and cement concrete, ready mix concrete, everywhere of the superstructure, cement mortar, also used a water repellent and hair cracks filler.

Figure 2. Water Proofing Admixture

2.8. EXPERIMENTAL INTENTION

This part describes the experimental work. First, determined the properties of sand. Second determined the appropriate cement sand ratio. Third determined the appropriate void percentage. Fourth, about this percentage experimented in different sizes. All the tests and investigations were conducted in the strength of the material laboratory of Rajshahi University of Engineering & Technology (RUET), Rajshahi.

2.8.1. DETERMINATION THE PROPERTIES OF SAND

Various properties were determined below.

2.8.2. BULK SPECIFIC GRAVITY

Consider,

Weight of oven-dry sample in the air (gm) = A

Weight of pycnometer + water (gm) = B

Weight of pycnometer + water + sand (gm) = C

Bulk specific gravity = $\frac{A}{A+B-C}$

Here,

A = 50 gm

B = 641.8 gm

C = 674.4 gm

Bulk specific gravity = 2.87

2.8.3. FINENESS MODULUS

Let say the dry weight of sample = 500 gm

Table 4. Sieve analysis values

Sieve size (mm)	Weight retained (gm)	Cumulative weight retained (gm)	Cumulative percentage weight retained (%)
4.75	2.40	2.40	0.48
2.36	4.10	6.50	1.30
1.18	30.30	36.80	7.36
0.60	178.10	214.90	42.98
0.30	251.00	473.70	93.18
0.15	10.70	499.20	99.84

Fineness modulus of sand = 2.46

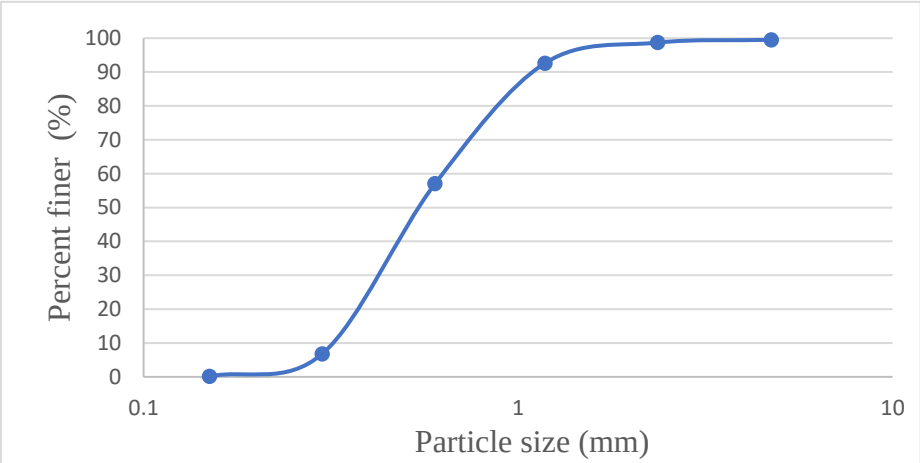

Figure 3. Represent sieve analysis report that why found fineness modulus easily and below graphical representation of sieve analysis. This sand is well-graded sand.

2.8.4. UNIT WEIGHT

Volume of cane = 0.00282 ft3

Empty cane weight = 0.0222 kg

Cane + Weight of sand (loose) = 0.141 kg

Weight of sand (loose) = 0.1189 kg

Cane + Weight of sand (dense) = 0.152kg

Weight of sand (dense) = 0.134 kg

Unit wt. of sand (loose) = $\frac{0.1189}{0.00282}$ = 42.09 kg/ft3

Unit wt. of sand (dense) = $\frac{0.134}{0.00282}$ = 47.52 kg/ft3

2.9. DETERMINATION THE APPROPRIATE CEMENT SAND RATIO

For higher compressive strength, it should be in mind that the cement-sand ratio is a major fact. Higher compressive strength means 28 days compressive strength of cylinder strength is 9 MPa when finding the cubic strength it converted, and the compressive strength is 12 MPa. Find this compressive strength mixed at a different cement-sand ratio such as 1:2, 1:3, and 1:4. After mixing the cement sand properly, water was added for made mortar. The water-cement ratio was 35%, and a superplasticizer was also used at the amount of 100 kg cement be used 0.3 kg superplasticizer. Then cast the cubic block. After the cast, the cubic block was curried for 28 days. The block was curried at room temperature. Then the block is tested by a universal testing machine.

2.10. DETERMINATION OF THE APPROPRIATE PERCENTAGE OF REPLACEMENT WASTE PLASTIC BOTTLES

After finding the appropriate cement-sand ratio, it should be determined the appropriate percentage of replacement waste plastic bottles for target strength. Find the higher compressive strength, cast the cubic block at different percentages of replacement waste plastic bottles such as (6%, 12%, 18%, 24%, and 30%). Then the blocks were curried at room temperature. After this, the block was tested, and found the exact percentage.

2.10.1. CALCULATION OF 6% REPLACEMENT OF WASTE PLASTIC BOTTLES IN MORTAR BLOCK FOR 6 IN CUBIC BLOCK.

Volume of cube, V = (6 × 6 × 6) in^3
= 216 in^3
= 0.125 ft^3

Volume a unit bottle = 0.00042 ft^3

Volume of 6% replacement of waste plastic bottles = (0.06 × 0.125) = 0.0075 ft^3

Required of bottles = (0.0075 ÷ 0.00042) = 18 pics

Required of sand = (47.52 × 0.12) = 5.7 kg

Wet of sand = (5.7 × 1.5) = 8.55kg

Wet of cement = (8.55 ÷ 3) = 2.85kg

Wet of plasticizer = $\frac{0.3 \times 2.85}{100}$
= 0.009 kg
= 9 mg

Similarly, for 12%, 18%, 24% and 30% find the amount of sand cement and plasticizer.

2.11. EXPERIMENT AT A DIFFERENT SIZE

After finding the exact percentage, cast the cubic block at a different size, such as (4, 6, 8, 10, and 12) in. Then the blocks were curried at room temperature. After 14 days and 28 days the blocks were tested.

Figure 4. Making Mortar

Figure 4 seen that mixing the cement sand with water and plasticizer to prepare the proper cement mortar and last picture is the proper mixing cement mortar. Mortar and last picture is the proper mixing cement mortar.

Figure 5. Concrete Casting

Figure 6. Concrete Curing

After preparing the mortar cast, the moulds shown in Figure 5 and Figure 6 curing period. After 24 hours late the moulds are removed, and the block place the curing tank. When testing the blocks, it was seen that without plastic blocks, the strength was good but with bottle blocks, the strength became reduced, because the poor bond plastic with mortar is shown in Figure 5 and Figure 6.

Figure 7. Broken blocks (without bottle)

Figure 8. Broken blocks (with bottles)

3. RESULTS AND DISCUSSION

In this chapter, the laboratory test results are represented. The test is occurred by the universal testing machine (Figure 9). The maximum loading capacity of this testing machine is 3000 kN and the minimum 1 kN. All the results are given below.

Figure 9. Universal testing machine

3.1. RESULTS ON THE APPROPRIATE CEMENT SAND RATIO

All the results were taken for 6×6×6 in block. From the machine find the load and used the equation

$P_a = 1.0106\ P_m + 28.638$

Here,

P_a = Actual Load

P_m = Machine Load

The results were following

Table 5. Compressive strength at 1:2 ratio

sample	14 days strength (N/mm^2)	28 days strength Predicted (N/mm^2)
1	26.56	31.25
2	23.37	27.56
3	24.06	28.32
Average	24.66	29.04

Table 6. Compressive strength at 1:3 ratio

sample	14 days strength (N/mm^2)	28 days strength Predicted (N/mm^2)
1	18.00	21.20
2	18.74	22.05
3	18.99	22.34
Average	18.58	21.86

Table 7. Compressive strength at 1:4 ratio

sample	14 days strength(N/mm^2)	28 days strength Predicted (N/mm^2)
1	12.02	14.15
2	10.76	12.70
3	11.26	13.25
Average	11.35	13.37

Table 5 Compressive strength at 1:2 ratio, Table 6 Compressive strength at 1:3 ratio, and Table 7 Compressive strength at 1:4 ratio. In this compressive strength, compared with the cost for each block and converting 9 MPa cylinder strength to cubic strength, found that the cement-sand ratio at 1:3 the ultimate strength is more economical than others. So, for economic consideration, the cement-sand ratio was 1:3, Getting higher compressive strength. Figure 10 shows that after curing the blocks are removed from the tank, and Figure 11, Figure 12 are the first, and second cracks, respectably, when it was tested.

Figure 10. Blocks

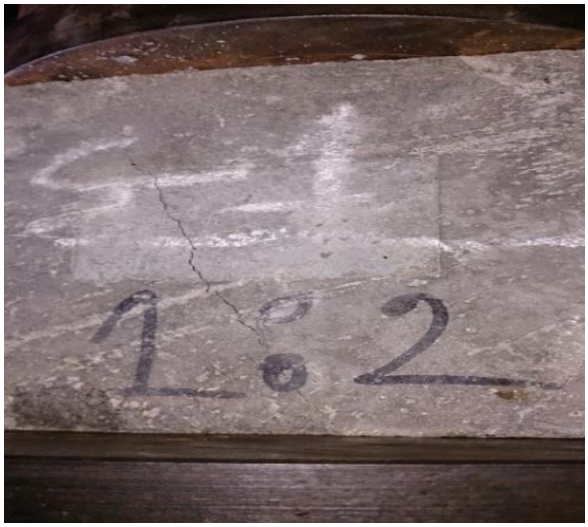

Figure 11. First crack

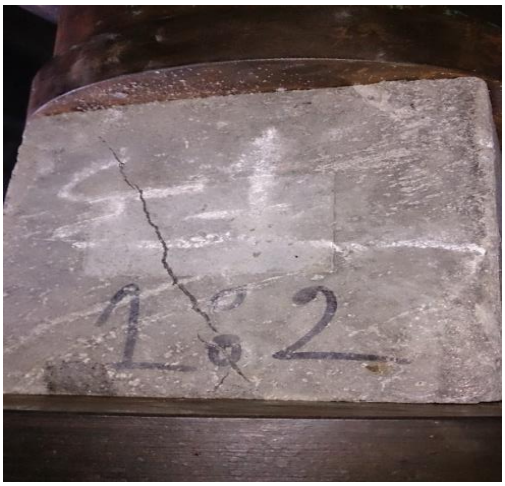

Figure 12. Second crack

3.2. RESULTS ON THE APPROPRIATE PERCENTAGE OF REPLACEMENT WASTE PLASTIC BOTTLES

Table 8. Compressive strength at 6% replacement waste plastic bottles

sample	14 days strength (N/mm^2)	28 days strength Predicted (N/mm^2)
1	11.21	13.20
2	12.46	14.66
3	12.23	14.39
Average	11.97	14.10

Table 9. Compressive strength at 12% replacement waste plastic bottles

sample	14 days strength (N/mm^2)	28 days strength Predicted (N/mm^2)
1	9.60	11.29
2	9.80	11.53
3	10.00	11.76
Average	9.80	11.53

Table 10. Compressive strength at 18% replacement waste plastic bottles

sample	14 days strength (N/mm^2)	28 days strength Predicted (N/mm^2)
1	9.11	10.72
2	9.16	10.78
3	9.11	10.72
Average	9.13	10.74

Table 11. Compressive strength at 24% replacement waste plastic bottles

sample	14 days strength (N/mm^2)	28 days strength Predicted (N/mm^2)
1	8.24	9.70
2	8.26	9.72
3	8.30	9.76
Average	8.27	9.73

Table 12. Compressive strength at 30% replacement waste plastic bottles

sample	14 days strength (N/mm^2)	28 days strength Predicted (N/mm^2)
1	7.36	8.66
2	7.58	8.92
3	7.80	9.20
Average	7.58	8.93

Tables 8, 9, 10, 11, and 12 are the results of compressive strength at 14 and 28 days at a uniform percentage of replacement waste plastic bottles such as 6%, 12%, 18%, 24%, and 30%. From this result, it is said that if we increase the percentage of replacement waste plastic bottles, the compressive strength becomes reduced.

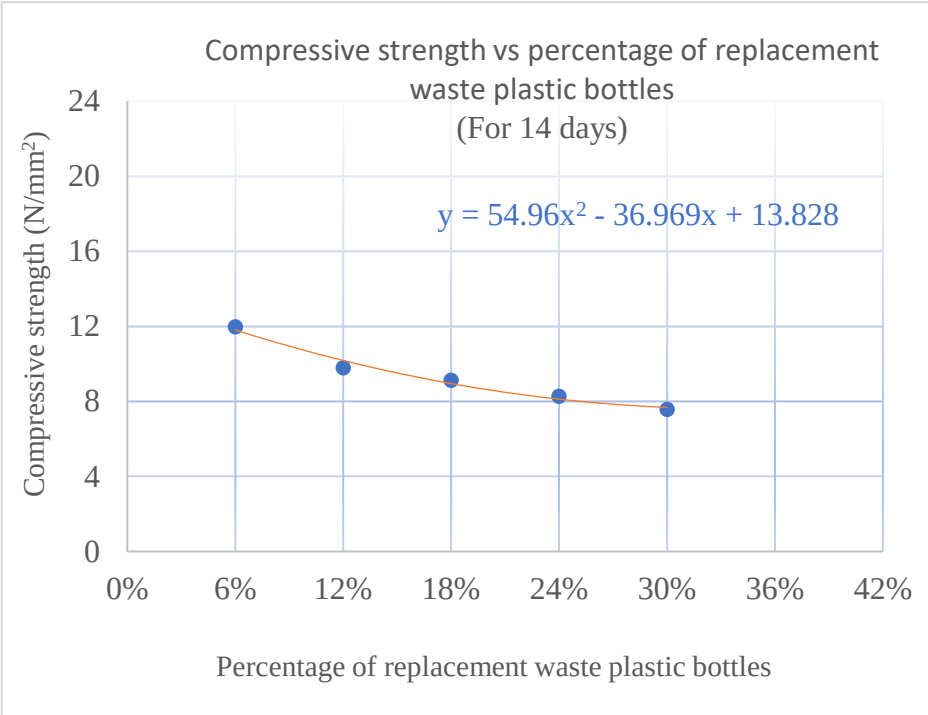

Figure 13. Compressive strength vs Percentage of replacement waste plastic bottles for 14 days

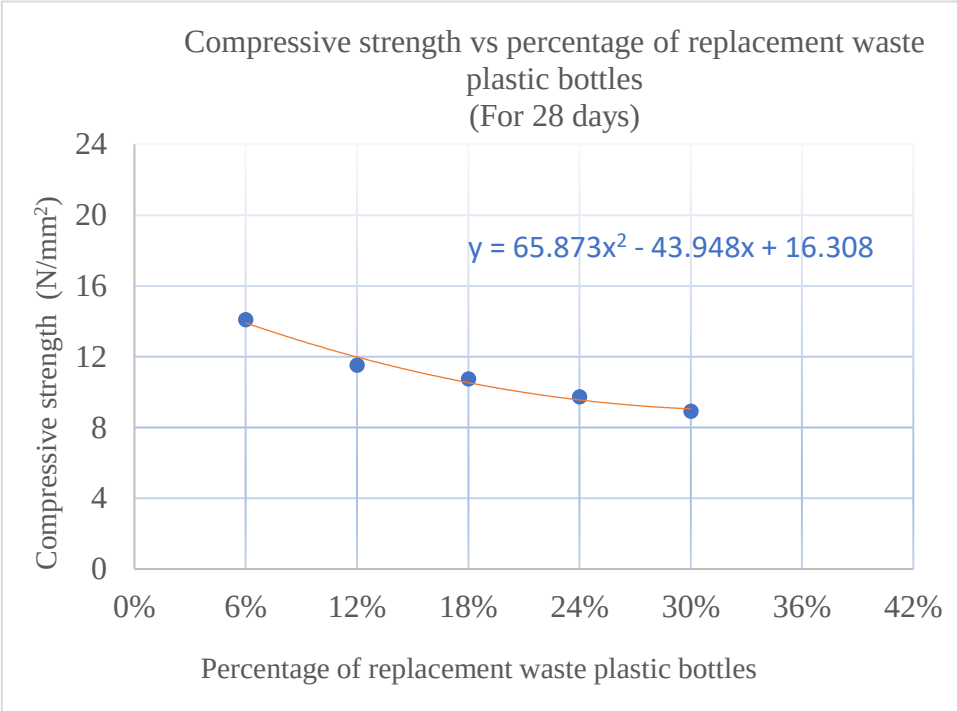

Figure 14. Compressive strength vs Percentage of replacement waste plastic bottles for 28 days

From the graph, it is obtained that to get the compressive strength 12 MPa, 11% volume be replaced by a plastic bottle.

3.3. RESULTS ON DIFFERENT SIZE

Table 13. Compressive strength at 4 in cubic block

sample	14 days strength (N/mm^2)	28 days strength Predicted (N/mm^2)	28 days strength (N/mm^2)
1	11.24	13.22	14.23
2	10.23	12.04	13.78
3	10.56	12.42	13.82
Average	10.68	12.56	13.94

Table 14. Compressive strength at 6 in cubic block

sample	14 days strength (N/mm^2)	28 days strength Predicted (N/mm^2)	28 days strength (N/mm^2)
1	9.50	11.25	12.32
2	9.60	11.45	11.84
3	9.89	11.60	12.23
Average	9.66	11.43	12.13

Table 15. Compressive strength at 8 in cubic block

sample	14 days strength (N/mm^2)	28 days strength Predicted (N/mm^2)	28 days strength (N/mm^2)
1	8.76	10.31	11.34
2	8.86	10.42	11.23
3	9.24	10.87	10.94
Average	8.95	10.53	11.17

Table 16. Compressive strength at 10 in cubic block

sample	14 days strength (N/mm^2)	28 days strength Predicted (N/mm^2)	28 days strength (N/mm^2)
1	7.54	8.87	10.20
2	7.24	8.52	10.12
3	7.12	8.38	9.86
Average	7.30	8.59	10.06

Table 17. Compressive strength at 12 in cubic block

sample	14 days strength (N/mm^2)	28 days strength Predicted (N/mm^2)	28 days strength (N/mm^2)
1	6.56	7.72	8.56
2	6.44	7.58	8.42
3	6.34	7.46	8.60
Average	6.45	7.59	8.53

Table 18. Unit weight of various specimens

Cubic specimen (in^3)	Weight (kg)	Volume m^3	Unit weight (kg/m^3)
4	2.34	0.00105	2228.57
6	7.83	0.00354	2211.86
8	19.23	0.00839	2292.01
10	35.56	0.01638	2170.94
12	62.34	0.02830	2202.83
Average			2221.24

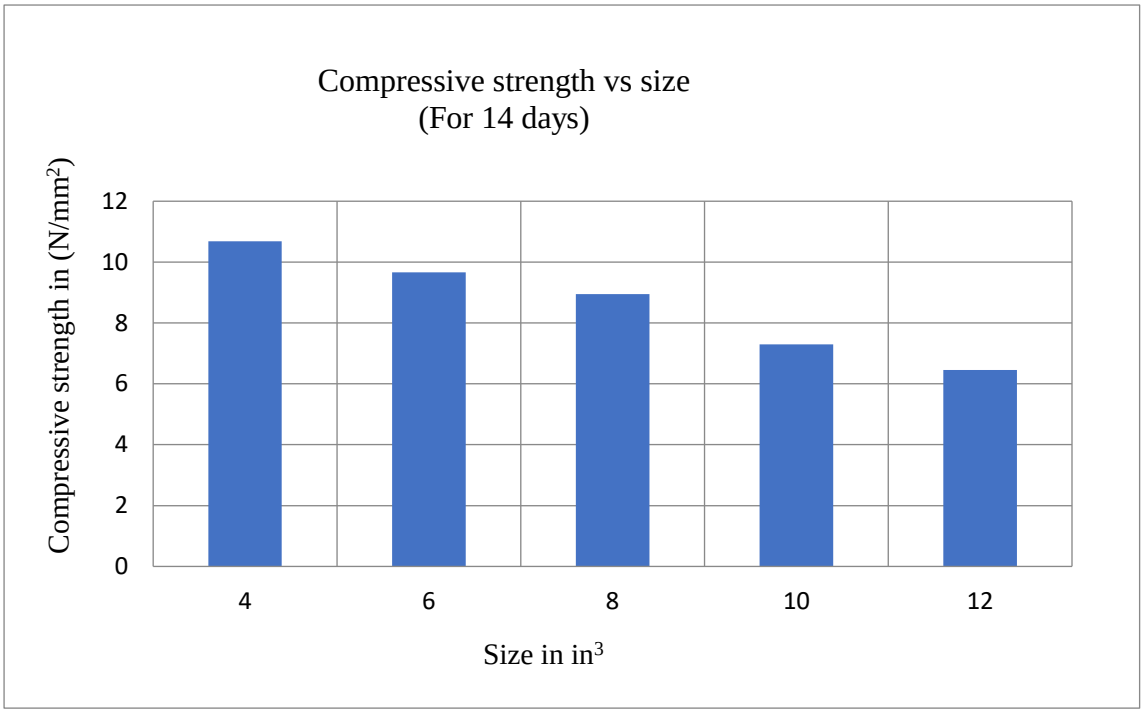

Figure 15. Compressive strength vs Size for 14 days

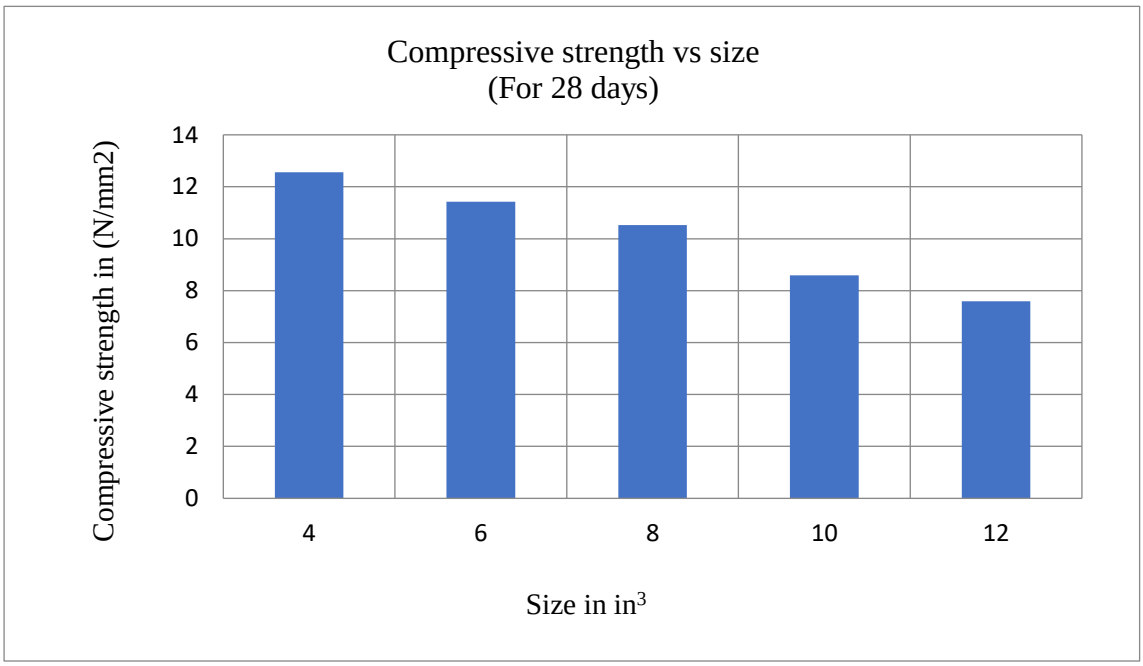

Figure 16. Compressive strength vs Size for 28 days

These two bar charts represent compressive strength at various sizes of the block. The compressive strength is decreased with the increase in the size of the block.

Tables 13, 14, 15, 16, and 17 are the results of compressive strength at constant 11% replacement waste plastic bottles of different sizes. But the result said that increasing the size of the cubic block decreased the strength. Unit weight is an important property of mortar blocks for bank protection work. The unit weight of the mortar block is greater than the value of 2000 kg/m3. Here all the value is greater than 2000 kg/m^3. According to unit weight, it is satisfied. From the two graphs, it is obtained that the compressive strength is reduced by the increase in block size. In the case in the study, due to confining a cubic mold and the size of the bottle, it is difficult to cast the block using a higher proportion of bottles. However, the compressive strength is decreased with an increase in the bottle content due to poor bonding between the mortar and plastic bottle surface.

4. CONCLUSION

The experimental investigation is carried out to observe the variation of unit weight, compressive strength of waste plastic bottle-filled mortar block. The obtained results are presented in chapter 5 On the basis of the test result and discussion, and the following conclusions are drawn.

- It has been identified that plastic waste can be disposed of by using them as construction materials.
- The compressive strength of the mortar block filled with waste bottle decrease with the increase of bottle content. For 6×6×6 in mortar block, the required strength of 12 MPa occurred at 11% of bottle content.
- The compressive strength of the mortar block decrease with the increase of the size of the mortar block when the waste bottle content is constant at 11

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CONFLICT OF INTEREST

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