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Utilization of Plastic Waste Materials in Manufacturing of Bricks & Paver Blocks

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Abstract: - The paper elucidates about the proper utilization of plastic materials in civil construction projects. The volume of plastic waste is increased, which results in creating unbalance in the environment by polluting land, air as well as water. According to CPCB (central pollution control board), India generates almost 26,000tonnes of plastic per day. From 26,000tonnes near about 10,000 tonnes a day, the plastic waste remains uncollected, and that plastic ends up in the natural environment mostly in seas. A vast amount of plastic waste is brought from tourist attraction regions, which further burnt and finally leads to toxic gasses that are harmful to even living beings. To outcome from this problem, the use of plastic should be controlled, and plastic waste should be utilized properly so that it does not create pollution. Nowadays, such waste material utilized in a different type of road construction and in other civil construction, which shows the hope of tackling this issue. In brick blocks, carry bags, disposable, PET, HDPE, and PE are used with sand to obtain high strength. These days, plastic waste used as a modifier, which further helps in a reduction in the volume of cement and results as a decrease in the overall cost required to complete the construction work. The plastic helps to raise the melting point for bitumen. Even moisture will not seep from brick due to the presence of plastic, which increases the working periods before any repairs of the building.

Keywords: plastic waste, paver blocks, strength

1. Introduction

In the modern era, individuals apply their all potentiality to consume different things more. Further, that results in massive consumption, which is nothing than unless a decrease in resources and raises the landfills. Nowadays, peoples from the one side are seeking sources with lower prices and at the same time, on the other hand, are following a different path to achieve rid of wastes. This work represents the development and low-cost civil construction by utilizing this waste. In recent times, plastic has become an essential part of our day to day life [1]. The natural and best way to control the hazards of plastic waste is to decrease use and reuse repeatedly.

Moreover, in the U.S., the department related to energy mentioned in an article that the utilization of plastic wastes in the way of insulation the building per year helps to save approx. 65 barrel of fuel. That directly means that plastic waste helps to keep energy in houses. After applying the reduce, reuse process in daily life, the left waste plastic material should be utilized in construction work which helps to increase the strength of the material and on the other hand its decomposition in this way helps prevent numerous hazards which will result if the plastic is left behind or decompose in land or river. So, plastic waste should be

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utilized in road construction on the manufacturing of blocks [2].

2. Methodology

This paper, we have used the following material.

A. Waste Plastic

According to the definition of plastic, it means it can be converted to any shape at high temperature (with the help of external sources of heat). Nowadays, plastic even exists in various forms like cup, basin, plastic carry bag, food container, liquid container, which, after use, became wastes, as shown in Fig 1. Accumulation of waste further results in creating hazards to living beings, plant life, and ends up in creating unbalance in the environment. That is why reuse and recycling are necessary, and then if waste left, it should be utilized in construction so that it can decompose effectively. Plastic waste is used in the manufacturing of blocks because of having different properties, which help to increase the strength of bricks and block [3].

Table1.Property of plastic polyethylene

S.No.	Experiment performed	Test result
1	The density of plastic waste (23 degrees C)	0.958
2	Young elastic modulus	9.00
3	Creep strength (T)	8.00
4	Bending creep modulus	1.00
5	Tensile strengths	2.00
6	Elongation test	>590
7	Thermal conductivity test	0.00
8	Ignition temp.	3.00

The result, as mentioned above, is taken from official websites of institutes of plastics eng. And tech Chennai (India).

Figure 1.Illustrates about plastic waste

B. Sand from river

River sand is found naturally as granular materials, as shown in figure2, that was composed of tinny mineral particles and small divided particles. Their compositions depend on rock conditions and sources. Moreover, the significant constituents of river sand in inland continentals setting and non-tropical coastal regions are quartz that is a form of silica-dioxide. It is followed by carbonate of calcium like aragonites; this is created approx—nearly past half billions of years in a different kind of life, such as corals and even shell-fish. From the last few decades, sand was utilized in every building project [4,5].

Table 2. Property of sand obtained from the river

S.No.	Experiment performed	Result obtained
1	Moisture content	10.700 %
2	Specific gravity	2.489
3	Self-unit weights	1.60
4	Fineness test	2.90

The property, as mentioned earlier of sand, is noticed by performing the various test in a college lab, which includes equipment and different samples of river sand.

Figure2. Sand from river

C. Ferric oxide (red oxide)

This compound is placed in in-organic compounds having formula fe_20_3. It consists of three oxides of Fe, pending two are FeO and Fe_3O_4. FeOis found rare, whereas Fe_3O_4 occurs as magnetic minerals in nature. Ferric oxide, as shown in Fig 3, is also named as hematite material due to which this even considered as imp sources of Fe in steel industries. Red oxide is dark radish in look, and it also ferromagnetic—iron (Fe) (III) generally known as rust. To a few areas, it is better, that is why because it shares few properties and even have some same compositions[6]. The main feature of ferric oxide is to provide the red color to block. The mass density of ferric oxide is noticed equally to 5.27 g/cm^3. Moreover, it melts at 2850 degrees Fahrenheit's.

Figure3. Ferric Oxide

D. Control mix designs

To check the compressive strength of soil brick manufactured using plastic waste, various mix proportions were made and tested in the lab with the help of testing machines such as the compression testing machine. The mix proportions are taken in the ratio of 2:1, 3:1, 4:1, 5:1, 6:1 as sand from river and plastics wastes respectively. Firstly, collect waste plastics bag along from which polyethylene bag was sorted outs and remained bags are disposed of in a proper way. After that, collected wastes bag were put into water and left behind to remove moisture; after the drying process, these bags were burnt out using any external source. After it, stones were placed in such a way that it holds drum and fire-wood were arranged in the gap. This drum is placed above, and heat is applied to remove moisture. Furthermore, plastics bags were put into the drum and mixed with sand collected from the river when plastic turn into hot molten. Setting time of sand plastic mixture is less so, mixing should not consume much time. In the manufacturing of blocks, ferric oxide should add less than 10% to give dark radish color. In last, this mixture is poured into the mold, and then compaction and finishing test are performed respectively[7].

3. Results and Discussion

To check the quality of plastic-sand brick block, some test was carried out which are as follow in lab and few in the field also.

A. Compressive strength test

This test is carried out to notice the strength of the material. It is also known as the crushing test. Usually, 5 samples of brick were taken to lab to perform tests. In this machine, pressure (force) is applied to brick and paver block one by one till cracks were not noticed. The ultimate pressure is taken into account for each sample. Paver block and bricks were tested using different specifications one by one, as mentioned above, and crushing strength was noticed.

Table 3. Compressive strength test data for plastic-sand brick

Mix design	Sand-plastic ratio	Strength (N/mm^2)
M1	2:1	4.650
M2	3:1	4.780
M3	4:1	5.120
M4	5:1	4.920
M5	6:1	3.170

Figure 4. Strength of plastic-sand brick

Table 4. Compressive strength test data for paver block of plastic-sand and ordinary block

S. No.	Paver block type	Strength (N/mm^2)
1	Plastic-sand paver block	8.19
2	Normal ordinary block	7.18

Figure5. Strength for plastic-sand paver block

B. Moisture absorption test

This test is carried out to check the percentage of water present in material means in brick and paver block. Firstly, brick or paver block is weighted by using a digital weight machine in the lab after that they were immersed in water for 24 hours [8]. After this mentioned period, they were taken out, and again weight is noticed, and in last, dry weight and wet weight percentage is noticed manually.

Figure 6. Weight of dry brick

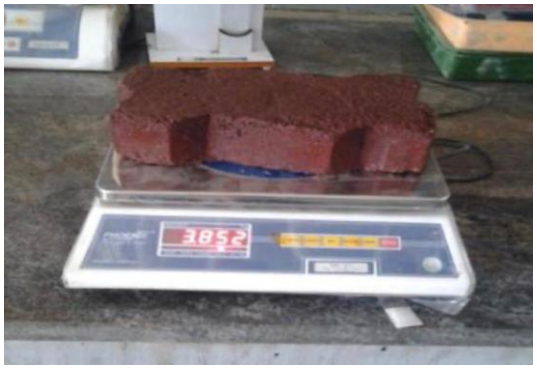

Figure 7. Weight of wet brick

Table5. Moisture absorption percentage for different brick

S. No.	Brick type	Moisture absorption percentage
1	Normally clay brunt brick	9.087
2	Plastic-sand brick	1.12

Table6. Moisture absorption percentage for different blocks

S. No.	Paver block type	Moisture absorption percentage
1	Plastic-sand paver block	1.083
2	Normal ordinary paver block	3.709

C. Efflorescence test

This test is carried out to notice the presence of alkalis in brick. If antacids are found in brick, it is considered harmful, and when a block came in contact with moisture, it results in the formation of a grey and white layer on the surface of the material. To check efflorescence, brick is immersed in water for one day, then allow to dry in shades. Plastic-sand blocks, as shown in figure 8, show low alkali presence, its result as few white patches on the surface of the brick.

Figure 8. Efflorescence test for plastic-sand brick

D. Fire resistance test

Typically plastic shows property as highly susceptible to fire, but in plastic-sand brick, the presence of river-sand results in imparts insulation like property. Until 180 degree Celsius temperature, its result as no change in a structural property of brick and block.

E. Hardness test

This test is carried out **to** check the hardness of block and brick. In this, scratch are made by a fingernail or and hard material. The result of the hardness test shows that plastic paver block possesses batter quality.

4. Conclusion and Future Scope

From the test, as mentioned earlier result, it can be noticed that plastic-sand brick shows more merits, which involve cost-efficiency, utilization of waste plastic products which help to tackle fertile land needed issues for decomposing, moreover, help to prevent environmental hazards.

After reuse and recycling of plastic, plastic waste can utilize in civil construction work to achieve high strength and other beneficial property in construction work. Further cost efficiency can also be decreased by using fly ash instead of river sand; it also imparts good strength and helps to utilize all waste in construction. It is owing to many merits more research help to improve the durability and strength of plastic-sand brick and paver block.

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