Replacement Of Bricks By Eco-Bricks With M-Sand

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Abstract: Disposal of non-biodegradable material has become a critical issue now adays. Mass of garbage has been created over the earth surface due to such kind of non-biodegradable materials. In order to overcome this issue a new concept of efficient bricks also known as Eco-Bricks is now been replaced with bricks. Pet bottles are a new type of building material which is made up of plastic bottles are filled with plastic wastes, but we are filling it with M-Sand (Manufactured Sand) for further use for construction purpose. [1] These are energy and resource efficient bricks and can be used to make gardend spaces partition walls, temporary godowns and low cost houses. Use of these bricks makes the work more economical as well as reduces the land pollution. This paper shows the study and investigation on a plastic bottle as well as construction material to use it as a future aspects. It also shows the manufacturing and other properties of Ecobricks. At the end, multiple factors such as cost efficiency, reduction of pollution which leads to promote very clean execution and minimization of construction wastage achieved by using PET bottles or Ecobricks.

Keywords: Polyethylene terephthalate, M sand (Manufactured Sand), Efficient Bricks, Eco-Bricks

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I. INTRODUCTION

Bricks are the most commonly used building material. These are structures built by using masonry units with mortar. The masonry units may be: Clay Bricks, Concrete Blocks, Structural Clay Tiles, Stone. Bricks can be used in different colours, sizes and orientations to get different surface designs. As an aesthetic material bricks can be used: In Pavements, As Facing Brick, For Architectural purposes. As bricks have been used for construction purpose from past few decades by conventional method only. We are surrounded by structure made up of bricks also cause some serious issue which needs to be sorted out by searching other alternative materials which will give more productivity to the structure, minimization of construction waste and proper utilization of resource with less manpower which leads to economical construction work.

If we compare Conventional clay Bricks with Eco-bricks, it charges more due to cost of indirect materials of wood materials, transportation cost and labor cost. The process of burning bricks emits (CO2) carbon dioxide to the environment so this causes environmental problems. Preparation of clay bricks consumes less time and energy but as the clay brick to burning in the kiln to time and energy consumed. Environmental effect transportation and other constraints make the use of clay bricks less attractive.

While an Eco-bricks can last as long as 300 years (undoubtedly longer than the cement used to bind the bottles together in the walls and columns). Clay bricks are set to be affected by vegetation, over burning, etc. But the pet bottle brick may not affected by vegetation, because it was covered by the M-sands inside of the pet bottles. So there is no vegetation growth in structures. When compared to pet bottles there are no such drawbacks. Especially the plastic wastes in environmental is to be reduced because it reduces the vegetation growth and it does not decompose soon.

II. Material And Methodology

Materials Used In Making Eco-Bricks
- Plastic Bottles
- M-sand
- Iron rod to compress the M-sand inside the bottle

PETbottle: PET a thermoplastic polymer resin of the polyester family and is used in synthetic

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Fibres, Beverage, food and other liqior content.

**Msand:** Manufactured sand is a substitute of river for construction purposes sand produced from hard granite stone by crushing. The crushed sand is of cubical shape with grounded edges, washed and graded to as a construction material. The size of manufactured sand (M-Sand) is less than 4.75mm.

### Necessity of Replacing River sand with M-sand

Environmental factors and shortage of good quality river sand has led to the invention of manufactured sand also known as M-sand or robo sand.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>M sand</th>
<th>River sand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shape</td>
<td>Angular and has rougher texture. Angular aggregates demands more water. Water demand can be compensated with cement content</td>
<td>Smoother texture with better shape. Demand less water.</td>
</tr>
<tr>
<td>Moisture Content</td>
<td>Moisture is available only in water washed M-sand.</td>
<td>Moisture is trapped in between the particles which is good for Concrete Purposes.</td>
</tr>
<tr>
<td>Concrete Strength</td>
<td>Higher concrete strength compared to river sand used for concreting.</td>
<td>Lesser concrete compared to M-sand.</td>
</tr>
<tr>
<td>Silt Content</td>
<td>Zero Silt</td>
<td>Minimum Permissible silt content is 3%. Anything more than 3% is harmful to the concrete durability. We can expect 5-20% silt content in medium quality river sand.</td>
</tr>
<tr>
<td>Over Sized Materials</td>
<td>0% Since it is artificially manufactured.</td>
<td>1-6% of minimum oversized materials can be expected. Like pebble stones.</td>
</tr>
<tr>
<td>Marine Products</td>
<td>0%</td>
<td>1-2% like sea shells, tree barks etc.</td>
</tr>
</tbody>
</table>

**Process of making Eco-Bricks:**

**Step 1:** Collection of discarded plastic bottles.
**Step 2:** Cleaning of discarded plastic bottles and check whether it has any hole or not, bottle with holes shall be kept aside and not been used.
**Step 3:** Take the bottles, fill them with M-sand, sealed and then paste them with a mixture made of earth, clay, and a little cement to provide additional strength and durability.

**Experimental Work On Pet Bottle Brick**

A. **Classification and characteristics of bricks as per is-1077 – 1973**

B. **Tests for the acceptance of bricks for building construction.**
   - Dimension and tolerance test
   - Compressive strength test
   - Water absorption test
   - Efflorescence test

### III. Specimens And Testing Details

Compressive load test: In the test, the compressive load for the pet bottle is found out by using compression testing machine or universal testing machine. Instead of the Compressive strength of test because its contact area is difficult to find as single bottle area.

The following specimens are pet bottle of different sizes filled with the dry sand and m-sand.

1. 3 Different sizes of bottle (600ml, 1lit & 2 lit) are taken for testing filled with dry sand.
2. The sand is compacted with the help of iron rod for better compaction.
3. Then the given specimen is been tested on compressive testing machine respectively as shown in figure below.
4. The required outcome of testing from 3 different specimen are shown below tabular form.
5. Now we have taken 1 litre bottle for testing filled with m-sand and adopted the same procedure as above.
Replacement of bricks by eco-bricks with M-sand

Figure 1. Pet bottle filled with dry sand

Figure 2. Compression Test
On 1 litre (Specimen 2) with Result (Specimen 2)

Figure 3. Compression Test
On 2 litre Bottle (Specimen 3) with Result (Specimen 3)
Replacement of bricks by eco-bricks with M-sand

IV. RESULTS

Table 1: compressive load test results

<table>
<thead>
<tr>
<th>SPECIMEN</th>
<th>LOAD (KN)</th>
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<tbody>
<tr>
<td>SPECIMEN 1</td>
<td>10KN</td>
</tr>
<tr>
<td>SPECIMEN 2</td>
<td>58KN</td>
</tr>
<tr>
<td>SPECIMEN 3</td>
<td>100KN</td>
</tr>
<tr>
<td>SPECIMEN 4</td>
<td>200KN</td>
</tr>
</tbody>
</table>

Figure 4. Compression Test
On 1 litre Bottle M-sand(Specimen 4) with Result (Specimen 4)
Eco bricks also known as bottle bricks are made with the help of plastic waste which is otherwise harmful for all living beings. Not only in India but globally the disposal of plastic has become an issue of major concern. As a Concerned Civil engineer its our responsibility to utilize these plastic as a form of construction materials. In order to deal with this problem new concept of eco bricks came into existence. Material which is considered as waste can be utilized in making material for construction. Every year thousands of animals die due to effect of plastic hence if this plastic will be used in making something useful it would be beneficial in preserving our wildlife as well marine life. These bricks are very cheaper in cost therefore the dream of shelter of the poor people can be fulfilled by using these bricks. These bricks provide good insulation as well as are bullet proof hence can be used in areas which are prone to attacks. Overall eco brick is a cost efficient and resource efficient building material which can be used in order to deal with the various environmental problems as well for the reduction in the cost of construction. It also do proper justice with factors like material and equipment costs causes lighter and higher volume , easy and cheap displacement which resulting reduction of overall cost of building or construction effectively.

V. CONCLUSION

Maximum Load attain by specimens on x-axis in KN and Loads shown in KN on y-axis

**FIGURE 5: COMpressive LOAD TEST**

**Reference**

[1]. https://en.wikipedia.org/wiki/Eco-brick