

CREATION OF ECO FRIENDLY ENVIRONMENT BY MANUFACTURING AND TESTING OF GEO PLASTIC BRICKS AND USAGE OF STABILIZATION TECHNIQUES IN THE PREPARATION OF AND GEO PLASTIC BRICKS

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Abstract

During the year of 2008-2012, world generated 260 million tonnes of plastic waste and 2012-2015 duration it reached 297.5 million tonnes. Coming to the India 67 million tonnes of plastic waste generated per day, metro city like Hyderabad generated 3500-4000 tonnes per day and as per survey conducted by the municipal waste management India, average of 0.5 grams plastic waste generated by single person per day. Out of this only 25% of plastic wastes recycle effectively, remaining 75% of plastic waste leads to create land pollution because whatever the plastic waste generated it takes 350-400 years decompose in soil. Finally it leads to create environmental pollution and in the case of 25 % effective recycle materials also expose some toxic element in to atmosphere so this kind of problems may resolve by preparation of GEO PLSTIC BRICKS and these are in something special and simple, but it is similar to the preparation clay bricks, how it will see the end of this paper work.

Key words: Geo Plastic Bricks, Plastic Waste, Land Pollution Control.

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1. INTROCTION

Day by day the usage of plastic waste increase quickly for example In year of 2008, the worldwide plastic using up worldwide has been anticipated at 260 million tonnes and according to 2012 report given by worldwide industry analyst, plastic utilization is to make 297.5 million tonnes as a result of 2015. Plastic is a flexible, pathetic, moisture conflict strong and moderately low-cost. A city like Hyderabad can generate just about 3400-4000 tonnes of plastic every day. The average time for plastic to debase is about 300-450 years. Due to lack of population control in India, the usage of plastic is too high and it is increased day by day. Due to plastic the soil losses its fertility and it effects to human beings, marine species and also obstruction of drainage system etc.

The amount of plastic waste generated every year in India has been increasing. The lack of natural recourses in India has also claptrap the need to reprocess materials for substitute uses. This mission focuses on one such way of recycle waste materials that is to use soil and plastic to make geo plastic bricks for construction of rigid pavement and construction of residential houses. Brick samples were produced with varying amounts of plastic content and laboratory testing was done on these samples to determine its physical and engineering properties. Some of the tests include compressive test, density test and moisture content test and etc.

The results obtained are compared against the properties of conventional bricks. Geo plastic bricks that were prepared with cement, lime, fly ash, calcium chloride and soil using a different method. Comparisons were also made in terms of cost effectiveness of forming bricks using the geo plastic method against the conventional method. As a highway

engineer, I would like to use these geo plastic bricks in placing at top layer of rigid pavements for prevention of land pollution due to plastic waste generation and create eco friendly environment and leads to reduce the cost of rigid pavement.

➤ These geo plastic bricks not only used in the rigid pavement these bricks also used in construction of walls in residential buildings so lot of plastic waste is recycle without harmful effects in general the process. Materials required for geo-plastic bricks are given below

- [1]. Plastic Waste
- [2]. Pens(HDPE)
- [3]. Plastic cover bags(LDPE)
- [4]. Threads
- [5]. Cement mortar (Bonding agent)
- [6]. Clay
- [7]. Admixtures (for stabilization purpose)
- [8]. Cement
- [9]. Lime
- [10]. Fly ash
- [11]. Calcium chloride
- [12]. Moulds and etc.

2.LITERATURE REVIEW

Different authors are said different manner about plastic waste utilization, recycle and reuse but there is a failure occur in their results such as different types of toxic elements are exposed in to atmosphere while reuse of plastic waste ex:-DEHA& etc. and this is only out of 25% of plastic waste recycling process and remaining plastic waste

are not recycle properly so I would like to give the solution for different way those who ever never follow or create this type of technique, that is preparation of geo plastic bricks.

3. METHODOLOGY:

It is similar to prepare as a conventional bricks but little bit variation that is described Step by step procedure for the preparation of GEO PLASTIC BRICKS as given below

1. Preparation of plastic roles
2. Preparation Clay (soil) for making bricks
3. Use of different stabilization technique
4. Placing of plastic roles
5. Drying and Burning process
6. Testing

3.1. Preparation of Plastic Roles

for the preparation of plastic role I collect lot of plastic pens and thick plastic covers at school zone areas and shopping zones then the plastic covers are rolled with plastic pens and then give treading on surface of that rolled one. That is as shown in Figure-1(a):-Plastic role & Figure-1(b):- Plastic role. And then it is dip in slurry for creation of bonding between plastic and soil so finally it will become as a plastic role after fully dry condition, it is lso shown in figure-2



Figure-1(a):-Plastic role



Figure-1(b):- Plastic role



Figure-2:- Plastic role after dib in slurry

After drying of plastic role it will ready for placing in the clay bricks but before placing this I would like to introduce a few stabilization techniques for achieving more strength than conventional clay bricks.

3.2. Preparation Clay (Soil) For Making Bricks

Here Sandy soils are called coarse-textured, and clay-rich soils are called fine-textured. Clay is a commonly used terminology defining the textural class representing about one-fifth clay, with sand and silt sharing the remainder equally. However clay is considered not feasible for good quality GEO PLASTIC brick making since it does not conform to the recommended (30% clay, 70% silt and sand) grain size distribution

3.3. Use Of Different Stabilization Technique

We have lot of stabilization techniques I selected major stabilization techniques those are cement, lime, fly ash and calcium chloride stabilization.

Cement Stabilization

As per recommendation the quantity of cement is require for the effective stabilization is 5-14% by the volume. The quantity of cement mixed with soil is sufficient to produce a hard and durable construction material; here I use sufficient of water to satisfy hydration requirements of cement and to make the mixture workable and this recommendation I use 5% of cement for making cement stabilized geo plastic bricks.

Lime Stabilization

The amount of lime require for the stabilization varies between 2-10% of soil. However if the lime is used only to modify some of physico-chemical characteristics of soil, the amount of lime required is 1-3%. The following amounts may be used as a guideline.

- [1]. 2-5% for cay gravel materials having less than 50% of silt-clay fraction.
- [2]. 5-10% for soils having more than 50% of silt-clay fraction.
- [3]. For soil having particle size intermediate between (1) and (2) above, the quantity of lime required is between 3-7%.

[4]. Above 10% for heavy clays. According to the above mentioned recommendation and field soil conditions 5% of lime is used to prepare lime stabilized geo plastic bricks.

Fly Ash Stabilization:-

In this technique the amount of fly ash is required is about 10-20% of weight of soil. Based on this recommendation I use 15% of fly ash for the preparation of fly ash stabilized geo plastic bricks as shown in figure-3.



Figure -3: Fly ash stabilization

Calcium Chloride Stabilization:-

In this technique the amount of calcium chloride is required is about 0.5% of weight of soil. Based on this recommendation I use it for preparation of calcium chloride stabilized geo plastic bricks.

Admixtures are one of the agents which help to increase the properties of the brick. Calcium chloride, fly ash, cement and lime are used as admixtures for a geo-plastic brick. Compressive Strength and hardness can be increased through this geo-plastic brick. The amount of admixture while adding in to the soil should be with accurate measure and carefully done as shown in figure-4.



Figure-4: Calcium chloride stabilization

3.4 Placing Of Plastic Roles

The plastic are placed at a centre position of the brick. So while placing it preliminary measures to be considered and placed the plastic role in to a brick very carefully. The brick which is placed with a plastic role inside it should be dried in an oven or at sun hot as shown in figure-5.



Figure-5: Placing of plastic roles

3.5. Drying and Burning Process

After moulding of bricks as the criteria mansion above that bricks should be dried at sun hot. After 15-30 days it is shifted for heating. The heating of this bricks carried gradually as

Temperature -100⁰C-causes drying and significant increase in the strength of clays, along with decrease in their compressibility.

- i. Temperature -500⁰C-causes permanent changes in the structure of clays resulting in decrease of plasticity and moisture adsorption capacity.
- ii. Temperature -1000⁰C-causes fusion of clay particles in to solid substance.
- iii. This heating continued up to 7 days. After that the geo plastic bricks are transferred to cooling section and cooled for one day. Finally geo-plastic bricks are ready for laboratory tests. Various stabilized geo plastic bricks as shown in figure-6.



Figure-6: Geo Plastic Bricks

3.6. Testing

Here I would like to conduct following tests for knowing properties of geo plastic bricks. Once I getting these results, I compare these results with conventional clay bricks.

❖ Field Tests

- Dimension
- Visual Inspection
- Hardness
- Soundness

❖ Laboratory Tests

- Compressive Strength - IS 3495 (Part 1): 1992
- Water Absorption - IS 3495 (Part 2):1992
- Efflorescence - IS 3495(Part 3):1992
- Bulk Density – IS 3495(Part 4):1992

3.6.1. Dimension of a Brick

Twenty brick are taken as random and measured the length, width, and height. Variation of about 1-10mm should be neglected and finally the brick size is noted as 19×9×9 Cubic centimeter.

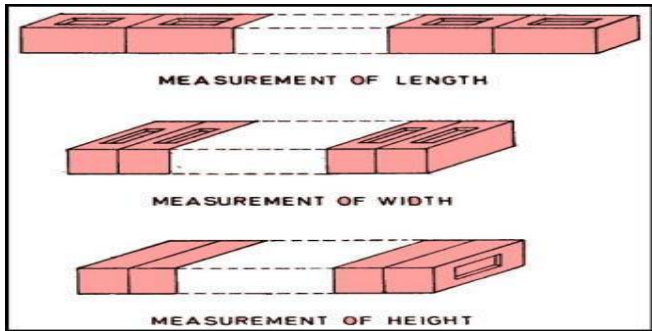


Figure-7: Dimensions of brick

3.6.2. Visual Inspection

In this test bricks are closely inspected for its shape. The bricks are uniform in shape; hence they are good quality and have truly rectangular shape with sharp edges.

3.6.3. Hardness of a Brick

A scratch is made on brick surface with the help of a finger nail. No impression is left on the surface; hence brick is treated as to be sufficiently hard and used for construction purpose and as shown in figure-8.



Figure-8: Hardness of a Brick

3.6.4. Soundness of a Brick

Two bricks are taken, one in each hand, and they are struck with each other lightly. Clear ringing sound is produced and brick should not break, Hence brick is of good quality. Tasting criteria as shown in figure-8



Figure-9: Soundness of a Brick

4. RESULTS

4.1. Test Results for Compressive Strength of Various Geo Plastic Bricks

- Compressive Strength of geo plastic bricks various tested and shown in the form of bar chart form

$$\text{Compressive strength} = \frac{\text{Maximum load at failure (N)}}{\text{Average area of bed face (mm}^2\text{)}}$$



Figure-10: Testing Of Geo Plastic Bricks at CTM

- Geo plastic brick = 35.4 N/cm²
- Cement stabilized geo plastic brick = 32 N/cm²
- Lime stabilized geo plastic brick = 28 N/cm²
- Fly ash stabilized geo plastic brick = 39.1 N/cm²
- Calcium chloride stabilized geo plastic brick = 41.6 N/cm²

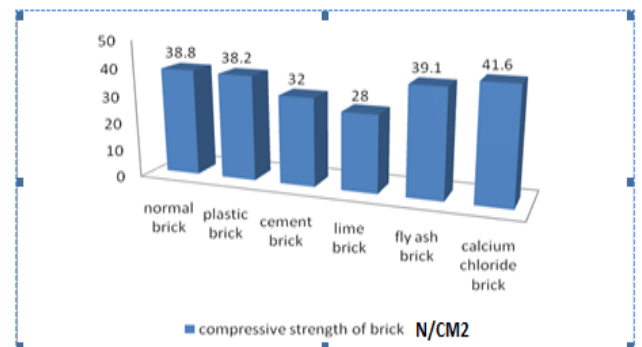


Figure-11: Compressive Strength of Various Geo Plastic Bricks

4.2. Test Results for Water Absorption of Various Geo Plastic Bricks

$$\text{Water absorption} = \frac{M_2 - M_1}{M_1} \times 100$$

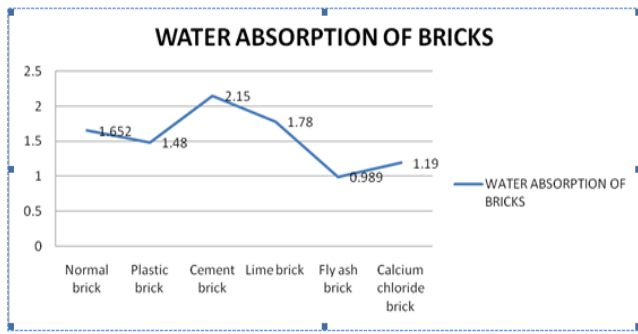


Figure-12: Water Absorption of Various Geo Plastic Bricks

4.3. Test Results for Efflorescence of Various Geo Plastic Bricks

- **Nil:** When there is no perceptible deposit of efflorescence
- **Slight:** When not more than 10 percent of the exposed area of brick is covered with a thin deposit of salts
- **Moderate:** When there is a heavier deposit than under ‘Slight’ and covering up to 50 percent of the exposed area of the brick surface but unaccompanied by powdering or flaking of the surface.
- **Heavy:** When there is a heavy deposit of salts covering 50 percent or more of the exposed area of the brick surface but unaccompanied by powdering or flaking of the surface.
- **Serious:** When there is a heavy deposit of salts accompanied by powdering and / or flaking of the exposed surfaces



Figure-13: Efflorescence of Various Geo Plastic Bricks

Table-1: Efflorescence values for various geo plastic bricks

TYPES OF BRICK SAMPLES	EFFLORESCENCE OF BRICKS
Conventional brick	Nil
Plastic brick	Nil
Cement brick	Moderate
Lime brick	Slight
Fly ash brick	slight
Calcium chloride brick	Nil

4.4. Test Results for Bulk Density of Various Geo Plastic Bricks

$$\text{Bulk density} = \frac{\text{Mass}(M)}{\text{Volume}(V)}$$



Figure-14: Bulk Density of Various Geo Plastic Bricks

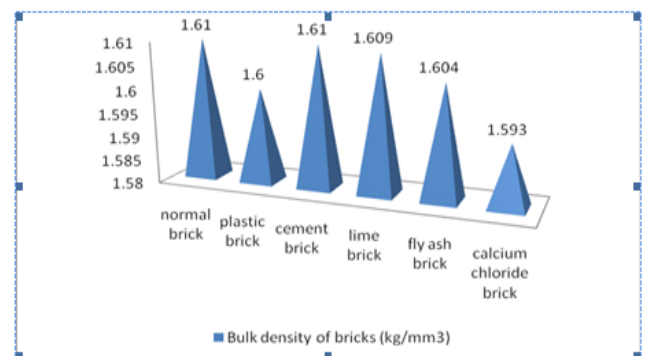


Figure-15: Bar Chart Results for Various Geo Plastic Brick

6. CONCLUSIONS

As per analysts the current Indian population is estimated to be 1.28 billion. The amount of plastic used by a person on average of 0.5 grams for a day, it depends up on area. With the increase of population, the amount of plastic is increased automatically. And it leads to create land pollution. To overcome this, the stabilized geo plastic bricks are prepared for construction of surface course of rigid pavement and also used as building materials, so that we can control the land pollution.

In one clay brick, plastic is placed at the centre of the brick to decrease the amount of plastic production. Plastic role is placed at the centre of the clay brick which form as a small void and results to a loss of strength. So I use some important stabilization techniques to increase its properties like strength, hardness, density etc.

I prepare different types of stabilized geo plastic bricks; out of that calcium chloride stabilized geo plastic bricks get good results when compare with properties of conventional clay bricks. From getting this kind of results, it can be recommended for construction material; especially these can be used in rigid pavement construction.

Example

- The amount of plastic waste generated per day
= $134488132.9 \times 0.5 = 67244066.4$ grams
- =67244.0664 kg=67.244 tonnes
- As per the results the amount of plastic on each brick is about **28gram**
- Finally, to prepare this kind of geo plastic bricks we should reduce the amount of plastic waste produce in world as well as in INDIA without any harmful effectives.

REFEFERENCE

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