

PREPARATION OF BRICKS USING SAND AND WASTE PLATIC BOTTLES

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ABSTRACT

This project paper manages utilization of waste plastic bottle containers as brick material. Plastic waste which is expanding step by step moves toward becoming high and also dirties the earth, particularly in high mountain towns and visitor trekking areas where no rubbish accumulation framework exists and furthermore which are disposed of or burned which prompts the pollution of land and air. The transfer of waste plastics is a greatest test, as continued reusing of PET bottles containers represent a potential risk of being changed to a cancer-causing material and just a little measure of PET bottles are being reused. Thus this Poly ethylene terephthalate (PET) bottles are cleaned and included with fine total (sand) at different ratios (1:2, 1:3, 1:4) to acquire high quality brick blocks that have warm and sound protection properties to control contamination and to decrease the general expense of development, this is a standout amongst the most ideal approaches to maintain a strategic distance from the amassing of plastic waste which is an on-degradable toxin. The sand that must be obtained from the valuable stream beds/mines. The plastic waste is normally accessible in surplus amount and thus the cost factor descends. Since this type of brick blocks have more compressive strength and less water absorption. Thus this sort of brick blocks are ideally utilized for underground septic tank construction, submerged constructions, and underground construction like passages and furthermore utilized for the sub structure of the buildings so as to oppose the leakage of the water on account of less water absorption limit and furthermore have high compressive quality which oppose the substantial basic burdens. The main drawback of this work is the cost because the sand rate is high due to the demand and also the cost of collection of plastic waste in large amount. But is preferable for government to dispose this waste plastic in the government buildings construction as a waste plastic bricks.

1. INTRODUCTION

In India the large amount of waste plastics are obtained from the household areas, hotels bus stand, Railway stations and other crowded areas. Especially the large quantity of waste plastic water bottles are obtained. Only few amount of water bottles are get recycled due to transportation cost and others are get disposed in the forest or nearby lakes, river beds, and sea. This causes land pollution, air pollution and water pollution due to contamination. It also one of the reason to cause various diseases like dengue, malaria, plague and rat-bite fever due to breeding of mosquitos and rat. Hence in order to reduce the waste plastic contamination in our environment and also to convert them into useful construction material this project work was carried out. In this project, the sand is the one of the main material used for the manufacturing process of the waste plastic bricks. Since sand gives the great property of this plastic bricks, which gives

required hardness, shapes and also gives the required physical properties to this plastic bricks. They also protect the plastic by resisting the thermal insulation up to certain degree Celsius. Hence the sand play vital role in the waste plastic bricks. As most of the local manufactures are producing bricks of size 220x100x75mm and 220x105x75mm, so the same dimensions was adopted for production of waste plastic bricks. The brick mould was prepared according to this dimensions with steel and wood at the workshop. Five samples of each ratio's (1:2, 1:3, 1:4 ratio's) were prepared. In this each ratios only one part of the waste plastic is taken from the total amount of weight and the sand amount is taken at different amounts. The casting and demoulding of this waste plastic bricks are done manually.

2. LITERATURE SURVEY

TITLE: UTILIZATION OF WASTE PLASTIC IN MANUFACTURING OF PLASTIC-SOIL BRICKS

AUTHOR: Puttaraj Mallikarjun Hiremath, Shanmukha shetty, Navaneeth Rai.P.G, Prathima.T.B

PUBLISHED ON: 2014

In this literature, they says that there is imbalance between the convential building materials availability and their demand. In this case, the laterite quarry dust is available at high amount and also the waste plastics like (PET, PP etc) disposal is a biggest challenge and recycling of PET bottles transfer into a danger able material. So they attempt to manufacture the bricks by using of waste plastic bottles in the range between 60 to 80% by weight of the laterite quarry dust, and bitumen grade 60/70 was added about 2 to 5% by soil weight in the molten form and this plastic-bitumen resin was mixed along with laterite quarry waste for the brick manufacture. The manufactured bricks possess neat and even finishing, with satisfactory compressive strength and with negligible amount of absorption when compared with laterite stone.

TITLE: STUDY OF PLASTIC DUST BRICK MADE FROM WASTE PLASTIC

AUTHOR: Ronak Shah, Himanshu Garg, Parth Gandhi, Rashmi Patel, Anand Daftardar.

PUBLISHED ON: October 2017

In this, they find a solution to utilize the waste plastic which is danger to ecological balance and to prevent the day to day increase of waste plastic. Throughout world the waste plastic causes bad effects. In order to get away from this issue they used the extruder machine. This machine changes the plastic wastes into construction materials. They also made an attempt to reduce the soil used for manufacturing burnt clay bricks and also to provide economic and ecofriendly bricks. Then they compared the plastic dust brick and burnt brick and obtained the result that the plastic dust brick has high compressive strength about 6.6 N/mm² which is greater than the compressive strength 3.5 N/mm² of red clay bricks.

TITLE: MANUFACTURING BRICKS FROM SAND AND WASTE PLASTICS

AUTHOR: Lairenlakpam Billygraham Singh, Loktak, Loukham Gerion Singh, Pongsumbam Boss Singh, Suresh Thokchom

PUBLISHED ON: March 2017

In this project work, they used sand and waste plastic to manufacture a brick. They prepared a brick by mixing sand and waste plastic after heating about 200°C. Since they manufactured two type of brick specimens one with using sand and waste CD'S and another with sand and waste water bottles at only one ratio (1:1.5). And they also tested the prepared brick specimens in order to obtain the physical and mechanical properties. This plastic sand are light weight and have waxy surface. It also observed that, it have less water absorption less apparent porosity and with high compressive strength then the normal traditional local bricks.

TITLE: UTILISATION OF WASTE PLASTIC IN MANUFACTURING OF BRICKS AND PAVER BLOCKS

AUTHOR: . Dinesh.S, Dinesh.A, Kirubakaran.K

PUBLISHED ON: January 2016

In this work, they examined and inquired about that the plastic waste which is expanding step by step moves toward becoming blemish and thus dirties the earth, particularly in high mountain towns where no refuse accumulation framework exists. A lot of plastic is being brought into the trekking regions are burned or disposed which prompts the pollution of environment and air. Henceforth, these waste plastics are to be adequately used. High-density polyethylene (HDPE) and polyethylene (PE) packs are cleaned and included with aggregates and sand at different ratios to acquire high quality bricks that have sound and thermal protection properties to control contamination and to decrease the overall cost of construction, this is a standout amongst the most ideal approaches to keep away from the accumulation of plastic waste which is an on-degradable polluting material. This then again spares the quanta of sand/dirt that must be detracted from the valuable river beds/mines. The plastic waste is normally accessible in surplus amount and thus the cost factor descends. Likewise Coloring admixtures can be added to the mix to achieve wanted shades. Henceforth in this theory, a work is made to gain knowledge with respect to the properties of the brick which is made utilizing waste plastics.

3. METHODOLOGY

3.1 COLLECTION PROCESS:

In this the collection procedure was done to acquire the required measure of materials for the preparing of plastic bricks. And further more to get the great quality materials for getting the extraordinary quality and other physical properties. The accumulation of sand was done from the river bed close Ponnai in Vellore region. The gathered measure of sand is around 50 kg in the cleaned bond sack. The accumulation of waste plastic containers was finished by gathering from the marriage functions, hotels and from the street collectors. So we collected the plastic wastes at various possible sites. In this the collection procedure was done to get the required measure of materials for the preparation of waste plastic bricks.

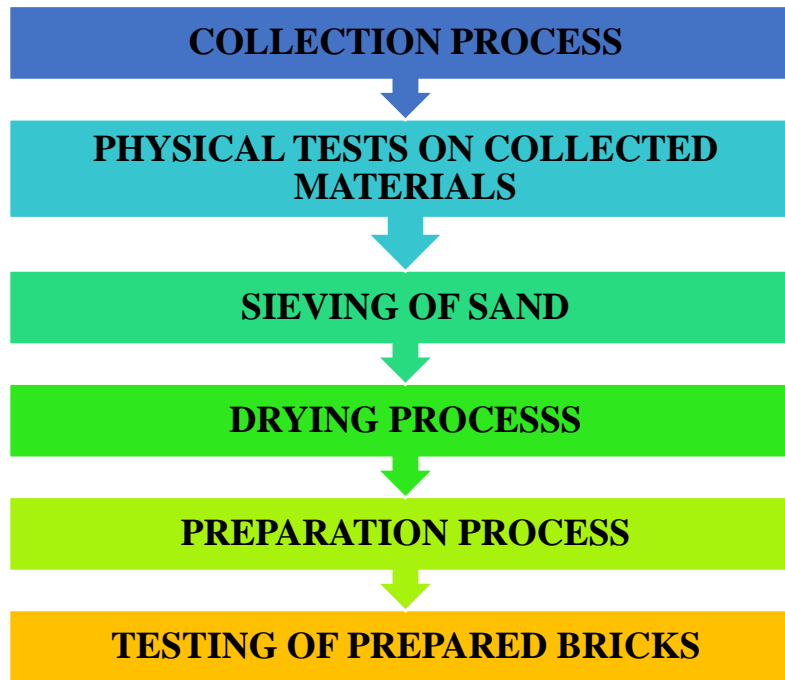


Fig 1 Methodology steps

3.2 PHYSICAL TESTS ON COLLECTED MATERIALS:

3.2.1 SAND

Sand is a granular material made out of finely separated shake and mineral particles. It is defined by size. Sand can likewise allude to a textural class of soil or soil type Hence the sand assume fundamental job in the waste plastic blocks The tests like Specific gravity, Fineness modulus, and Sand Replacement test were directed for getting the physical properties of sand and the acquired outcomes are

Table 1 Properties of sand

S.NO	CONTENT	VALUES
1	Specific Gravity	2.56
2	Bulk Unit Weight	1.42 g/cm ³
3	Grade of sand	Grade zone 1
4	Fineness modulus	3.96
5	Coefficient of uniformity	2.48
6	Coefficient of curvature	1.06

3.2.2 POLYETHYLENE TEREPHTHALATE (PET)

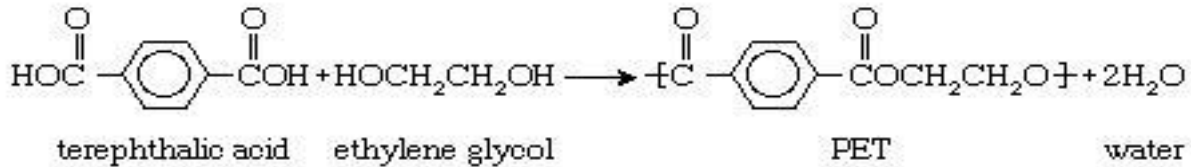


Fig 2 Chemical equation of PET

Presented by J. Rex Whinfield and James T. Dickson in 1940, this plastic is a standout amongst the most ordinarily utilized on earth. Curiously enough, it took an additional 30 years before it was utilized for completely clear drink bottles, for example, the ones created by Coca-Cola and Pepsi Companies. PETE plastics make up 96% of every plastic jug and holders in the United States, yet just 25% of these items are reused. By being careful and making a point to reuse code 1 plastics, you're guaranteeing a cleaner domain and less landfill contamination. Some of the Physical properties of polyethylene terephthalate (PET) are

Table 2 Properties of plastic (PET) bottles

S NO	CONTENTS	VALUES
1	Chemical Formula	(C ₁₀ H ₈ O ₄) _n
2	Density	1.38 G/Cm ³ (20 °C)
3	Melting Point	> 250 °C
4	Boiling Point	> 350 °C
5	Solubility In Water	Practically Insoluble

3.3 SIEVING OF SAND

The sieving of sand process was carried out in order to take the required size of sand. And also to avoid the large size aggregates (chips) from the sand. So the sand was sieved with IS sieve 4.75mm.

3.4 DRYING PROCESS

The drying process was done in order to remove the water content from the collected river bed sand and collected waste plastic water bottles. In this drying process the collected materials are spreaded over the cleaned surface at the sunlight during day time and then collected the spreaded materials after the sunset and then stored in the covered room. Since the collection was done after the sunset was to prevent the retaining of moisture content from the snow fall during the winter season. This drying process was carried out upto 3 days

3.5 PREPARATION PROCESS.

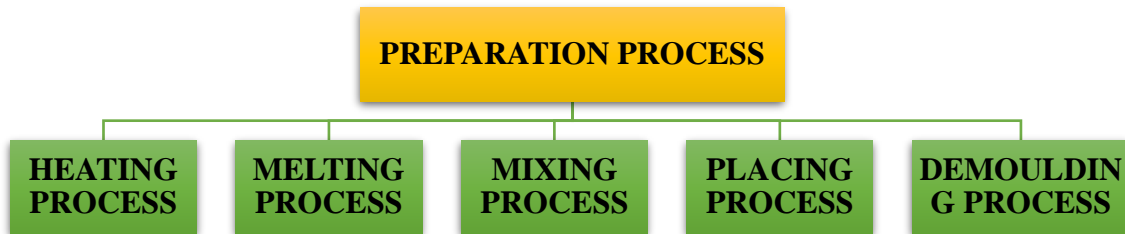


Fig 3 Preparation steps

The Pan which is used for melting the waste plastic bottles should be heated until the drop of water get evaporated. After the heating was done the collected and dried waste plastic bottles (PET) was put into the pan which get heated due to the heated pan and at certain temperature this placed plastic get melts and get boiled. During the melting process the continuous stirring was required. Because the continuous stirring helps to melt the non-melted plastics bottles. During to the melting there is no form of adding water or other cooled materials. Since the plastic gets bursted around the surroundings due to the presence or addition of moisture. The mixing process was carried out after the plastic bottles get melted properly and then in boiling condition. The while the boiling of the plastic molten immediately add the dried sand into the pan which was having molten plastic inside it. After the process of mixing the sand and liquid plastic molten in the pan the process of placing the prepared sand and plastic slag in the prepared brick mould was take place. But in this, the prepared slag was in hot condition so the process of self-compaction takes place upto 3/4th of the mould. So then it requires normal compaction with steel rod. The demoulding of the casted plastic bricks was done one hour later after the process of placing the plastic sand slag into the brick mould.



Fig 4 Preparing steps of waste plastic sand bricks

3.6 TESTS ON PREPARED BRICKS

The different sorts of tests on plastic bricks were led to check the characteristics of blocks for developments. This kind of brick tests are led at both in building site and in laboratory center. This brick blocks are most established and imperative development materials in view of their toughness, loading bearing strength, quality and minimum cost. To get the quality structure, the great quality materials are required. To choose the good quality materials a few tests on brick blocks are to be carried out. Hence the tests which are required to discover the reasonableness of the bricks for construction purpose are examined beneath.

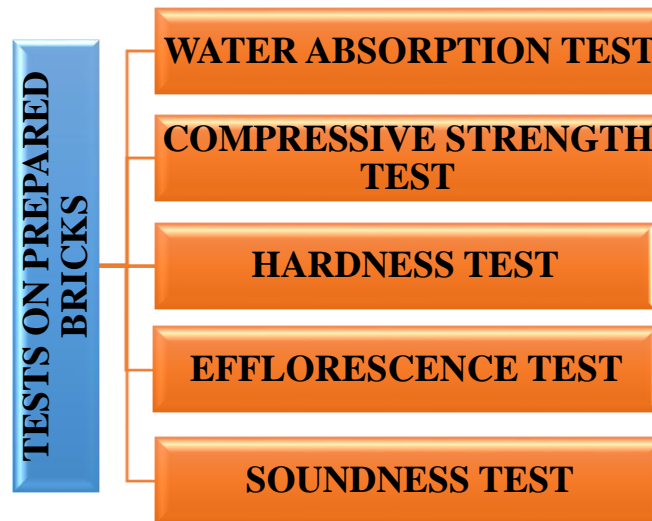


Fig 5 Types of test on bricks

3.6.1 WATER ABSORPTION TEST



Fig 6 Immersed bricks in water for 24hrs

Absorption test is carried on the brick is to discover the measure of dampness content consumed by the brick under extreme conditions. In this test, dry bricks are taken and weighted. Then these bricks are

put in water with full drenching for a time of 24 hours. After 24 hours the wet brick are cleaned the water at the surface with cloth and weight this wet brick. The distinction among dry and wet brick block weights will give the measure of water assimilation. Normally the brick should have less than 20% of water absorption value. Hence this test result are shown below

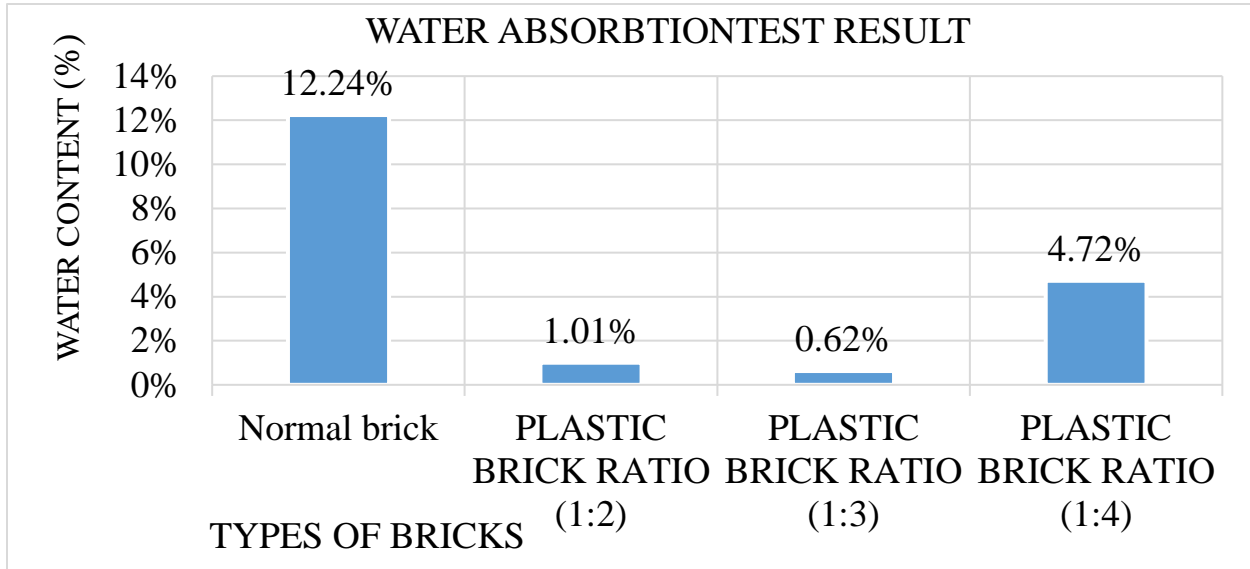


Fig 7 Chart about water absorption results

3.6.2 COMPRESSIVE STRENGTH TEST



Fig 8 Compression testing machine

Normally the Compressive strength of bricks is determined by compression testing machine. Hence the prepared bricks are placed in the compressive testing machine. After placing this brick in compression testing machine, the load is applied on it until brick breaks. Note down the value which obtained at the breaking point and find out the compressive strength value of brick. Minimum compressive strength of

brick is 3.50N/mm^2 . If it is less than 3.50N/mm^2 , then this type of bricks are not useful for construction purpose. The obtained results was shown in chart

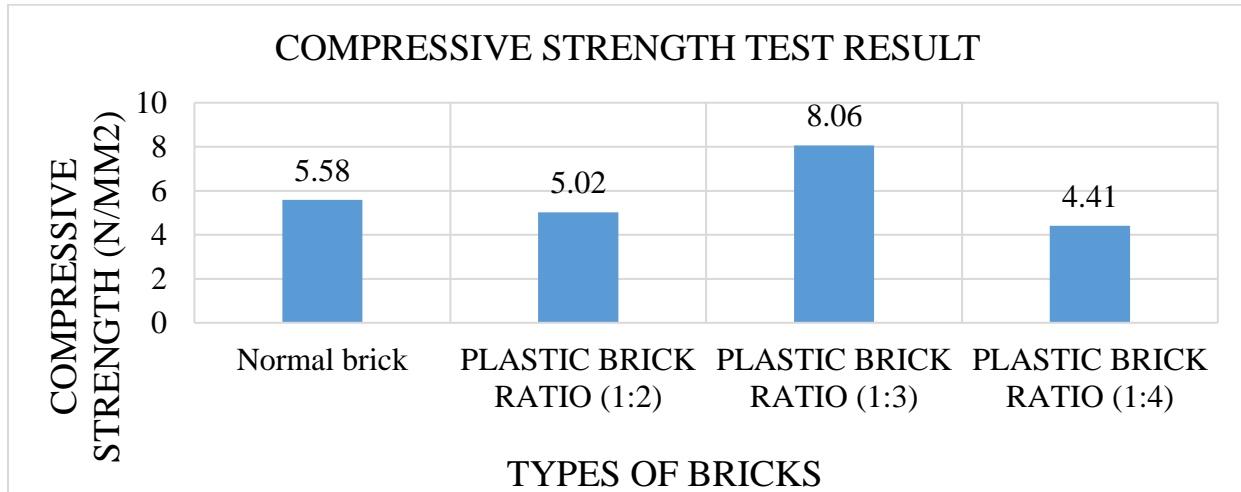


Fig 9 Chart for Compressive test results

3.6.3 HARDNESS TEST

This type of test was conducted to check the hardness property of the prepared plastic brick. Hence this test was carried out either in laboratory or in construction site. In this test the sharp tool was used to scratch the surface of the bricks and the identifying the hardness by the depth of the scratch which was done by the sharp tool. If the brick has less impression then the brick is a hard brick. The following figure shows the before and after scratch results.



Fig 10 Before scratching



Fig 11 After scratching

3.6.4 SOUNDNESS TEST

From this test, the observed result was that the sound of normal burnt clay brick was less when compared with the plastic sand bricks of different ratios. The plastic bricks does not get any crack or damages during the process of checking the soundness, but the burnt clay bricks get abraded at their surface.



Fig 12 Soundness test

3.6.5 EFFLORESCENCE TEST

From the testing of efflorescence for the bricks, it was observed that the plastic sand bricks does not show any efflorescence. Since the plastic contains less amount of soluble salts in it. Hence finally proved that the efflorescence of the plastic brick was very less.

4 COST ESTIMATION

The chart was plotted on the basis of experimental material cost and collection cost. Since the chart was plotted between the types of bricks along x-axis and cost of a single along y-axis. In this chart the cost of normal burnt clay brick, fly ash brick is compared with prepared plastic sand brick.

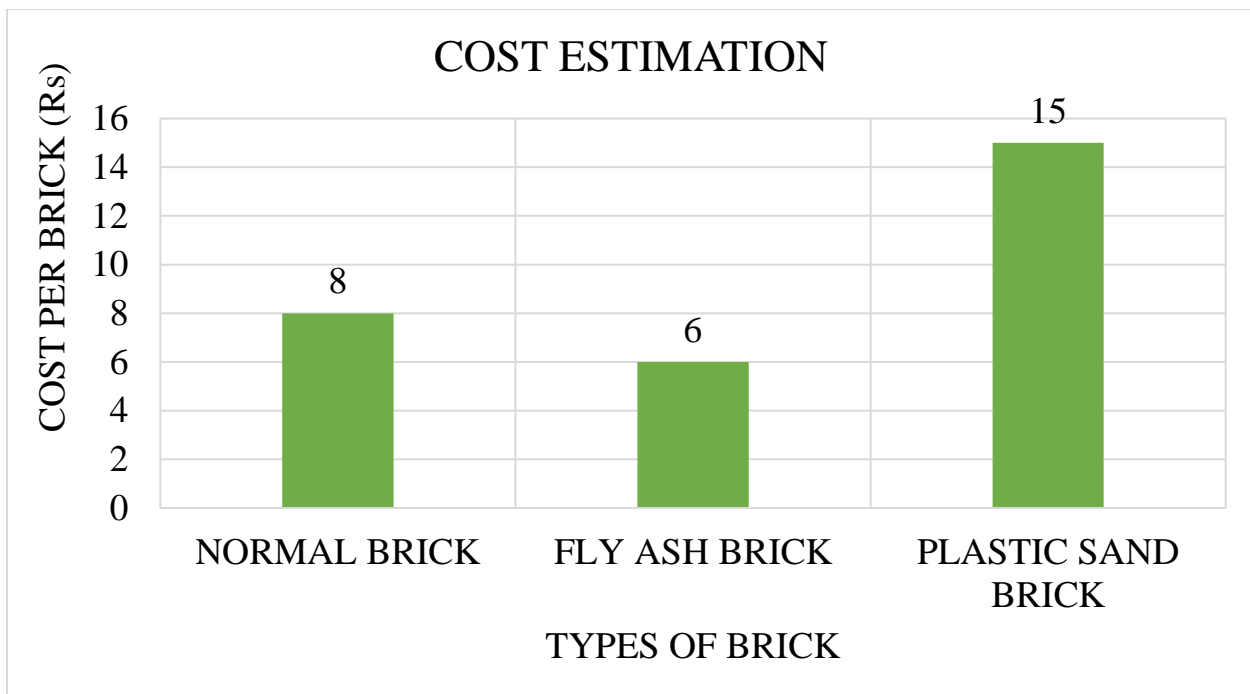


Fig 13 Chart for cost comparison

Table 3 Cost analysis

SL NO:	CONTENTS	COST (Rs)
1	Cost of sand per kg	3
2	Cost of plastic per kg	3.5
4	Cost of sand required per brick with 10% wastage	9 (about 3kg)
5	Cost of plastic required per brick with 10% wastage	3.5 (for 1kg)
6	Total cost along with lump sum cost (Rs 2.5)	15 (per brick)

5 REFERRED IS-CODE BOOKS

- IS.1077 (1992): (For the tests and dimensions of bricks).
- IS 14534(1998): (Guidelines for plastic recycle).
- IS 2386-3(1963) Part 3: (Testing methods for aggregates for Specific gravity, density, voids, absorption and bulking).
- IS 383 (1970): (Coarse and Fine Aggregates Specification for Concrete).

CONCLUSION

In this project, the plastic is used as the binder material so it restrict the absorption of water and also provides the good plasticity to the brick. So hence this type of bricks also resist the earthquake loads. This type of plastic bricks have high compressive or crushing strength at the ratio (1:3). And also has less absorption value when compared to normal conventional burnt clay bricks. So hence the plastic sand brick ratio 1:3 is preferable for the usage for the constructions. By use of plastic sand bricks, the water absorption was highly reduced. This plastic sand bricks are used as foundation bricks below the plinth level in order to avoid the seepage of ground water. Also the study presented above helps in reducing the plastic waste disposal problem and converts that useless waste material into a useful construction material. The main drawback of this type of waste plastic sand bricks are easily get fire at normal fire. So this type of bricks can be used at underwater construction, underground construction and also used for underground septic tank construction. Because this type of bricks can withstand high load than the normal brick. Hence the main aim of this project was to reduce waste plastic in our environment by utilizing as a material for the building construction. Since by using in the underground construction the plastic also get degraded naturally.

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