

UTILIZATION OF PLASTIC WASTE IN BRICKS AS ECO FRIENDLY MATERIAL

Submitted in partial fulfilment of the requirements for the award of
Bachelor of Engineering Degree in
Civil Engineering
By

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DEPARTMENT OF CIVIL ENGINEERING
SCHOOL OF BUILDING AND
ENVIRONMENT

SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)

Accredited with Grade "A" by NAAC
JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI - 600 119

APRIL - 2020



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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **N.K. ARIF AMEENI (REG. NO. 37200045)** and **S.S.S. KOUSHIK (REG. NO. 37200067)** who carried out the project entitled **"UTILIZATION OF PLASTIC WASTE IN BRICKS AS ECO-FRIENDLY MATERIAL"** under our supervision from December 2020 to April 2021.

Internal Guide

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Head of the Department

Submitted for Viva voce Examination held on _____

**Internal Examiner
Examiner**

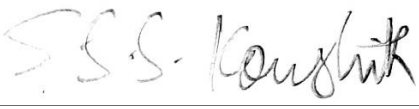
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DECLARATION

WE, N.K. ARIF AMEENI (REG. NO. 37200045) and S.S.S. KOUSHIK (REG. NO. 37200067) hereby declare that the Project Report entitled "UTILIZATION OF PLASTIC WASTE IN BRICK AS ECO-FRIENDLY MATERIAL" done by US under the guidance of Dr. S. Packialakshmi is submitted in partial fulfilment of the requirements for the award of Bachelor of Engineering degree in Civil Engineering.



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ABSTRACT

Plastics are one of the most using and leading material in our life only because of its low cost, easily availability and its properties. Even though the plastics are shown massive results but usage is limited only because of the material is dangerous environmentally. Plastic pollution is the accumulation of plastic objects and particles in the atmosphere, which has an effect on habitats, wildlife habitat, and humans (e.g. bottles, bags). Pollution caused by plastics Plastic materials that are harmful are known as micro or macro debris depending on their size and thickness. Since plastics are both inexpensive and durable, people manufacture a lot of them. Many plastics, on the other hand, have a chemical structure that makes them resistant to many natural degrading processes and slow to degrade. Together, these two causes have resulted in a significant amount of plastic waste in the atmosphere. Food packaging, covers, and bottles are the most commonly used plastic items. The most serious problem with plastics is its decomposition. Polymer additives are used to make plastic, which is then recyclable. This means that if plastic were to be deposited on Earth, it would not decay.

The main idea of the project is to convert this waste plastic into useful plastic bricks for constructive purpose under proper environmental conditions. In this the molten waste plastic is mixed with sand at the ratio of 1:3 and 1:4 and with cement and sand at the ratio of 1:1:3 to form the plastic bricks to achieve the sufficient strength. The plastic waste was obtained from the bags, food processing packets of LDPE type, which are chopped into the small pieces and melted for mixing with sand and cement to form the composites by using casting and moulding process. To analyze the performance of the moulded brick the Local brick testing methods were conducted such as soundness test and hardness test. In both of those tests, our brick showed sufficient properties. The brick was also tested for compression and water absorption test to know the proper applicability in construction site.

It is observed that the plastic bricks have low water absorption and high compressive strength when compared to normal conventional brick. These results showed that, the Plastic Brick was more efficient than the clay brick and cement brick.

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CHAPTER 1

INTRODUCTION

1.1 GENERAL

Humans are now using all of their capacity to consume a massive amount of food. The result of this high consumption is nothing more unless first-time capital is reduced and the lowland rises. People have lately been searching for greater outlets at lower prices, on the one hand, and because waste is evaded, on the other hand. Waste is now created where human footprints remain, indicating that the appropriate technique for exploitation of nature is no longer needed. In India, clean energy tools such as stars and power are already in use, and the development of renewable energy and diverse energies is on the rise. Plastics have been an important part of our everyday lives since their creation over a century ago. Cutting down and using the sole is the safest way to avoid plastic hazards. Ability, lightness, hardness, chemical resistance, water, and impact are only a few of the sensitive properties of plastic. Plastic is one of today's most popular disposable products. It accounts for a significant portion of road litter in both urban and rural areas. It easily fills up wastebins as a surprising water source. Plastic is to blame for the content pages that emerged around November 11th, which have major climate implications. The following are some plastic facts based on the results:

- It is calculable that one hundred million heaps of plastic square measure created every year.
- The average European throws away thirty-six kilo. of plastics every year.
- According to the Environmental Protection Agency, plastics developed a 12-ton system that created 254 million waste heaps in 2007. This equates to about 30,000,000 plastic heaps each year. According to some sources, plastic goods have been breaking up in a very lowland for many years.

Plastics made from oil, which is a non-renewable resource, are measured in square meters. It is called property wastes and environmental waste in nature for three

hundred years due to the plastic material. To reduce environmental effects, it can either be used or reused. The use of plastic as an innovative building material has been shown to be a viable alternative to traditional materials.

1.2 PLASTIC AS CONSTRUCTION MATERIAL

Plastic are often utilized in several forms within the construction like bricks, tiles, road pavements etc. several construction corporations area unit victimisation plastic materials. The elements utilized include embody everything from plastic screws and hinges to larger plastic components that area unit used in decoration, electrical wiring, wall covering so on. Using only plastic waste or adding another ingredient like powder, fly ash, etc plastic is reborn into useful construction materials like pavers, railway sleepers, building blocks, etc. variety of trials with completely different mixtures were conducted to expeditiously convert waste plastic into bricks. The main blessings to use plastic in construction are:

1. plastic area unit typically low price.
2. It is simple to manufacture.
3. It is sturdy and robust for his or her weight.
4. It is electrically and thermally insulative.
5. It is immune to shock, corrosion, chemicals and water.

Plastic is extremely useful because it is often coloured, melted, shaped, squashed, rolled into sheets or created into fibres plastics. Plastic also area unit sanitary and it's not poison to our bodies. Plastic is used created ropes that area unit terribly robust and fishing lines, glues and paints

CHAPTER-2

LITERATURE REVIEW

2.1 GENERAL:

A plastic may be a material which will amend its form. Several things are a unit product of plastics, actually because creating them to the proper form is simple. The most purpose of literature review is to grant an inspiration regarding the analysis work conducted for creating plastic as construction material. This forms the premise on that one will perform the work and techniques which will be used for conducting more experiments. The subsequent literature review elaborates the analysis studies created regarding the utilization plastic in creating a construction material wherever some proportions of cement and sand was replaced with plastic.

2.2 REVIEW OF LITERATURE:

Aeslina Abdul Kadir and Noor Amira Sarani, (2012) examined a survey of waste recycling in fired clay bricks was carried out. Several attempts were made in this study to incorporate waste into brick production. Recycling such waste and turning it into building materials is a feasible solution to the pollution crisis. The recycling of various wastes into fired clay bricks is the topic of this article. The effect of a wide range of successfully recycled materials on the physical and mechanical properties of bricks has been investigated. The production of light-weight bricks, increased porosity, and improved thermal conductivity of fired clay bricks have had positive effects in a variety of factories that deal with various types of waste. However, in some situations, lower mechanical properties output was observed.

Amit et al (2012) studied a analysis of the use of waste plastic in road asphalt has been performed. The amount of plastic waste in municipal solid waste (MSW) has been the due to population growth, urbanization, construction activities, and changes in the landscape's way of life, according to this study. As a consequence, waste waste disposal is a possibility, and because of their non-biodegradability and unsightly nature, it has become a major global issue. Since they have not been scientifically

disposed of, there is a risk of contamination of soil and water. To improve the mechanical characteristics needed for the particular road mix, this plastic was partially replaced by conventional material. This paper looked at how plastic waste was used to make roads and flexible flooring. In the traditional form, bitumen is used as a binder. Plastic waste pieces can be used to change the bitumen, resulting in a bitumen mixture that can be used as a flexible pavement top layer coat. This plastic waste improves the properties of the bitumen mix, resulting in improved binding, longevity, density, and water resistance.

Ganesh et al (2014) examined the use of recycled plastic in concrete pavers has been tested. In this analysis, recycled plastic aggregates are used and their suitability in various amounts is checked. Waste plastics have accumulated in the twenty-first century, presenting significant disposal problems, and policymakers have been forced to speculate in praising the use of coarse plastic waste in a very concrete way. Because of its low biodegradability and widespread existence, plastic disposal in a related environment is regarded as a significant disadvantage. Industrial wastes from plastic bottles, pallets, and bags; plastic (PP) and polythene, Terephthalate have been studied in various replacement areas of traditional concrete aggregates in recent years polythene Terephthalate (PET). If the plastic wastes are present in some quantity or type with the concrete mass, but the essential and distinct features or minor bargaining power are not affected. The use of plastic (PP) and polythene Terephthalate (PET) industrial waste as a separate alternative to traditional concrete aggregates was investigated. There are three levels of replacement. Aggregates of 10%, 20%, and 30% by weight are used in the preparation of concrete.

Jain et al (2011) examined the impact of using polymeric waste packaging materials on bituminous paths was discussed. By increasing paving temperature, decreasing mix rigidity, and increasing transport loads, this study investigates the process of bituminous surface deformation. The aim of this paper is to present research findings on increasing the rigidity of oil mixes by waste polymeric packaging material (WPPM) material, with the goal of improving paving performance while also protecting the environment. The use of WPPM in road construction is the topic of this study. Polymer poly containers are used to label milk for sale to consumers, and these bags are discarded after the milk is consumed. These milking bags are used to supplement bituminous mixtures and other HDPE-based bags. The best dose for

adjusting bitumen and bitumen blends in these two styles of WPPM is being investigated. The optimal dose by weight of a bituminous blend of WPPM is 0.3 to 0.4 percent, according to the findings. As the dosage was increased, the mixing rigidity increased, which was unwelcome. Bituminous mixing can be reduced to 3.6 mm by using an acceptable amount of WPPM in a bituminous blend for road building, with a value of 16.2 mm, after 20,000 cycles. The indirect strength ratio of tensile mixes confirms that moisture damage prevention potentials also improve pavement efficiency, in addition to reducing waste removal problems for a safe and healthy environment.

Maneeth et al (2014) examined the use of waste plastic in the development of plastic soil bricks was investigated. The thesis focuses on the use of plastics in civil engineering. Plastic screws and hangers, as well as larger plastic parts used for lighting, electric cable, flooring, wall, and waterproofing, are among the products used. In recent history, there has been a major gap between supply and demand for conventional building materials. Lateral quarry waste, on the other hand, is readily available, and waste plastics (PET, PP, etc.) are the most difficult to recycle, as recycling repeat PET bottles increases the risk of being a carcinogenic product, despite the fact that only a small portion of the PET bottles is recycled. In comparison to laterite steel, the produced bricks have properties such as cleanliness and even finishing, as well as low water absorption and compressive strength, which meet the growing demand for conventional construction materials.

Dinesh et al (2016) Studies on the use of waste plastic in brick and paver block production. It was found The growing amount of plastic waste becomes an eye and pollutes the atmosphere, in particular in high mountain villages where there is no waste collection system. A large quantity of plastic is thrown out or burned onto tourist trails, which contributes to pollution of environment and air. Those waste plastics can then be used efficiently. The bags are cleaning and sanding and aggregate high-density polyethylene (HDPE) and polyethylene (PE) to produce high strength bricks, which have pollution control and general cost reduction thermal and sound insulation qualities. Best ways to prevent plastic waste accumulation which is a pollutant that is degradable. This decreases the quantity of sand/lay from vital beds/mines of the river. Naturally, there is a surplus of plastic waste, which decreases the cost factor.

Coloring agents may also be applied to the mixture to obtain the desired hue. As a result, the properties of the brick made from plastic waste are examined in this report.

Shikhar (2010) Plastic waste blocks were investigated. This study explores one safe and effective method of managing plastic waste in urban and rural areas of India in order to minimize negative environmental effects. The need for such research is justified, as the unsustainable existence of the material's use, produce, and disposal is fascinating. I invented a method for using soft plastic waste to ascertain the current state of affairs and incorporating it into plastic bricks that are square flash in weight and can withstand higher pressures than regular plastic bricks. However, due to certain plastic physical and chemical properties that may be harmful to the brick that comes from it, some changes in its style and production methods are produced.

Manish Kumar Sahu and Lokesh Singh (2010) studied on fly ash bricks, a critical test is performed. Bricks are predominantly made of clay and are usually produced in small, unorganized factories. Every year, the brick industry produces approximately 250 billion bricks. The manufacture of clay bricks consumes a larger amount of clay, resulting in substantial soil and soil depletion. Massive swaths of land are lost every year in developing countries due to the range of soils from a depth of one to two meters from agricultural land. A crucial step of brick manufacturing is the firing of bricks in brick kilns, which results in extreme pollution of the environment and health issues. Greenhouse gas emissions in the atmosphere are mainly affected by brick burning. To avoid environmental threats, this results in significant pollution, and staff in the brick industry are particularly susceptible to metastases. Ash-bricks made from various materials, such as lime, gypsum, sand, and ash, are referred to as waste as a residue from various factories and plants. The aim of this paper is to illustrate how ash bricks were made as building materials in the gift period, as well as the advantages of mismanagement. Throughout this post, the benefits of ash as a building material are explained.

Sengupta (2002) In India, researchers have looked into recycling agro-industrial waste for the production of building materials and components. Owing to a scarcity of natural resources, rapid urbanization causes conventional construction materials to fail. The energy used to create traditional construction materials, on the other hand, pollutes the air, water, and soil. To meet increased demand for energy-

efficient building materials, a cost-effective, environmentally sound technology must be adopted, and antiquated methods must be upgraded without their native materials.

Another major issue in developing countries is the disposal of agro-industrial and other solid waste. The current study looks at the possibility of using agro-waste as a replacement for conventional construction materials. Supported the supply of agro-waste materials as well as the assessment of physical-mechanical properties, handling processes, and environmental impacts of land construction materials units. Agro-waste equipment for construction materials is a resource-saving approach that saves resources.

Christopher Koroneos and Aris Dompros, (2007) examined the economic growth of brick in the balcony country was investigated. The current research also looks at the various stages of brick production, as well as the materials and energy used in each stage. The aim is to identify "hot spots" that contribute to the overall environmental impact, i.e. are part of the life cycle. The investigation is performed using a life cycle assessment (LCA) methodology, which is a method of identifying and quantifying the environmental performance of a process or a "cradle-to-grave" product. The framework for life cycle assessment provides a quantitative base for evaluating future improvements in a system's environmental performance over its lifetime. The sourcing of raw materials, industrial manufacturing, packaging, and transportation are all part of the system. Energy consumption and emissions are estimated, and potential environmental impacts are assessed. The key sources of energy in the production system are electricity, gasoline, and solid fuel (Pet-Coke). The strain of abode resulting from the brick construction process is largely due to air pollution caused by fossil fuels.

Nitin Goyal and Manisha, (2016) conducted research on the use of eco-bricks in the design of houses. Non-biodegradable material disposal has become a major problem in recent years, with mounds of garbage accumulating across the globe. According to the investigation, a new concept of eco bricks, also known as bottle bricks, is being developed to address this problem. Eco bricks are a brand-new form of building material made from plastic bottles that have been filled with plastic waste and, in some cases, soil, and can then be used for construction. The use of these bricks reduces both the expense of construction and the amount of carbon dioxide released into the atmosphere. Plastic bottles will be studied as a building material in

this article. It also goes over the production of eco bricks as well as their other characteristics. Finally, different considerations such as cost and reduction in pollution due to the use of these bricks are addressed.

Puttaraj et al (2018) Plastic waste was investigated for use in the manufacture of plastic-soil bricks. In recent years, there has been a gap between supply and demand for traditional building materials, according to this report. On the other hand, quarry waste is readily available in soil, and waste disposal (PET, PP, etc.) is a major challenge, as recycling PET bottles repeatedly runs the risk of turning into a hazardous substance, and only a small percentage of PET bottles is recycled. A trail was developed to produce the bricks in this project, using wastes ranging from 60 to 80 percent by weight of soil quarry waste and 60/70 percent by weight of molten soil in the range of 2 to 5 percent, mixed with soil quarry waste. In contrast to ground stone, manufactured bricks have properties such as smoothness and even finishing, minimal water absorption, and adequate strength to meet the increasing demand for traditional building materials.

Velmurugan et al (2019) conducted the reconstruction of plastic waste in pavement bricks was investigated. The rich materials are recycled in this study. The type of plastic used in this project is polyethylene. Electric heaters melt plastics and combine a variety of sand types, including river sand, sand, and fly ash brick. At a temperature of about 700°C, this heating system is also designed to recycle the plastic brick. The heating components for this project are "Type A1 Nichrome," which melts at about 1400°C. The film used can withstand temperatures of up to 1400°C.

Ankit Mathur et al (2017) conducted the experiment focused on the combination of concrete exploitation of e- and plastic waste as a gross combination of leaps and limits, as well as a dynamically adjusted amount of waste generated by industrial enterprises. During this article, hazardous and alternative waste poses a good health and environmental threat. As a result, proper waste management is essential in order to protect life, health, and the environment. The following are real-world reports on the use of recycled e-waste and plastics as a gross concrete mix. Plastic and e-waste properties, such as density, relative density, water absorption, compressive power, and tensile of the individual concretes, were studied and analyzed in relation to the management concrete in a gross combination (2.5, 5, 7.5, and 10%).

Vytlačilov (2011) examined the following is a list of recycled aggregates used in fibre concrete. According to this report, using recyclable materials in the construction industry is critical for every country's property growth. In terms of economics and the environment, the use of primary sources and commodities has become unacceptable, so it is vital to exploit the ability to use these products before their usefulness has run out. Job creation is the only way to deal with rising waste volumes while still preserving the environment. Recycled materials can be used in a number of engineering applications. This article focuses on an experimental program designed to verify the elite material characteristics of fibre concrete, in which all natural stone aggregates will be used instead of recycled aggregates such as masonry and concrete. The recycled construction and demolition waste is combined with similar artificial fibres to make an uncommon fibre reinforced concrete; a modern composite that has a wide range of potential applications. The analysis demonstrates the research and results of the density, compression, resilience, flexibility and bending durability and the modulus physical property of fibre concrete, in the composite - mechanical and physical characteristics. The composite behaviour that is good enough to be used in the soil structures as intended, endorsed an over-sized set of inherited experimental results on the entirely different characteristics of the material being tested. The application of this material is assured by artificial fibres, which along with the opposite parts are the powerful structure of the composite which, thanks to its high meltability, is particularly favourable under tensile load.

CHAPTER-3

AIM AND SCOPE

3.1 AIM:

The main focus of this project is to target the reduction of plastic pollution and its impact on the earth. In order to reduce the dumping of plastic without any management measures the present study intended to utilize the plastic in an efficient way in the manufacturing of brick. we tend to adapt plastic within the bricks. By using plastic waste as modifier, it can able to scale back the proportion of cement and sand by their weight. hence the present study paves the way in protecting the environment by reducing the consumption of cement and sand

3.2 OBJECTIVES:

By conducting an intensive literature survey, the following objectives are formulated:

- To develop an efficient way to utilize the plastic waste which is great threat for the environment.
- To design a high performance of sand brick, that is eco-friendly.
- To vary the proportion of plastic in bricks to determine the strength performance.
- The waste plastic is to be effectively use.
- To examine the strength characteristics tests such as compression test, water absorption test, hardness test, soundness test.

CHAPTER 4

MATERIALS AND METHODS

4.1 METHODOLOGY

The methodology adopted in this study is discussed below in Figure 4.1 and it was adopted to achieve the objective of this study.

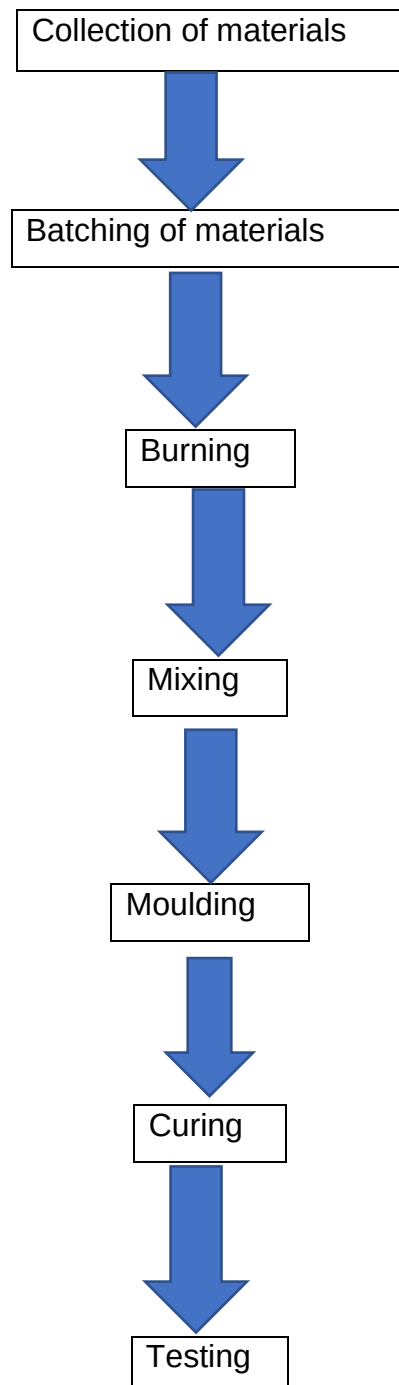


Fig. 4.1 methodology flow chart

4.1.1 EXPLANATION OF METHODOLOGY

•**Collection of materials:** -The non-hazardous solid waste as plastic bottles, grocery bags, soft drink bottles, sand and cement were collected.

•**Batching:** -- Batching is a material technique used to make bricks. When the various materials are put together, we separate the different plastic categories, eliminate other waste from the substance, and make sure that any water in the sample is burned.

•**Burning:** - Combustion of waste plastic After batching, the plastic was taken to be burned, where it was lowered and melted in the container. To prevent toxic gasses being released into the atmosphere, this should be achieved in a closed vessel. This is at a temperature of 90-150 degrees Celsius.

•**Mixing:** - For the development of uniform and brick strength the mixing of materials is important. The blending must ensure that the mass is uniform, consistent in colour. Two types of mixture, mechanical blending and mixing of hands typically occur. In this we took mixing of our hands. Until the entire plastic content required to manufacture a combined proportion of plastic 1 brick is intercalary. Then these plastic liquids are fully mixed until they harden by a plumb. The mixture has terribly short setting baggage are turned to liquified state; the stream sand is intercalary to that. The sand intercalary is mixed time. therefore, commixture method mustn't consume longer.

•**Moulding:** - Following the proper mixing technique, we pour the mixture into the suitable mould. In these ventures, we use regular brick sizes (20x10x10 cm). After one day, remove the brick from the mould and complete the process.

•**Curing:** - The test sample was allowed to dry for 24 hours after molding and the samples were maintained in the curing tank.

4.2 PROPERTIES OF MATERIALS USED

4.2.1 Plastic: -

In the plastic process, two greenhouse gases, methane and ethylene, are exposed to ambient radiation. Because of its low density (branching) properties, it divides more easily over time, resulting in larger surface areas. Tank building, dispensing bottles, wash baskets, tubing, computer bags, and various laboratory mouldings are all examples of where low-density polyethylene (LDPE) is used. Plastic bags made of low-density polyethylene are the most commonly used application.

Table 4.1 Properties of plastic (LDPE)

PROPERTY	LDPE
Chemical structure	More branching
Density	Low density 0.91-0.94 g/cm ³
Flexibility	Low crystallinity (50-60%), and therefore more flexible
Heat resistance	Drastic decrease in density when subjected to temperatures beyond 20°C
Melting point	~115°C
Chemical resistance	Resistant to most alcohols, acids, and alkalis; low resistance to oxidising agents and selected hydrocarbons
Strength	Relatively increased impact strength in cold conditions
Transparency	High, due to amorphous condition

4.2.2 Sand: -

The silica material was used in concrete and mortar as a fine aggregate. The best choice of fine aggregate material is natural coarse sand water. River silica sand is a natural by-product of years of rock weathering. It is drained from the river's beds.

Table 4.2 properties of sand

S.No	Property	value
1	Specific gravity	2.62
2	Bulk density	1690 kg/cubic metre
3	Fine modulus	2.36
4	Quality of sand	River sand

4.2.3 Cement: -

Heating rock with small quantities of different materials (calcium carbonate) was used to make cement (such as clay). For various physical characteristics of cement, tests were carried out with data displayed on the output field unit. As a binding agent, cement may be used.

Table 4.3 properties of cement

S.No	Property	Standards
1	Initial setting time	30 minutes
2	Final setting time	600 minutes
3	Fineness	2%

4.3 PROPORTIONS: -



Fig 4.2 MIX PROPORTIONS OF BRICKS (1:3)



Fig 4.3 MIX PROPORTIONS OF BRICKS (1:3)



Fig 4.4 MIX PROPORTIONS OF BRICKS (1:3)

4.4 PROCEDURE FOR PLASTIC BRICKS: -

- Collect the LDPE plastic waste and separate it from other wastes.
- Dry the plastic waste, if it's wet and has water content. The plastic waste should to be dry.
- The ratio of plastic and sand are 1:3 and 1:4. Cement, plastic and sand is 1:1:3.
- The sand which is used in manufacturing process of bricks is sieved for a size less than 2.36mm using sieve analysis.
- The fine particles of plastic waste was heated on a vessel upon it changes into liquid form (100 degree centigrade-200 degree centigrade).
- Add the sand and cement according to calculated proportions into melted plastic.
- Mix it adequately and make a mixture.
- Pour the mixture into moulds.
- Keep the mould for dry and demould it on a next day.
- Weight of each brick is between 3Kg to 3.5Kg.



Figure 4.5 burning of plastic waste

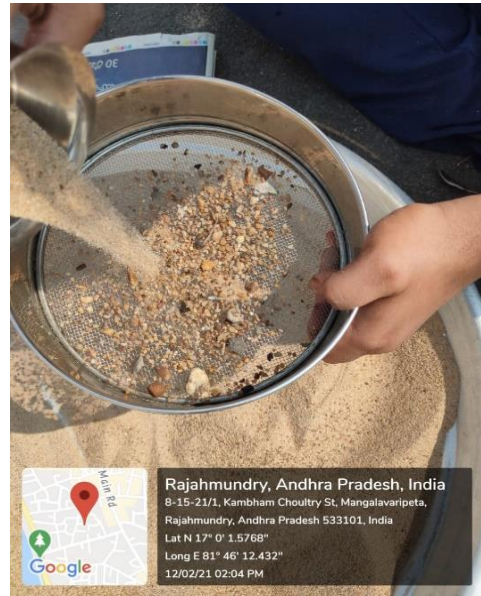


Figure 4.6 sieve size of 2.36mm



Fig.4.7 Proportioning of cement and sand

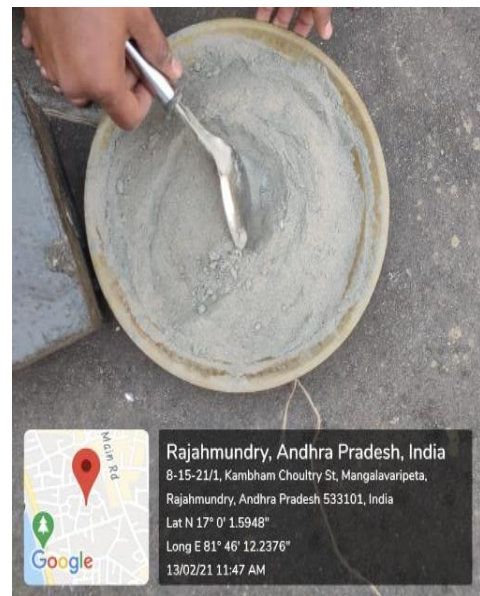


Fig.4.8 Mixing of cement and sand



Fig. 4.9 The process of mixing



Fig. 4.10 The process of moulding

4.5 TESTS CONDUCTED ON THE BRICKS ARE: -

- Compression strength test
- Water absorption test
- Hardness test
- Soundness test

4.5.1 COMPRESSIVE STRENGTH TEST:

The tests on Compressive strength of the specimen brick shall be calculated for after the curing for cement plastic brick for 14 to 28 days using the formula as follows,

Compressive strength = peak load / area of the specimen

After the curing period gets over bricks are allowed for testing. To test the samples, the bricks are placed in the calibrated compression testing machine of capacity 3000 KN (Kilo Newton) and applied a load uniformly at the speed rate of 2.9 kN/min. once the specimen is exposed to the peak load shall be consider as failure of specimen which fails to produce any further increase in indicator reading on testing machine.

4.5.2 WATER ABSORPTION TEST: -

Bricks should not absorb water more than 15% by its weight. The bricks to be tested should be dried in an oven at a temperature of 105 degree Centigrade to 115 degree Centigrade till attains constant weight. Cool the bricks at room temperature and weigh (W1) the bricks. Immerse fully dried and weighed (W1) bricks in clean water for 24 hrs. at a temperature of 27 +/- 2-degree Centigrade. take out the bricks from the tank and wipe out any traces of water if any and weigh immediately (W2).

Water absorption (%) = (final weight/initial weight) *100

4.5.3 HARDNESS TEST: -

To consider the brick hard, it has to be associated with good compressive strength and sound resistance to saturation of moisture. In this test, a scratch was made on bricks' surfaces using four (4)-inch common nail. Then, the impression made on the sand brick was recorded.

4.5.4SOUNDNESS TEST: -

This soundness test is to be carried out to find that a clear ringing sound is produced or not when the two bricks are strike with each other without breaking any of the two bricks. If the two bricks are not broken after hitting with each other and a clear ringing sound was produced, that means the bricks are sufficiently sound.

CHAPTER-5

RESULTS AND DISCUSSIONS

5.1 COMPRESSIVE STRENGTH TEST: -

After 14 days and 28 days curing for cement plastic brick, the compression testing machine checks the specimen. Load at a rate of 13.73/mm² should be applied progressively before the specimen fails. The compressive force is given by the load on the failure divided by sample space.

$$FC = P/A$$

Where, FC= Compressive strength (N/mm²)

P = Ultimate load (N) or Breaking Load

A = Loaded area (200mm *100 mm) = 20000 mm²

•PROCEDURE: -

- Place the brick at the middle of the lower platen of The Compression Test Machine must be applied in such a way that the load is applied not on the top and bottom of the opposite sides of the brick as cast.
- The specimen's axis must be strictly aligned with the centre of the spherical platter thrust. Between the faces of a measuring machine no packing shall be used and hence the steel plate.
- At a rate of approximately 13.73N/sq.mm/min the load should be applied without shock and continually increased until a resistance of the specimen to increasing load decreases, and no higher stress often remains.
- The maximum load applied to the specimen is then registered.

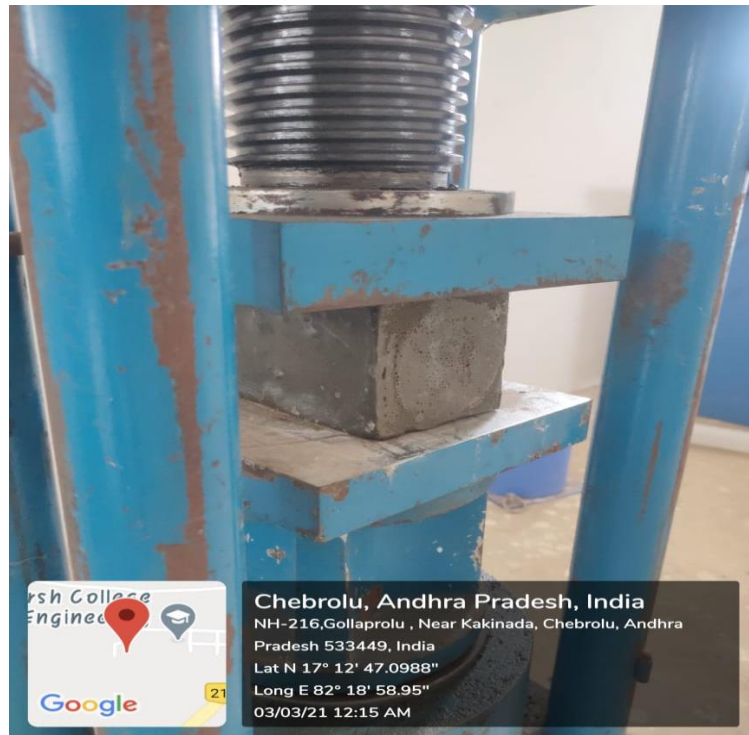


Fig. 5.1 Compressive strength Machine and Specimen



Fig. 5.2 Failure of the specimen at the maximum load

Table 5.1COMPRESSIVE STRENGTH FOR MIX DESIGN OF 1:3

samples	Compressive strength (N/sq.mm)
1	14
2	14.5

Table 5.2COMPRESSIVE STRENGTH FOR MIX DESIGN OF 1:4

Samples	Compressive strength (N/sq.mm)
1	12
2	12.5

Table 5.3COMPRESSIVE STRENGTH FOR MIX DESIGN OF 1:1:3

Samples	Compressive strength (N/sq.mm)
14 days	15.75
28 days	17.5

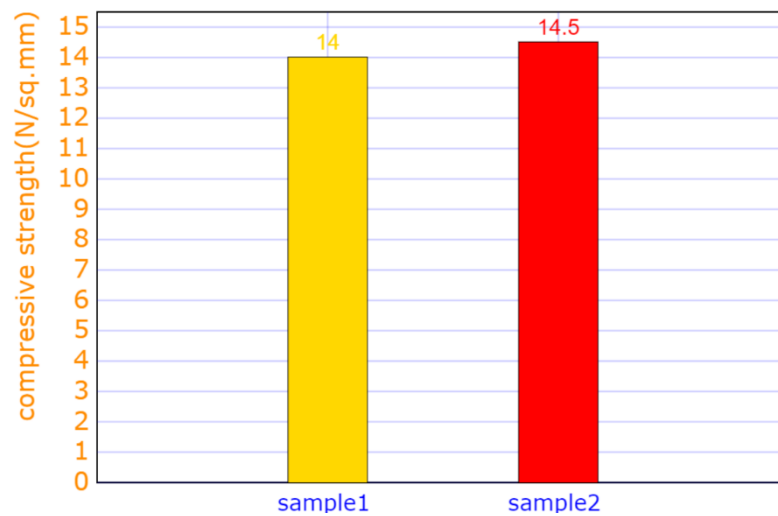


Fig. 5.3compressive strenght of brick (1:3)

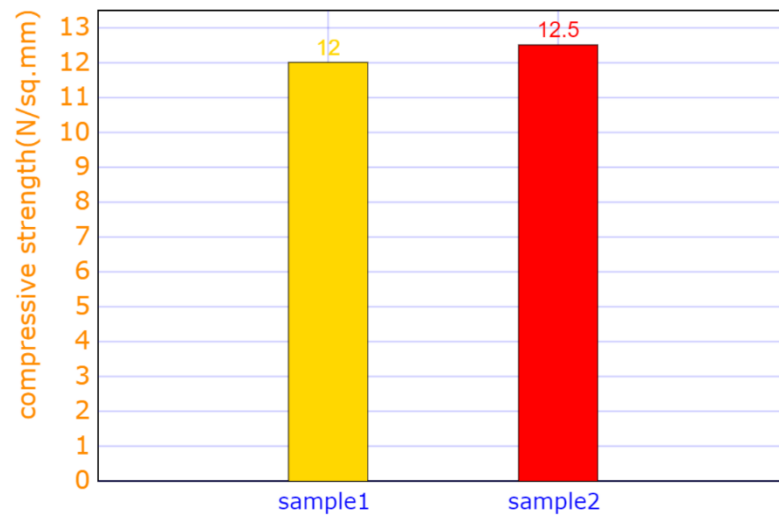


Fig. 5.4 compressive strength of brick (1:4)

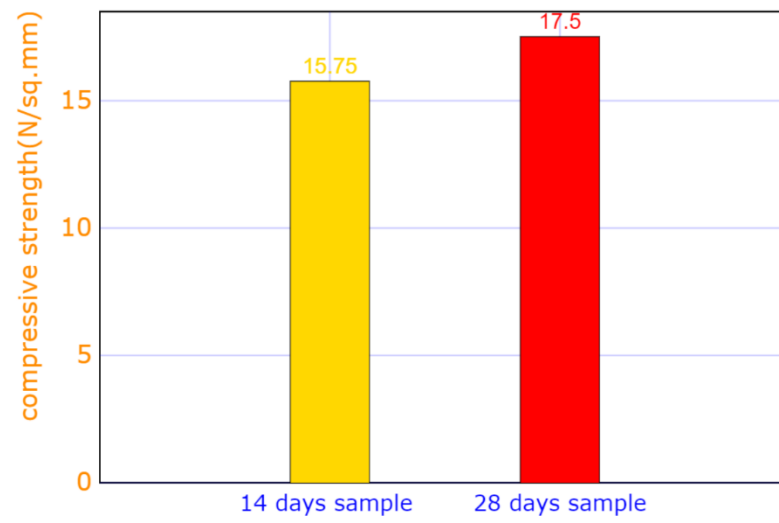


Fig.5.5compressive strength of brick(1:1:3)

5.2 WATER ABSORPTION TEST: -

Water Absorption test on brick is conducted to find out the moisture absorbed by the bricks when subjected to extreme conditions. The absorption test used to determine the durability properties of the brick such as quality, behaviour of brick in weathering.

Table 5.4 Water absorption for mix design (1:3)

Sample	Initial weight(kg)	Final weight(kg)	Percentage of absorption
1	3.125	3.235	3.5%
2	3.210	3.315	3.27%

Table 5.5 Water absorption for mix design (1:4)

Sample	Initial weight(kg)	Final weight(kg)	Percentage of absorption
1	3.360	3.510	4.4%
2	3.405	3.550	4.25%

Table 5.6 Water absorption for mix design (1:1:3)

Sample	Initial weight(kg)	Final weight(kg)	Percentage of absorption
14 days curing	3.185	3.280	2.9%
28 days curing	3.205	3.305	3.1%



Fig. 5.6 weight of cement plastic brick (1:1:3) Fig.5.7 weight of plastic brick (1:4)

5.3 HARDNESS TEST: -

A scratch of a four (4) inch standard nail was made on brick surfaces in this examination. A very light impression was left on the sand brick surfaces with the help of a traditional nail on the bricks. The plastic waste that acted as a binding machine, as well as the sand fillers, contributed to the brick hardness. As a result, all brick specimens were classified as "hard."



Fig.5.8 Hardness of brick

5.4 SOUNDNESS TEST: -

In this take a look at 2 bricks area unit control by each hand and stricken with each other. The bricks given clear metallic ringing sound and don't break, so these are good quality.



Fig.5.9 Soundness of brick

CHAPTER 6

SUMMARY AND CONCLUSION

6.1 GENERAL

In the present study, series of experiments were conducted to investigate the dense characteristics on plastic brick and the impact of plastic with sand and cement in several proportions was investigated by conducting compressive strength, water absorption, hardness test and soundness test, were carried out and results were compared for different specific specimens.

6.1.1 COMPRESSIVE STRENGTH

By referring table 5.1, 5.2, 5.3 following interpretation's taken and noted below:

- Compressive strength of cement sand bricks was steadily increased after curing in water by 14 to 28days.
- By examination the compressive strength of brick after curing of 10 days it's determined that the compressive strength of plastic sand brick (1:3) is 14N/sq.mm and 14.5 N/sq.mm, for the compressive strength of plastic sand brick (1:4) is 12N/sq.mm and 12.5N/sq.mm, and for the compressive strength of cement plastic brick after 14 and 28days curing is 15.75N/sq.mm and 17.5 N/sq.mm (1:1:3).
- It showed the pattern of strength has exaggerated because of solidifying of bricks from 14 to 28 days.
- As the minimum compressive strength of brick is 3.5N/sq.mm, All the above brick specimens are suitable for use.

6.1.2 WATER ABSORPTION

By referring table 5.4,5.5,5.6 following points are noted and listed below:

- The rate of Water absorption of 2 samples of cement plastic bricks have steadily increased for 14 to 28 days curing.
- By examination the water absorption of 2 samples of 10 days, it's determined that the water absorption was 3.5% (1:3 (sample 1)) and 3.27% (1:3 (sample 2)), 4.4%

(1:4 (sample 1)) and 4.25% (1:4 (sample 2)); after 14 to 28 days curing, it varies from 2.9% (1:1:3 (sample 1)) to 3.1% (1:1:3 (sample 2)).

•As the water absorption ratio of brick should not exceed 20%,All the above brick specimens are suitable for use.

6.1.3 HARDNESS TEST

From fig 5.8 following points are noted and listed below:

- There was a very light impression left on the sand and cement sand brick surfaces with the help of common nail of 4 inch on the brick.
- Thus, all the brick specimen were thought of “HARD” supported the impression made.

6.1.4 SOUNDNESS TEST

From fig 5.9 following points are noted and listed below:

- The bricks samples given clear bimetal ringing sound and don't break.
- So, the brick specimen area unit have good quality.

6.2 CONCLUSION

- I. Making bricks from sand and waste plastics will be an effective another to the available ancient clay bricks.
- II. The water absorption for sand plastic bricks is leaser than for regular clay bricks.
- III. Sand plastic bricks have higher compressive strength than traditional clay bricks.
- IV. Waste plastics that is accessible everywhere could also be place to associate economical use in the manufacturing of brick.
- V. Sand plastic bricks will minimize contamination and create a clean and safe environment.

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