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Strength Characteristics of Concrete Mixes Using Pet Bottle and Burnt Clay Bricks as Alternate Substitute for Coarse Aggregates

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ABSTRACT:

This investigation highlights on the behavior of concrete, prepared by the partial replacement of regular aggregate with PET bottle and over-burnt brick aggregate (jhamabrick)with a replacing percentages of 0% , 25, 50% & 75% over M20 Grade of concrete . The effect of compressive strength, split tensile strength and flexural strength were determined. The received compaction factor is 0.915, 0.88, 0.878, and 0.867 with varying percentage of (0%, 25%, 50%, 75%) PET bottle and Jhama class brick respectively. The purpose of the current investigation was to determine whether crushed PET bottles and burned bricks would provide suitable substitute coarse aggregates for concrete. The concrete cube, beams and cylinders of M20 grade were used to measure compressive strength , split tensile strength and flexural strength to explore work and analyzed different properties of concrete with pet bottle and crushed over burnt bricks as an alternative material. The result shows that the aggregate in concrete derived from Over Burnt bricks aggregate attained relatively higher strength up to the certain percentage and decreases after that, than the regular concrete. For Beams On The Basis Of Load Carrying Capacity:-Normal Beams:-When tested for flexure all three specimens failed in bending.

With 25% Replacement:- The beam with 25% replacement shows 16.1% decrease in the average load w.r.t. the normal beam.With 50% Replacement:- The beam with 50% replacement shows 34.2% decrease in the average load w.r.t. the normal beam.With 75% Replacement:- The beam with 75% replacement shows 54.4% decrease in the average load w.r.t. the normal beam. Hence, it is not advisable to use beam with 75% replacement .

ON THE BASIS OF ECONOMY:-On the basis of Rate Analysis , the normal beam is costly as compared to the beam with 25% replacement and the cost goes on decreasing with the increase in the replacement percentages. The replacement with 75% being the least costly.On The Basis Of Weight:-On the basis of weight normal is heavier than others. And the beam with 75% is lighter of the all. And the weight goes on decreasing with the increase in the replacement percentage.

Keywords: Jhama Class Brick, Compressive Strength, Flexural Strength, Compaction Factor. Split tensile strength.

I. INTRODUCTION

Eco friendly concrete is a concrete in which some part of the concrete is been replaced by some natural or the industrial waste , thus reducing the effect created by the cement and concrete in the environment .

The lightweight eco friendly concrete is concrete in which we are replacing some percentage of concrete by PET bottles and the rest by the burnt bricks. This type of concrete can be used in the light weight carrying structure. The RCC structure when constructed is basically formed to take the compressive force. The concrete is weak in taking the tension force so the reinforcement is used in the structure , and the concrete in the tension part of the structure is just for the cover and support for the reinforcement.

Lightweight aggregate concrete can be produced using a variety of light weight aggregates. Lightweight aggregates originate from either:

- Natural materials, like volcanic pumice.
- The thermal treatment of natural raw materials like clay, slate or shale etc.
- Manufacture from industrial by-products such as fly ash, i.e. Lytag.
- Industrial waste like PET bottles.

2. OBJECTIVES OF THE PRESENT STUDY

- To study the property of fresh concrete.

- ➢ To study The Compressive strength, flexural strength, tensile strength of concrete by replacing coarse aggregate with over burnt bricks.
- ➢ Cost analysis of concrete with over burnt brick will be studied.

➢ As partial substitute for the fine aggregate in concrete composites by plastic fibres.

➢ As partial replacement of coarse aggregate by burnt bricks in concrete composites.

3. LITERATURE REVIEW

Based on the past researcher following literature review can be done for the present investigation:

- **Akçaözoğlu et al. (2010)** The utilization of crushed, wasted Poly-ethylene Terephthalate (PET) bottle grains as a low-weight mortar aggregate was investigated in this study. Two sets of mortar samples—one produced entirely of PET aggregates and the other with PET and sand aggregates combined—were used in the investigation. In order to save money and minimise the quantity of cement used, blast-furnace slag was also utilised as a mass replacement for cement at a replacement ratio of 50%. In the mixtures, the water-binder (w/b) and PET-binder (PET/b) ratios were 0.45 and 0.50, respectively. The shredded PET granules used in mortar mixture preparation ranged in size from 0 to 4 mm. Based on the results of the testing and laboratory study, mortars with only PET aggregate, mortars with PET and sand aggregate, and mortars modified with slag in place of cement can all be classified as structural lightweight concrete in terms of strength and unit weight. Thus, it was determined that there might be a chance to employ waste PET granules that have been shredded as aggregate in the creation of structurally lightweight concrete. Shredded waste PET granules are utilized to lessen the unit weight of concrete, hence lowering the death weight of a structural concrete element of a building, due to their low unit weight. Understanding a building's death weight can assist reduce its seismic risk because earthquake pressures are linearly related to the building's dead weight. Additionally, it was determined that using industrial wastes in concrete, such as PET granules and blast-furnace slag, has certain benefits, including lowering the need for natural resources, disposing of trash, preventing environmental contamination, and saving energy.
- **Apebo et al. (2013)**

The study's goal was to find out whether burned brick waste could be used as coarse aggregate in structural concrete. In trial mixes, only shattered, overburned bricks known as "brick bats" were utilized as coarse aggregates. To find the compressive strength of concrete, cubes were created and tested. Based on the findings, concrete containing brick bats as particles is classified as medium-light weight concrete with a density of 2000–2200 kg/m3. To get the same workability as concrete with ordinary gravel particles, concrete containing brick aggregates requires a proportionately higher amount of water. Using broken and burned bricks as coarse aggregate in structural concrete is recommended when natural aggregate is hard to come by and high concrete strength is not required.

- **Akinyele et al. (2020)**

Effect of PET waste on the structural properties of burned bricks. Plastic packaging is commonly made of polyethylene terephthalate (PET), which is resistant to both chemical and environmental degradation. However, disposing of this nonbiodegradable material properly has proven to be a significant difficulty. In order to explore the potential of this material as an additive to clay in burnt bricks, this study mixed PET at 0, 5, 10, 15, and 20% with lateritic clayThe bricks were burned in a kiln for 48 hours at a temperature of about 900 °C. After that, the samples were tested for mechanical, density, and water absorption. The results demonstrated that while the brick samples from the lower percentage samples exhibited edge deformation, the brick samples from the 15% and 20% samples crumbled at high temperatures. In contrast to the compressive strength data, which are 5.15, 2.30, and 0.85 N/mm2, respectively, the modulus of rupture values for the 0, 5, and 10% samples are 13.20, 11.96, and 8.53 N/mm2, respectively. The water absorption percentages of the three samples were 10.29, 9.43, and 6.57%, respectively; all of these values are within acceptable ranges. This study discovered that less than 5% PET may be used in burnt bricks under controlled conditions.

Olukanni et al. (2021) An analysis of plastic waste in civil engineering as a sustainable resource Plastic wastes can persist in the ecosystem for many years since they are not biodegradable. It may age as a result of chemical, biological, and physical processes that have the potential to destroy habitats and degrade the environment necessary for life. A thorough investigation of a workable substitute for the care, processing, and disposal of used plastic containers has been prompted by the severe environmental issue caused by the careless disposal of plastic waste containers. Because of this, scientists have discovered uses other than its recovery. The trash can be recycled, repurposed, or reprocessed to replace building materials as a substantial amount of aggregates and cement are needed for construction. Its application can also be applied to bricks, plastic reinforcement, bitumen modification, soil stabilisation, geosynthetic materials, and natural aggregates, all of which help to limit the amount of natural aggregates that can be extracted for use in the building sector. The review includes the gathering of pertinent data from published sources regarding plastics, including their many forms, waste products associated with them, and applications in the building sector. It also looks at the problems with plastic garbage and how it may be used sustainably as building material. It might be possible to manage plastic trash, clean up, and enhance our natural environment by altering the way plastics are made. According to this analysis, there is a chance for the building industry to employ plastic trash as a creative substitute.

- **Hanis, Gani and Uvarajan (2021)** recycling plastic trash for use as gravel in building supplies. Due to the massive amounts of plastic garbage generated every day and the lack of an efficient method for disposal, there is an accumulation of plastic trash in the environment. garbage management and public awareness campaigns have increased the need to find alternatives to the current disposal methods. Utilising waste or recycling plastic has been seen as a great way to minimise environmental effects and cut down on the copious amounts of plastic waste that are produced. This article discusses the use of various plastic waste kinds as aggregate in construction materials by reviewing 163 prior studies conducted between 2012 and 2021. This study assesses the usage of plastic as aggregate in terms of the building materials' mechanical, physical, and durability qualities as well as cost and environmental considerations. It was discovered that the inclusion of plastic as aggregates changed the mechanical and durability qualities of the created materials, but the materials still meet the requirements for construction materials. In addition, a basic SWOT analysis was carried out to illustrate the benefits and drawbacks of using plastic trash.

- **Karthik and Mangala (2021)** Analyse the behaviour of concrete mixtures by substituting waste plastic for coarse aggregates.In place of natural coarse particles in M20 mix concrete, this study suggests using waste plastics, namely high density polyethylene (HDPE), low density polyethylene (LDPE), and polypropylene ethylene (PPE). Examining specimens made by substituting recycled waste plastic coarse aggregates (RPCA) produced through a semi-mechanized process with a conventional mix, the study examined the plastic aggregates' behaviour at high temperatures as well as their workability, compressive strength, flexural strength, and split tensile strength. Using HDPE, LDPE, and PPE plastic wastes, three distinct sets of plastic aggregates were created. It was shown that the workability of concrete mixtures decreased as the percentage of plastic waste aggregates increased. Because of the weak Interfacial Transition Zone (ITZ) between the plastic aggregates and paste, the compressive and flexural strengths were lowered. Because of its aggregate characteristic, the inclusion of waste plastic aggregates boosted the tensile strength. Concrete specimens exposed to higher temperatures exhibited favourable behaviour in terms of strength measures. It is possible to replace 10%–20% of RPCA without compromising durability and strength standards.
- **Paul and Jahidul (2022)** A comparative analysis of concrete using waste plastic polypropylene and polyethylene terephthalate in place of certain coarse aggregate. Over the past 60 years, there has been a tremendous increase in the production of plastic worldwide, with 10% of that plastic ending up as solid trash. If suitable recovery techniques are not used, this plastic represents a threat to the environment. Another method of recycling this waste plastic is to mix it with concrete. Two of the most often used plastics that are rarely recovered and recycled are polypropylene (PP) and polyethylene terephthalate (PET). Consequently, 10%, 20%, and 30% by volume of coarse aggregate are replaced with PP and PET in the current study. Three different water-to-cement ratios (0.42, 0.48, and 0.57) are compared for these concretes. Comparable characteristics include density, workability, compressive, and tensile strengths. Compared to brick aggregate concrete, concrete containing PP aggregate has demonstrated up to 39% stronger compressive strength and 9% lower density. Conversely, compared to the reference concrete, concrete containing PET aggregate showed a 53% decrease in compressive strength. It also exhibits decreased density and better workability. Relationships between the splitting tensile and compressive strengths of concrete are described using equations, together with the impact of the proportion of plastic aggregate. According to a cost estimate, using waste plastic in concrete has a higher cost than using standard brick aggregate concrete. However, up to 10%, PP may considering the gain in compressive strength.
- **Islam et al. (2022)**

Mechanical and long-term qualities of concrete partially substituted with recycled polypropylene waste plastic for coarse aggregate. Reusing waste materials made of non-biodegradable plastic can help minimise the amount of natural resources used in building while also lowering environmental risks. Hence, the purpose of this study is to examine the possibilities of using waste polypropylene (PP) plastic as coarse aggregate in concrete. The purpose of this study is to assess the durability and mechanical qualities of PP concrete. Its primary areas of interest are bond strength, flexural strength, splitting tensile strength (STS), hardened density, compressive strength, modulus of elasticity (MoE), shrinkage characteristics, temperature effect on compressive strength, and chloride ion penetration. In the experimental study, the water-cement ratios are 0.35, 0.40, 0.45, and 0.50, and the percentage of PP aggregate is varied between 10% and 20% of the volume of coarse aggregate. The experimental findings showed that adding PP aggregate to the mixture improved the concrete's workability. With 10% and 20% PP content, respectively, concrete density can be reduced by approximately 5% and 10%. After adding PP aggregate to the concrete, all of the following parameters decreased: flexural strength, MoE, compressive strength, and STS. Compressive strength dropped by up to 10.8% and 34% at 100°C and 200°C, respectively, at high temperatures. Additionally, when the percentage of PP aggregate grew, the shrinkage percentage also rose. All of the PP concrete, however, had a moderate level of chloride ion penetrability. Compared to the other percentages, the 10% PP concrete showed superior bond strength and a larger slip carrying capacity. In addition, the PP concrete cylinders failed more ductilely than the reference concrete, which broke brittlely. Lastly, it is advised to include up to 10% PP aggregate in structural concrete in order to generate effective and environmentally friendly concrete.

- **Darzi (2022)** The impact of shredded plastic on the reinforced concrete slab'sbehaviour.The use of recycled plastic trash in slabs was examined in the current study. 21 standard cylinders with 5%, 10%, and 15% RPET and RPEP were tested for slump, density, compressive, and splitting tensile strengths in order to examine the mechanical properties of concrete. It demonstrates that both additives reduced concrete density by up to 9.8%, although RPET enhanced workability more than RPEP. By 10%, the RPET group outperformed the RPEP in strength. Splitting tensile strength decreased as a result of minor differences in RPET and RPEP. Seven 500x500x110 mm reinforced concrete slab samples were subjected to experimental testing in order to assess the impact of substituting aggregate with 5%, 10%, and 15% RPET and RPEP. The slabs were tested with a line load at midspan, comparing failure mode, initial fracture load, ultimate load, and deflections for each group after being divided into control, RPET, and RPEP groups. Flexure caused all of the samples to fail. In comparison to the control and RPEP slabs, RPET slabs fractured less. First cracking loads are decreased by 3.2-24.3% when coarse aggregate is substituted with RPEP. The results of the experimental flexural load testing indicated that the use of RPET reduced the ultimate load by 13.9–21.6 percent, while the usage of RPEP reduced it by 2.4%, 7.9%, and 14%. When 5% of RPET and RPEP were used, there was a decrease in deflection, but a rise in deflection when 10% and 15% of RPET and RPEP were utilised. Slab failure and cracking loads in the studies were lower than the theoretically predicted values. The work uses slab simulation with FEM. The final loads for RPET and RPEP slabs are calculated using the finite element approach, which agrees with experimental results. The way the slab responded to load was not consistent with the finite element approach. Compared to experimental testing, finite element analysis produces more flexible slab behaviour.

- **Ibrahim and Mushtaq (2022)** using plastic trash to produce sustainable concrete. Plastic is an inexpensive, light-weight, adaptable, and easily obtainable material. Plastic is now used in many aspects of our daily life and has been produced at an exponential rate over the past 50 years. Consequently, there is a rise in the production of plastic garbage, which compromises the environment. This motivates scientists to employ this waste as a sustainable material in the production of concrete. This paper, however, examines current studies that demonstrate how adding recycled plastic to concrete might improve thermal and acoustic insulation. Eighty-five percent of the weight of concrete is made up of aggregate, which is the largest and heaviest component. Additionally, the plastic's density is lower than the aggregate. As a result, the effectiveness of thermal and acoustic lightweight concrete insulation is greatly increased when plastic waste is used to replace a portion of the aggregate, between 50% and 75%. Furthermore, plastic's manufacturing costs are significantly lower than those of regular concrete, and because it is lightweight, it can be built and used more rapidly with fewer workers. Waste plastic might be regarded as a standard ingredient in the creation of lightweight green concrete, which is suitable for use as a non-structural building element.
- **Ameh et al. (2022)** The performance of polymer bricks made from scrap plastic.This study was motivated by the growing housing shortage in developing nations as well as the necessity to address the harmful effects of plastic waste on the environment. The use of melted leftover polyethylene terephthalate (PET) bottles as a binder in the creation of polymer bricks is described in this work. In order to prepare the polymer bricks, melted waste PET bottle resin and natural sand were mixed at mass ratios of 1:1, 1:2, 1:3, 1:4, 1:5, 1:6, 1:7, and 1:8 PET/sand. The mixture was then cast in moulds. The appropriateness of the polymer bricks as an alternative masonry unit was assessed based on their physicomechanical properties. According to the study, polymer bricks' compressive strength, flexural strength, and Poisson's ratio all rose with values of 17.96 N/mm2, 9.01 N/mm2, and 0.34, respectively. According to the elastic modulus-to-compressive strength ratio, the minimal requirement was satisfied by polymer bricks made with PET/sand ratios of 1:3, 1:4, and 1:5. For significant splitting tensile strength performance, a minimum sand content of 75% is required. For polymer bricks made with a 1:8 PET/sand ratio, the maximum water absorption is 4.42%. The low sorptivity values of 1.76×10^{-3} kg/(m2h0.5) to zero were observed, suggesting the potential use of polymer bricks as a damp proof course.
- **Olubisi (2023)** Sources of recycled aggregates used in the manufacturing of concrete. Putting sustainable ideas into practise is imperative for the building sector. Reducing the use of natural resources to an extreme degree and maximising the recycling of industrial and construction wastes for use in the production of concrete are two ways this might be accomplished. Since recycled waste aggregates make up roughly 70% of concrete, concrete's qualities are determined by the aggregates themselves. In recent times, natural aggregates have been substituted with recycled waste aggregates to generate concrete. Therefore, it is vital to get sufficient understanding regarding the origins of the recycled aggregates utilised in the manufacturing process of concrete. This chapter aims to provide an overview of the different recycled aggregate sources, conduct a thorough analysis of the viability of the recycled aggregates investigated in earlier research projects as the primary constituents of concrete, and present a range of findings from the studies conducted on each type and source of recycled aggregate.
- **Mohan and Chakrawarthi (2023)** Utilising leftover plastic from recycled Bakelite as an environmentally beneficial aggregate for concrete beams.Recent years have seen research on the use of plastic trash to replace coarse aggregate in concrete mixtures, either entirely or in part. The number and quality of coarse plastic waste particles, however, have proven to be problematic. The purpose of this study is to examine the mechanical performance of concrete that has some of its coarse aggregate replaced with scrap Bakelite plastic. Tests were conducted on six distinct concrete mixtures with Bakelite doses ranging from 0% to 10%. The findings show that, even at smaller doses, the inclusion of Bakelite plastic changes the behaviour of the concrete and decreases its compressive and flexural strengths. With the exception of the mixture containing 6% Bakelite, which demonstrated improved strength, the addition of waste Bakelite to concrete mixtures typically results in a drop in compressive and split tensile strength. Bakelite waste preserves specimen integrity and inhibits abrupt specimen breaking, despite a minor drop in flexural strength. With the exception of the 8% waste Bakelite beam, which showed a similar ultimate load capacity of 60 kN, the ultimate load capacity of reinforced concrete beams with Bakelite waste is often lower than that of the control beam. Using Bakelite waste in concrete can be a sustainable way to manage garbage, even if controlling it can be challenging because it can eventually cause microplastics to form in landfills. The creative use of discarded Bakelite to partially substitute coarse aggregate in concrete solves the environmental issues associated with disposing of non-biodegradable plastics and provides a long-term solution to the waste management issue. This study offers a workable approach to creating economical, environmentally friendly building materials and supporting sustainable waste management techniques.

Rebeca Sánchez-Vázquez et al.(2024) Waste from the construction sector has been increasing considerably in recent years, making it urgent to find alternatives to this waste that will enable us to preserve the environment and ecosystems. Many studies demonstrate the viability of using this and other waste in the construction sector, such as wood, ashes, and plastics. This article presents a review of research works where residual materials have been applied in the construction sector. To achieve this objective, a total of 35 articles were reviewed, published in English-speaking journals between 2015 and 2023. This review shows that, although in recent years efforts have been made for the application of waste materials in the construction sector has been significant, however, there is still work to be done in the study of the behavior of these residual materials, such as the emission of greenhouse gases, as well as the importance of residual materials pretreatment to ensure compatibility with the rest of the components. Another important aspect is that most studies consider environmental aspects without taking into account social and economic issues surrounding them in the construction sector.

4. METHODOLOGY

- To collect the PET bottles and burnt bricks needed for research.
- To arrange the equipments and the materials needed.
- Shredding the waste bottles into pieces and crushing of the burnt bricks into aggregates to small size.
- Granulating the plastic pieces to smaller size as that of sand.
- Casting and curing of the basic test specimens(cubes) for determination of strength.
- Casting and curing of the structural elements.
- To test the structural models (RC beams with various percentage of plastic waste and burnt bricks) for the results.

In present investigation used beam of size **150mm x 150mm x 700mm**

Therefore,

Effective depth (d) = 150-20-(10/2)

= 125mm

Here clear cover = 20mm

Diameter of Steel bar = 10mm

As per IS-**456:2000**(clause 26.5.1.1)

Ast min =0.85 x bd dfy

=0.85 x 150 x 415d 415

= 38.40 mm^2

Astmax = 0.04 x b x D

= 0.04 x 150 x 150

= 900mm^2

Where Ast = Area of steel in tension

For all four types of beams , keeping the cross sectional area and percentage of steel same . So that, can compare the results of all types of beams.

4.1 Normal Reinforced Beam

Taking main reinforcement as 4#8

A_{st}= 4 x 50.26

= 201.06 mm^2

Percentage steel (p_t) = Ast x 100
bd

= 201.06 x 100
150 x 125

= 1.07%

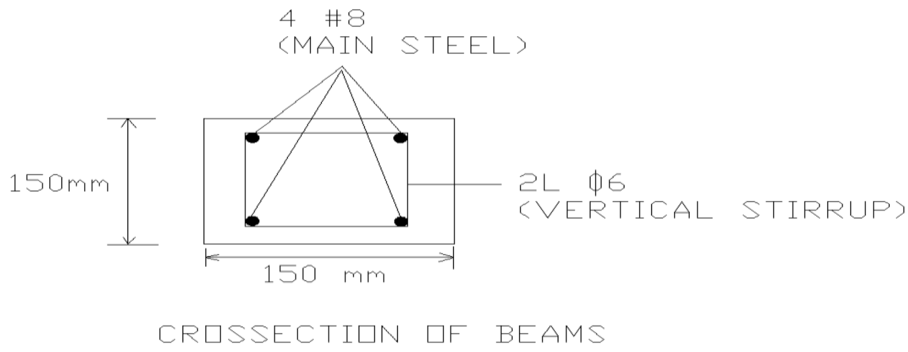


Figure 3.7 Cross section of beams used in present investigation

4.2 Required cubes & beams specimen:-

- Size of cube :- 150mmx150mmx150mm
- Size of beam:- 700mmx150mmx150mm

4.3 PREPARATION OF CONCRETE

- Normal concreting without any use of PET bottles and burnt bricks.
- In second stage, 4% of fine aggregates will be replaced by the PET bottles and the 25% of course aggregate will be replaced by the burnt bricks.
- In third stage, 4% of fine aggregates will be replaced by the PET bottles and the 50% of course aggregate will be replaced by the burnt bricks.
- In fourth stage, 4% of fine aggregates will be replaced by the PET bottles and the 75% OF course aggregate will be replaced by the burnt bricks.

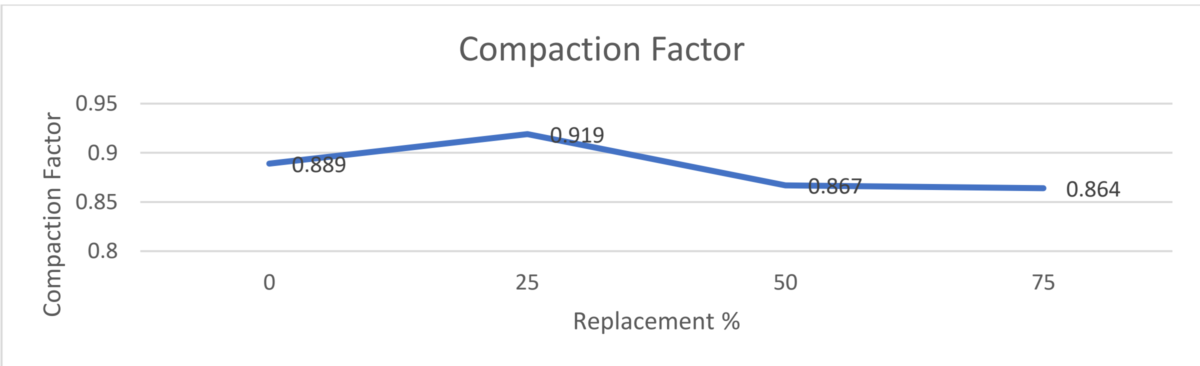
Figure 1 Dry mixing used in present investigation

Figure 2 Compression Testing Machine used in present investigation Testing of Cubes

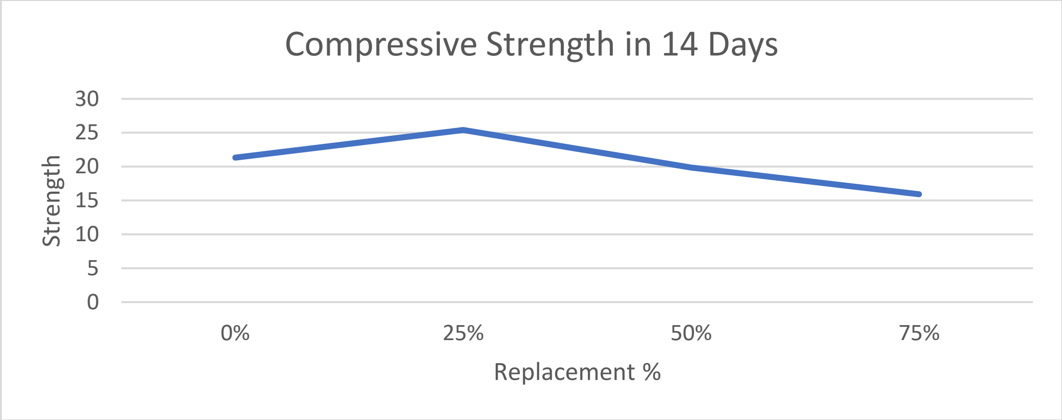
Table 1 Required materials for cubes & beams specimen

Type	Cement (Kg)	Sand (Kg)	Coarse Aggregate (Kg)	Pet Bottles (Kg)	Burnt Brick (Kg)
Normal	360	584	1223.6	-	-
4% PET bottles + 25% Burnt Brick(BB)	360	584	868.7	49	305.9
4% PET bottles + 50% Burnt Brick(BB)	360	584	207.9	49	611.8
4% PET bottles + 75% Burnt Brick(BB)	360	584	257.35	9	917.25

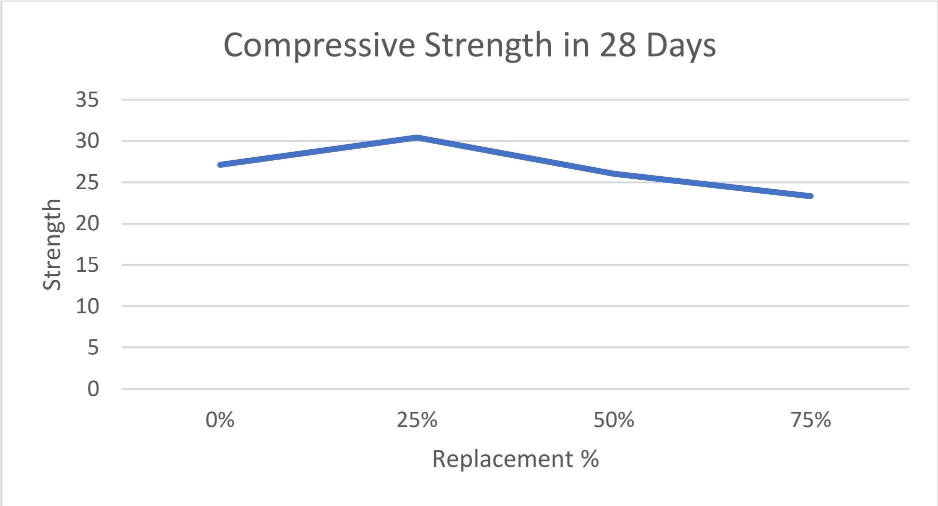
5. DISCUSSION ON RESULTS:



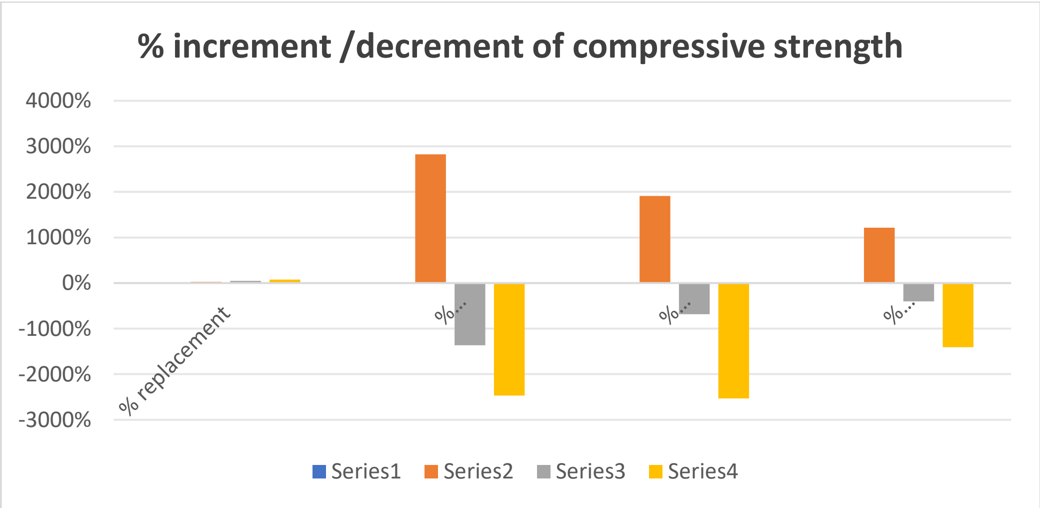
Graph 1 % replacement v/s compaction factor



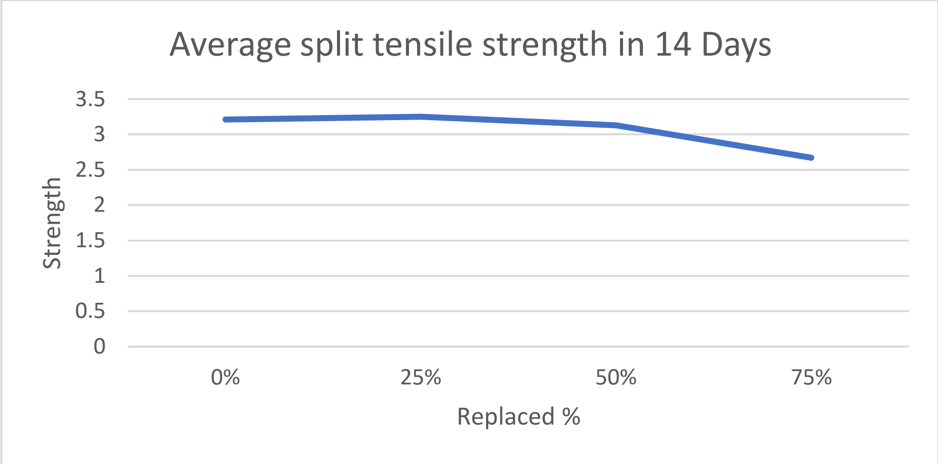
Graph 2 %replacement v/s compressive strength at 14 days



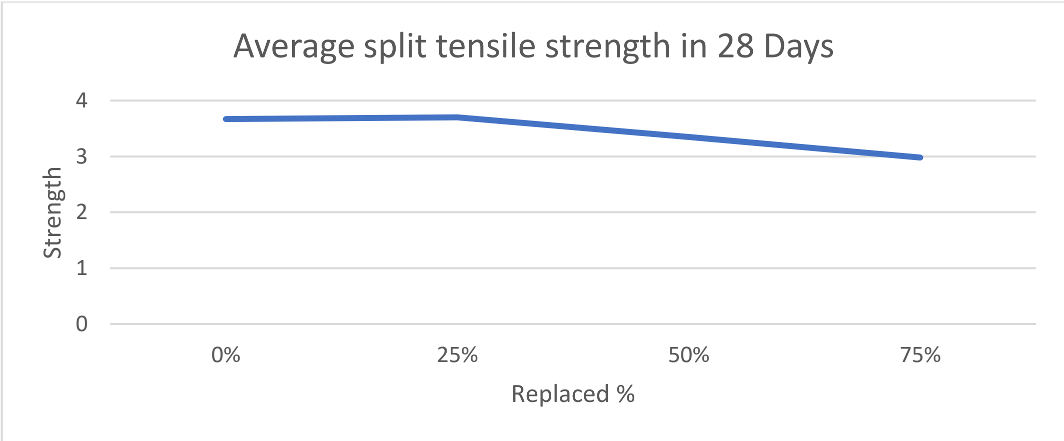
Graph 3 %replacement v/s compressive strength at 28 days



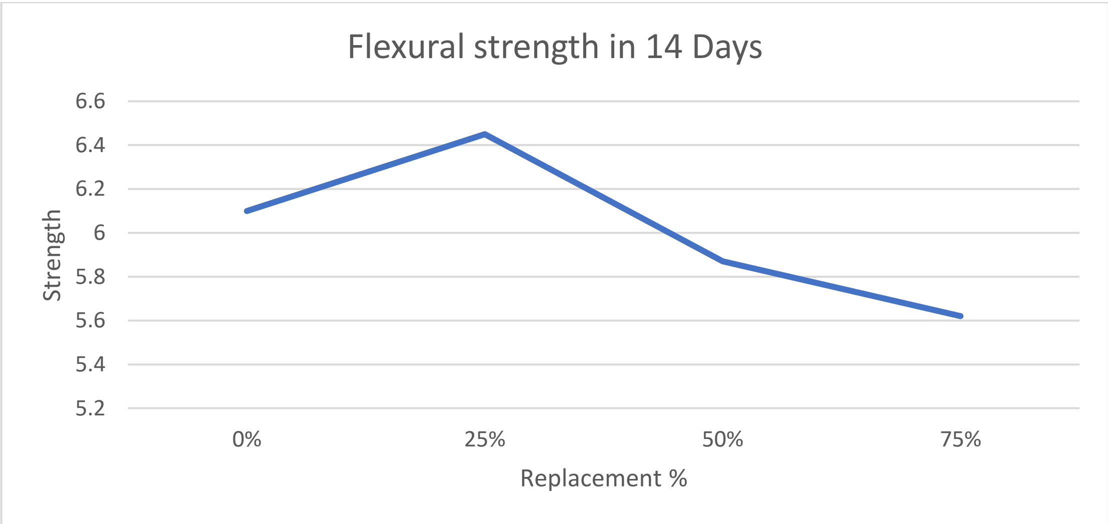
Graph 4 % replacement v/s % increment /decrement of compressive strength at ,14 and 28 days



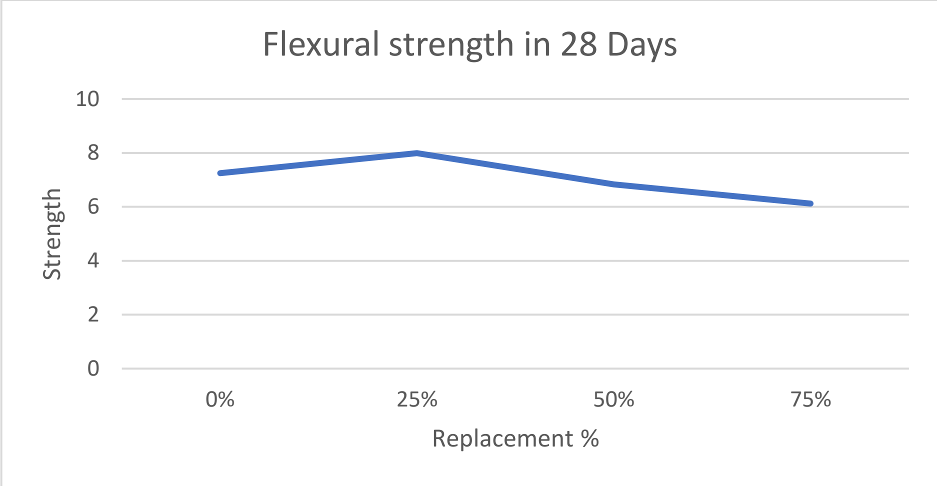
Graph 5 %replacement v/s Average split tensile strength in 14 Days



Graph 6 %replacement v/s Average split tensile strength in 28 Days



Graph 7 %replacement v/s Flexural strength (N/mm^2) in 14 Days



Graph 8 %replacement v/s Flexural strength (N/mm^2) in 28 Days

6. CONCLUSION

Based on results followingconclusionsaredrawnrom the study:

For Cubes

As per the Design of M20 grade, compressive strength of cubes as:

1. The compressive strength without fibre the gain in strength for 14 and 28days are 19.14% and 12.13% for 25% replacement of burnt clay bricks.

2. The split tensile strength without fibre at 28days are 3.67mpa,3.7mpa,3.35mpa and 2.98mpa respectively.

3. The compressive strength of NWAC and LECAC with 0%, 0.5%,0.75% and 1% steel fibers concrete mixes at 28 days are 37.30MPa ,32.50 MPa, 26 & 20.90 MPa respectively.

4. The reduction in strength is due to the replacement of fine and the coarse aggregates. And the most feasible is to use the one with the replacement of 50% of aggregates, not below it.

5. The compressive strength of cylinder for NWAC and LECAC with 0%, 0.5%,0.75% and 1% steel fibers concrete mixes at 28 days are 29.83 MPa, 25 MPa, 19.53 MPa, and 13.64 MPa.

6. The flexural strength of prisms for NWAC and LECAC with 0%, 0.5%, 0.75% and 1% steel fibers at concrete mixes 28 days are 7.25MPa, 7.99MPa, 6.83 MPa, and 6.12MPa.

7. The compressive strength of cylinder, split tensile strength of cylinder, and flexural strength of prisms of LECAC without steel fibers is reduced when compared to NWAC, but increased with steel fibers.

8. The use of steel fibers in Lightweight burnt Clay Aggregate Concrete (LECAC) exhibits improvement in the compressive strength of cubes and cylinders, split tensile strength of cylinders, and flexural strength of prisms compared to NWAC.

For Beams

On The Basis Of Load Carrying Capacity:-

Normal Beams:-When tested for flexure all three specimens failed in bending.

With 25% Replacement:-The beam with 25% replacement shows 16.1% decrease in the average load w.r.t. the normal beam.

With 50% Replacement:-The beam with 50% replacement shows 34.2% decrease in the average load w.r.t. the normal beam.

With 75% Replacement:-The beam with 75% replacement shows 54.4% decrease in the average load w.r.t. the normal beam. Hence, it is not advisable to use beam with 75% replacement .

ON THE BASIS OF ECONOMY:-

On the basis of Rate Analysis , the normal beam is costly as compared to the beam with 25% replacement and the cost goes on decreasing with the increase in the replacement percentages. The replacement with 75% being the least costly.

On The Basis Of Weight:-

On the basis of weight normal is heavier than others. And the beam with 75% is lighter of the all. And the weight goes on decreasing with the increase in the replacement percentage.

7. SCOPE FOR FURTHER STUDY

- Study may further be extended by changing the percentage of burnt brick as well as the grade of cement.
- Further study may be carried out by changing the percentage of crushed PET bottles , replacing the fine aggregates.
- Model studies may be extended for prototype of actual sizes of beams by carrying out dimensional analysis.
- To study the Compressive strength and durability properties like % weight loss, % compressive strength loss in HCL, H2SO4 solutions 28 days .

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