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Experimental Study On Glass Fibre Reinforced Light Weight Concrete By Partial Replacement Of Coarse Aggregate Using Coke Breeze

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Abstract— Lightweight concrete has many applications in concrete and construction industry now a days. Concrete elements are the heaviest weight in structure, and it is the main component of a dead load in structure. Light weight concrete is used to minimize overall dead load in structures.

Index Terms— Lightweight concrete, Replacement of coarse aggregate, Coke breeze, M20 grade concrete, Compressive strength.

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1. INTRODUCTION

L ightweight concrete may be defined as a concrete of substantially lower density than made from gravel or crushed stone and it is usually obtained by using light weight aggregate, or by injecting air or gas into the mortar. The following materials can be utilized to create lightweight concrete.

2. TYPES OF LIGHT WEIGHT CONCRETE

2.1 NO-FINES CONCRETE:

No fines concrete is a very lightweight type of concrete that does not contain fine aggregate (or sand) in the concrete mixture. This type of concrete is formed using ordinary Portland cement, water, and coarse aggregate.

2.2 LIGHTWEIGHT AGGREGATE CONCRETE:

The lightweight aggregate is a kind of coarse aggregate which is used in the production of light-weight concrete products like concrete block, structural concrete, and pavement.

2.3 AERATED/ FOAMED CONCRETE:

Foam concrete is an incredibly useful material used to produce large volumes of relatively low strength void filling material; it can easily be pumped long distances and will fill most cavities.

3. LIGHT WEIGHT AGGREGATES:

Replacement of usual mineral aggregates by cellular porous or light weight aggregates reduces the density of concrete. Light weight aggregate are of two types- natural light weight aggregates and artificial light weight aggregate.

3.1 NATURAL LIGHT WEIGHT AGGREGATE:

Pumica, Diatomite, Scoria, Volcanic Clinders, Sawdust, Rice Husk ash aer called Natural Light-weight Aggregates.

3.2 ARTIFICIAL LIGHT WEIGHT AGGREGATE:

Artificial clinders, Cock breeze, Foamed Slag, Bloated clay, Expandable shales and slate, sintered

flyash, Exfoliated perlite, thermocole beads are called as Artificial Light weight aggregate.

4. APPLICATION OF LIGHT WEIGHT AGGREGATE:

- a) Decks of long span bridges.
- b) Floors in steel frame buildings (lightweight concrete on fire-rated steel deck assemblies)
- c) Construction of partition walls and panel walls in frame structures.
- d) General insulation of walls.
- e) Surface rendered for external walls of small houses.
- f) It is also being used for reinforced concrete.

5. ADVANTAGE OF LIGHT WEIGHT AGGREGATE:

- a) It minimizes the dead load of the building.
- b) It is simple to handle, which decreases the cost of transportation and handling.
- c) Enhances workability.
- d) Thermal conductivity is decreased with lightweight concrete.
- e) Stronger and more durable in comparison.
- f) The use of lightweight concrete provides an outlet for industrial wastes such as fly ash, clinkers, slag, and so on, which cause problems in landfills.

6. DISADVANTAGE OF LIGHT WEIGHT AGGREGATE:

- a) Lightweight concrete is often particularly sensitive to the amount of water in the mix.
- b) Because of the porosity and angularity of the aggregate, placement and finishing are difficult, necessitating the use of experienced labor.
- c) Lightweight concrete is porous and has a low resistance.
- d) To ensure the correct mixing of concrete, the mixing period is longer than that of standard concrete.

7. NEED FOR THIS STUDY:

With the increasing awareness about the environment, scarcity of landfill space and due to its ever increasing cost, waste materials and by-products utilization has become attractive alternative to disposal. High consumption of natural sources, large production of industrial waste and environmental pollution require obtaining new solutions for a sustainable development. Utilization of waste materials and by-products is a partial solution to environmental and ecological problems. Use of these materials not only helps getting them utilized in cement, concrete and other construction materials, it helps in reducing the cost of concrete manufacturing but also has numerous indirect benefits such as reduction in land-fill cost, saving in energy and protecting the environment from possible pollution effects.

The advancement of concrete technology can reduce the consumption of natural resources. They have forced to focus on recovery, reuse of natural resources and find other alternatives. The use of the replacement materials offers cost reduction, energy savings, arguably superior products, and fewer hazards in the environment.

In this study, we have used coke breeze as a light weight aggregate for the partial replacement of coarse aggregate in concrete and additionally 0.5 % of glass fibre was used for the reinforcement in concrete for providing high tensile strength, high chemical resistance and insulating properties.

5. BRIEF OVERVIEW OF LITERATURE

“Experimental Study on Light Weight Concrete by Partial Replacement of Cement by Flyash, Coarse Aggregate Pumice Stone and Thermocol Beads ” Mohsin Mushtaq Khan and Anuj Sachar (2022), had investigated that in today’s world when focus is on reducing self-weight of concrete, light weight concrete has come with the high number of applications to reduce selfweight of concrete. In this study an attempt has been made to compare conventional concrete with the lightweight concrete which is made by partially replacing cement with fly ash and coarse aggregate with pumice stone and adding Thermocol beads using M25 grade of concrete. Lightweight concrete has been made by partial replacement of Coarse aggregate by pumice stone varying in the ratio of 10% 15% and 20% and Thermocol beads by 0.2%, 0.4% and 0.6%. Also cement is replaced by fly ash in the varying ratios of 20% 30% and 40% by weight of cement. In addition to that fine aggregate is replaced by Thermocol beads in the varying ratios of 0.2%, 0.4% and 0.6%.

“Mechanical Properties of Lightweight Concrete Using Recycled Cement-Sand Brick as Coarse Aggregates Replacement Ilya Joo-hari et al, (2018), had investigated that this paper presents the result of replacing natural coarse aggregate with recycled cement-sand brick (CSB) towards the mechanical properties of concrete. Natural aggregates were used in this study as a control sample to compare with recycled coarse aggregates. This study was also carried to determine the optimum proportion of coarse aggregates replacement to produce lightweight concrete. Besides, this study was conducted to observe the crack and its behaviour development during the mechanical testing. Through this study, four types of concrete mixed were prepared, which were the

control sample, 25%, 50% and 75% replacement of CSB. The test conducted to determine the effectiveness of recycled CSB as coarse aggregates replacement in this study were slump test, density measurement, compression test, and flexural test and. The strength of concrete was tested at 7 days and 28 days of curing. From the results obtained, the optimum proportion which produced the highest strength is 25% replacement of recycled CSB. The compressive and flexural strength has decreased by 10%-12% and 4%-34% respectively compared to the control sample. The presence of recycled coarse aggregates in sample has decreased the density of concrete by 0.8%-3% compared to the control sample.

“Experimental Study of Light Weight Concrete by Partial Replacement of Coarse Aggregate Using Pumice Aggregate Rajeswari S and Dr. Sunilaa (2016), had investigated that george Light weight concrete has many applications in concrete and construction industry now a days. In this Study an attempt has been made to compare the conventional concrete and light weight aggregate concrete using mix M25. Light weight concrete is made by Partial replacement of Coarse Aggregate with different ratios of Pumice ranging from 50%, 60% and 70%. This study is focused to determine the strength parameters of light weight aggregate concrete to find the favorable replacement with the above mentioned replacements. The results are compared with conventional concrete.

“Light Weight Concrete Using Cinder – A Review Annapurna P Bennur and Chethan Kumar S (2022), had investigated that the rising demand in the building industry has resulted in an increase in the cost of concrete production. The rising cost of construction materials prompted researchers to develop new low-cost, high-strength construction materials. Aggregates play a significant role in concrete volume, accounting for 60 to 70 percent of overall volume. As a result, they have a significant impact on several material qualities such as density, specific gravity, and water absorption, among others. The coarser normal weight aggregate in traditional concrete can be partially or completely replaced with low density particles, resulting in light weight concrete with strong compressive resistance.

“Mechanical Properties and Flexural Response of Palm Shell Aggregate Lightweight Reinforced Concrete Beam Md. Habibur Rahman Sobuz et al, (2023), had investigated that this work focuses on examining the mechanical characteristics and flexural response of rein-

forced concrete (RC) beams by incorporating oil palm shell (OPS) lightweight aggregate from oil palm shell waste. The OPS aggregates are replaced in various percentages, such as 0 to 50% of natural coarse aggregate (NCA). Mechanical properties of OPS concrete were conducted, and these properties were used to quantify the flexural performance of RC beams. Five RC beams with several gradations of OPS aggregates were cast and tested for this investigation. The first cracking, ultimate strength, load-deflection behavior, ductility index, and failure patterns of OPS aggregate beams were investigated as the corresponding behaviors to the NCA concrete beam. The fresh properties analysis demonstrated lessening the slump test by varied concentrations of OPS concrete. Furthermore, compressive strength was reduced by 44.73%, 50.83%, 53.33%, and 57.22% compared to 10%, 15%, 20%, and 50% OPC substitution at 28 days. Increasing OPS content in concrete mixes decreased splitting tensile strength, comparable to the compressive strength test. Modulus of rupture and modulus of elasticity experiments exhibited a similar trend toward reduction over the whole range of OPS concentrations (0–50%) in concrete. It was revealed that the flexural capacity of beams tends to decrease the strength with the increased proportion of OPS aggregate. Moreover, crack patterns and failure modes of beams are also emphasized in this paper for the variation of OPS replacement in the NCA. The OPS aggregate RC beam's test results have great potential to be implemented in low-cost civil infrastructures.

“Oil palm shell as a lightweight aggregate for production high strength lightweight concrete Payam Shafigh et al, (2011), had investigated that in Malaysia, oil palm shell (OPS) is an agricultural solid waste originating from the palm oil industry. In this investigation old OPS was used for production of high strength lightweight concrete (HSLC). The density, air content, workability, cube compressive strength and water absorption were measured. The effect of five types of curing conditions on 28-day compressive strength was studied. The test results showed that by incorporating limestone powder and without it, it is possible to produce the OPS concretes with 28-day compressive strength of about 43–48 MPa and dry density of about 1870–1990 kg/m³. The compressive strength of OPS HSLC is sensitive to the lack of curing. The water absorption of these concretes is in the range of good concretes.

“Materials, properties and application review of Lightweight concrete Jihad Hamad Mohammed and Ali Jihad Hamad (2014), had investigated that the lightweight concrete has many advantages as compared to conventional concrete. It has significant applications on the structure, the featuring lightly gives several functions in of thermal and acoustic insulation and reduce the weight of the structure, which leads to reduced structural elements and steel reinforcement, thus lower the cost of the construction. This paper presents a review of the classification of lightweight concrete, where the lightweight concrete classified into two types according to production methods and utilization purpose. Also, it focuses on the materials used to obtain lightweight concrete. The production methods and properties for each type of lightweight concrete was reviewed. This paper also discusses the applications of lightweight concrete.

“Production of A Green Lightweight Aggregate Concrete by Incorporating High Volume Locally Available Waste Materials Javad Nodeh Farahani et al, (2017), had investigated that lightweight concrete offers numerous benefits compared to normal weight concrete such as reduction in dead load and construction costs. One of the most common methods of producing structural lightweight concrete is the use of lightweight aggregates. The application of waste substances as cement substitutes or aggregates in concrete can support a solution in order to decrease negative influences of the concrete industry. One of the agricultural solid wastes derived from the industry of palm oil is oil palm shell (OPS) which processes about 50% lower weight compared to normal weight aggregates. The paper reports an investigation on the oil palm shell as coarse aggregate as well as fly ash and rice husk as supplementary cementitious material to generate more environmentally friendly lightweight concrete. Based on the research findings, the environmentally friendly structural lightweight aggregate concrete has the potential to be made through combining three kinds of waste substances: oil palm shell as coarse aggregate and blended RHA-FA as a substitution for cement (by mass) up to 70%. The act of replacing the cement by blended RHA-FA in OPS concrete leads to density reduction.

“Properties of Structural Lightweight Aggregate Concrete Based on Sintered Fly Ash and Modified with Exfoliated Vermiculite Patrycja Przychodzien and Jacek Katzer (2021), had investigated that despite the undoubt-

ed advantages of using lightweight concrete, its actual use for structural elements is still relatively small in comparison to ordinary concrete. One of the reasons is the wide range of densities and properties of lightweight aggregates available on the market. As a part of the research, properties of concrete based on sintered fly ash were determined. The ash, due to its relatively high density is suitable to be used as a filler for structural concretes. Concrete was based on a mixture of sintered fly ash and exfoliated vermiculite aggregate also tested. The purpose of the research was to determine the possibility of using sintered fly ash as alternative aggregate in structural concrete and the impact of sintered fly ash lightweight aggregate on its physical, mechanical and durability properties. Conducted tests were executed according to European and Polish standards. Created concretes were characterized by compressive strength and tensile strength ranging from 20.3 MPa to 54.2 MPa and from 2.4 MPa to 3.8 MPa, respectively. The lightest of created concretes reached the apparent density of 1378 kg/m³.

“Experimental study on light weight fiber concrete using pumice stone as partial replacement of coarse aggregate Ashuvendra Singh (2019), had investigated that light weight concrete has many applications in construction industry nowadays. It has many advantages such as dead load reduction, high thermal reduction and it also increases the life of building and reduces the handling cost. This can relate to both serviceability and structural integrity. The new source of structural aggregate which is produced from environmental wastes is natural aggregate. The use of structural light weight concrete reduces the weight of structure and helps to construct heavy precast elements. In this experimental work an attempt has been made to study and compare the structural properties of light weight concrete of M40 grade using the light weight aggregate Pumice stone as a partial replacement to natural coarse aggregate and mineral admixture materials like GGBFS and with some percent of Recron 3s. This study has been done by varying 10% - 50% pumice stone on partial replacement. Compressive strength, flexural strength and split tensile strength were evaluated for this study and comparison was made with that of conventional concrete. All these concrete specimens were cured for 7 days and 28 days in water tank on normal 27 ± 2 °C atmospheric temperatures.

“Study on light weight concrete using steel cinders S.G. Uma et al (2021), had investigated that the light weight concrete has been used most widely in the world for many years and has a very special advantages when compared with the conventional concrete. In this study coarse aggregates are partially replaced with steel cinders, obtained from steel industries. These steel cinders have lower specific gravity and hence the cinder concrete is lighter when compared with the normal concrete and thus reduce the cost of constructions and also the dead load of the structure, which helps in designing heavy structures. The objective of the research work is to find the maximum percentage of replacement of steel cinders in concrete and to compare the mechanical properties of the optimum values with the conventional concrete of M20 grade. The coarse aggregate is partially replaced with steel cinders in various percentages say 20%, 40%, 60%, 80% and to full replacement of 100%. The compressive test was conducted for cubes of 150 mm size at various percentage of replacement and was compared with the conventional concrete. It is observed that cinder aggregate concrete with 60% replacement of cinder reached the equal target mean strength as conventional concrete.

“Experimental Study On Light Weight Concrete Using Leca R.N. Raj Prakash and A.Krishnamoorthi (2017), had investigated that this report presents experimental study on effect of partial replacement of coarse aggregate (Jelly) by Light weight coarse aggregate (LECA). LECA is also more or less similar to properties of Jelly. LECA is used in concrete to minimize the demand of coarse aggregate (Jelly) and also in design of concrete structures, self weight occupies very large portion of total load coming on the structures critically in cases such as weak soils and tall structures. also impressive benefits in lessening density of concrete, thus contributing towards economy of work. The light weight concrete gives low density than conventional concrete and has better thermal insulation comparatively. Main intention of carrying out this project is to compare the weight of concrete and strength properties viz. cube compressive strength, split tensile strength cylinders and flexural strength of light weight concrete against conventional concrete by partially replacing natural aggregates by LECA by 20%, 40%, 60%, 80% and 100%. Lightweight aggregate has been effectively utilized for well more than two millennia and use of lightweight total adds to the maintainable advancement by moder-

ating energy, bringing down transportation prerequisites, boosting outline and construction proficiency and expanding the service life of the item it is utilized as a part of with expanding concern over the intemperate abuse of common aggregates, lightweight aggregate delivered artificially is a feasible new resource of structural aggregate objects.

“Experimental Study on Light Weight Concrete by Using Light Expanded Clay Aggregate (LECA) Arivalagan S and Dinesh Kumar K S A (2022), had investigated that analysis of this concrete was done in fresh state as well in hardened state to evaluate mechanical properties of concrete. This paper concentrated on performance parameters such as compressive strength, splitting tensile strength of the light weight concrete using LECA. The Lightweight concrete density varies from 40% - 100% replacement of LECA such as 1996kg/m³- 1597kg/m³. It reduces the weight of concrete and cost of concrete by reducing the aggregate cost and produces economical system.

“Structural Concrete Using Oil Palm Shell As Lightweight Aggregate Manasmita paikaray and Ankit Jena (2018), had investigated that this paper represents the experimental results to produce structural Lightweight concrete (LWC) using oil palm shell (OPS). It has been widely used in buildings as masonry blocks, wall panels, roof decks and precast concrete units. For low-cost housing construction and also for use in earthquake prone areas. Structures were constructed on the campus, which is located near the coastal area. When OPS blended with cement, it makes the most eco-friendly versatile supplementary cementing material to concrete. Reported in the paper are compressive strength, workability and density of oil palm shell concrete.

“A Study on the Mechanical Properties of Light Weight Concrete by Replacing Course Aggregate with (Pumice) and Cement with (Fly Ash) B. Venkatesh and B. Vamsi Krishna (2015), had investigated that light weight concrete has become more popular in recent years owing to the tremendous advantages it offers over the conventional concrete. Even Light concrete but at the same time strong enough to be used for the structural purpose. Lightweight concrete has been successfully used since the ancient Roman times and it has gained its popularity due to its lower density and superior thermal insulation properties. Compared with Normal weight concrete, Lightweight concrete can significantly reduce the dead load of structural elements, which makes it especially at-

tractive in multi-storey buildings. The most important characteristic of light weight concrete beside its light weight is its low thermal conductivity. This property improves with decreasing density. The adaptation of certain class of light weight concretes gives an outlet for industrial wastes and dismantled wastes which would otherwise create problems for disposal. The conventional mix has been designed for M25 grade concrete. Coarse aggregate replaced with Pumice aggregate in volume percentages of 25% and 33.33% further Cement replaced with the Fly ash in weight percentages of 15%, 20%, 25%, 30% for study in the present investigation. The properties like Compressive strength, Split tensile strength, Flexural strength and Youngs' modulus of above combinations were studied and compared with conventional design mix concrete. It is observed that there is retardation in Compressive strength, Split tensile strength, Flexural strength and Young's modulus for the light weight aggregate replaced concrete when compared to the concrete made with normal aggregate. For these light weight aggregate concrete mixes when 'cement' was replaced by 'fly ash' it is noticed that there is a marginal improvement in the properties studied. For 25% replaced light weight aggregate when cement was replaced by 15%, 20%, 25% and 30% fly ash, the maximum gain in compressive strength of 18.71% at 28 days is observed for 20% replacement of fly ash. Similarly the gain in split tensile strength, flexural strength and Youngs' modulus of 16.66%, 29.51% and 10.15% is observed at 20% replacement of fly ash respectively. For 33.33% replaced light weight aggregate when cement was replaced by 15%, 20%, 25% and 30% fly ash, the maximum gain in compressive strength of 26.3 % is observed for 20% replacement of fly ash. Similarly the gain in split tensile strength, flexural tensile strength and Youngs' modulus of 19.23%, 26% and 3.33% is observed at 20% replacement of fly ash respectively. Hence we can infer that 20% replacement of cement by fly ash is optimum proportion among the proportions tested for the properties studied in the present investigation.

8. SCOPE AND OBJECTIVE OF THE STUDY

The main objectives of this project are,

- To decrease the density of the concrete to make it lightweight.
- To look for the alternative source for coarse aggregate and its mechanical characteristics.
- To research the impact of fibers in con-

crete and their failure.

- To study the compressive strength of the concrete and control concrete on standard IS specimen size (150 x 150 x 150) mm.
- To study the split tensile strength of the concrete and control concrete on standard IS specimen size (150 x 300) mm.
- To Identify potential applications for lightweight concrete, such as in building construction, infrastructure projects, and insulation.
- To provide economical construction material & to provide safeguard to the environment by utilizing.
- Evaluate the economic feasibility of using lightweight concrete compared to conventional concrete in different construction scenarios.

9. SELECTION OF MATERIALS:

a) CEMENT:

The most common cement is used is ordinary Portland cement. Out of the total production, Ordinary Portland Cement accounts for about 80-90 percent. Many tests were conducted to cement some of them are consistency tests, specific gravity, sieve analysis, etc. by standard procedures. The specific gravity of cement is 3.15.

b) FINE AGGREGATE (FA)

Locally available free of debris and nearly riverbed sand is used as fine aggregate. The sand particles should also pack to give minimum void ratio, higher voids content leads to requirement of more mixing water. The specific gravity of sand is 2.68. Those fractions from 4.75 mm to 150 micron are termed as fine aggregate, and the bulk density of fine aggregate (loose state) is 1393.16kg/m³ and rodded state is 1606.84kg/m³.

c) COARSE AGGREGATE (CA)

The crushed aggregates used were 20mm nominal maximum size and are tested as per Indian standards 6 and results are within the permissible limit. The specific gravity of coarse aggregate is 2.83; the bulk density of coarse aggregate (loose state) is 1692.31kg/m³ and rodded state is 1940.17kg/m³.

d) COKE BREEZE

Coke breeze" typically refers to fine particles of coke, which is a solid carbonaceous material derived from coal. Coke breeze is often used as a fuel in various industrial processes, particularly in

the production of iron and steel. It's also used as a fuel in power plants and for heating purposes. The term "breeze" refers to the small particles or granules of coke that result from the screening or crushing of larger coke pieces. These fine particles can be used in various applications where a smaller size of coke is desirable.

e) GLASS FIBER

Glass fiber, also known as fiberglass, is a material made from extremely fine fibers of glass. These fiber can be spun into yarn or woven into fabric sheets. Glass fiber is valued for its strength, durability, and resistance to heat, moisture, and chemicals.

f) WATER

Water available in the college campus confirming to the requirements of water for concreting and curing as per IS: 456-2000.

10. EXPERIMENTAL WORK

a) CUBE

The mix design of concrete was done according to Indian Standard guidelines 6-9 for M 20 grade for the granite stone aggregates and the water cement ratio are 0.5. Using a mix design ratio of 1:1.5:3 and water binder ratio of 0.5, a total of 24 Concrete cubes of size 150mm x150mm x 150mm were cast using varying ratio of 100:0, 90:10, 80:20, and 70:30 respectively, i.e., 3 cubes per percentage replacement as shown in Fig.3.3 and the proportions were shown in table.3.1. The cubes were cured and crushed after 7 and 28 days respectively and then the compressive strength was determined.

b) MIXTURE PROPORTIONS OF CONCRETE

The ingredients of concrete were thoroughly mixed in mixer machine till uniform thoroughly consistency was achieved. Before casting, machine oil was smeared on the inner surfaces of the cast iron mould. Concrete was poured into the mould and compacted thoroughly using table vibrator. The top surface was finished by means of a trowel. The specimens were removed from the mould after 24h and then cured under water for a period of 7 and 28 days. The specimens were taken out from the curing tank just prior to the test. The test for compressive strength was conducted using a 2000KN compression testing machine.

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c) CYLINDER

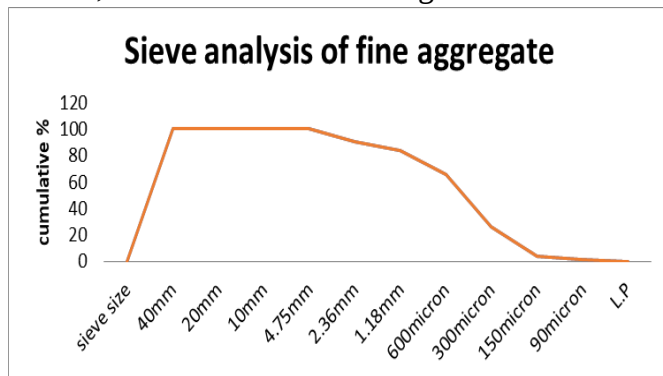
Using a mix design ratio of 1:1.5:3 and water binder ratio of 0.5, a total of 24 Concrete cylinders of size 150mm x300mm and the cylinders were cast and cured as shown in fig.3.6 and fig.3.7. Then it was tested using Compressive Testing Machine (2000kN) after 7 and 28 days respectively and then the Split tensile strength of the specimen was determined.

% of replacement	Cement (g/m ³)	Glass fiber (g/m ³)	FA (g/m ³)	CA (g/m ³)	CB (g/m ³)	w/c ratio
0% (control)	1413		119.5	239		0.5
0%	1413	0.5	2119.5	5.1	23.9	0.5
0%	1413	0.5	2119.5	391.2	47.8	0.50
0%	1413	0.5	2119.5	967.3	271.7	0.55

11. RESULTS AND DISCUSSION

The mixture of coke breeze was used as a partial replacement of coarse aggregate in concrete and their results were discussed below. The results

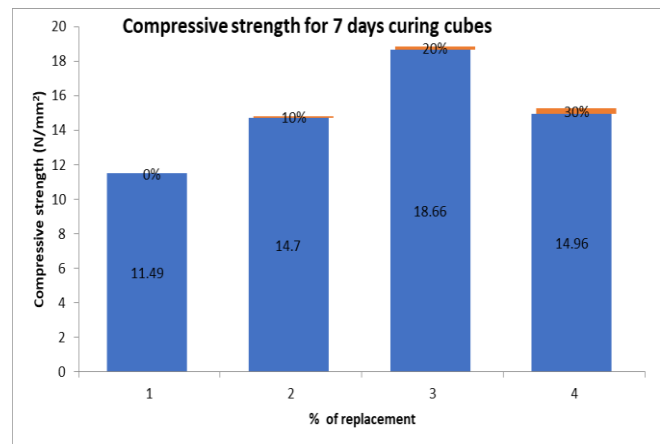
obtained from the sieve analysis test for FA, CA, Cement, coke breeze as shown figure:



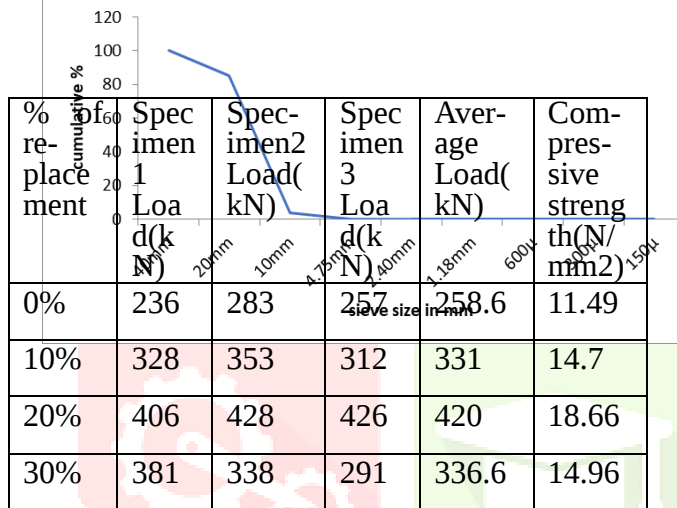
12. COMPRESSIVE STRENGTH

Concrete cubes of age at 7 days and 28 days were tested. The compressive strength values were tabulated in fig. The compressive strength was increased at 20% (20% CB, 0.5% glass Fibre & 80% coarse aggregate) concrete mix than the control concrete mix (100% mix). As the proportion of mix was increased, the compressive strength values were decreased at both 7 days and 28 days curing cubes. The 20% concrete mix showed better result at both 7 days and 28 days curing cubes as shown in Fig

Compressive strength at 7 days curing

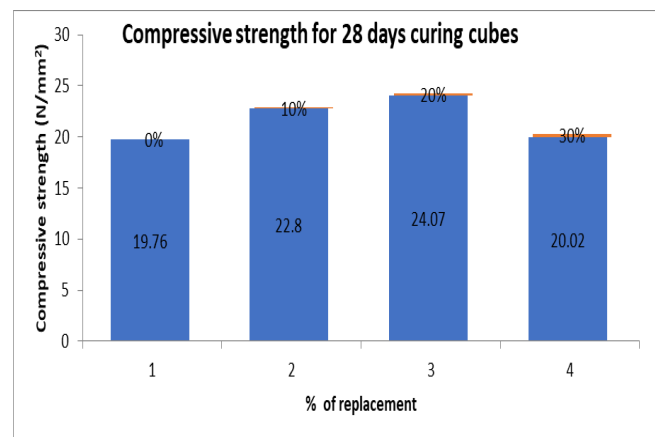
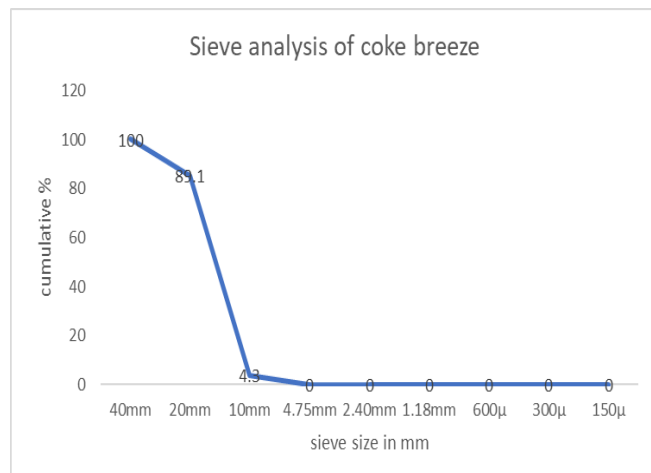


Sieve analysis of coarse aggregate



Compressive strength at 28 days curing

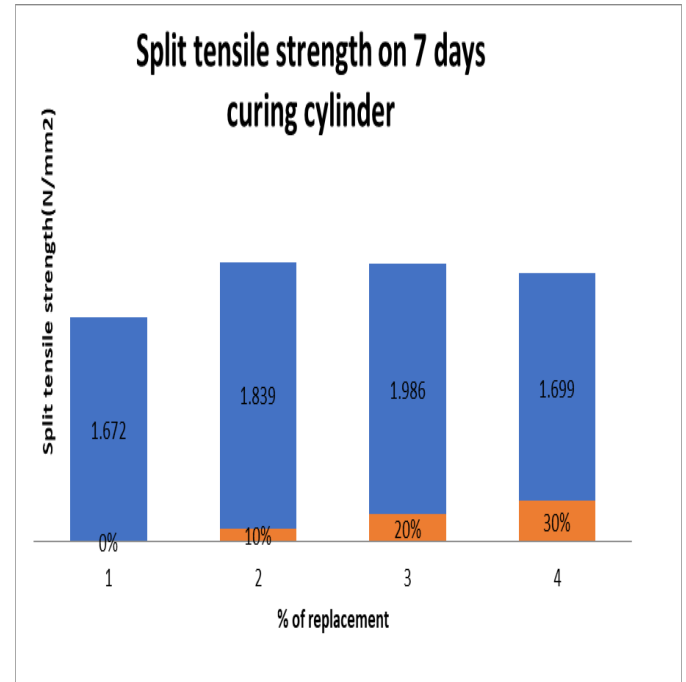
% of replacement	Specimen 1 Load (kN)	Specimen 2 Load (kN)	Specimen 3 Load (kN)	Average Load (kN)	Compressive strength (N/mm²)
0%	408	454	472	444.6	19.76
10%	512	527	506	515.0	22.8
20%	564	532	529	541.6	24.07
30%	422	429	501	450.6	20.02



% of replacement	Specimen 1 Load (kN)	Specimen 2 Load (kN)	Specimen 3 Load (kN)	Average Load (kN)	Split tensile strength (N/mm ²)
0%	113.7 7	118.9	121.7 3	118. 13	1.67 2
10%	129.1 9	131.22	129.5 5	129. 98	1.83 9
20%	140.2 7	140.68	140.1 7	140. 37	1.98 6
30%	119.1 8	124.42	116.5 2	120. 04	1.69 9

days curing cylinders. This showed that the time period increases the split tensile strength was also increased.

SPLIT TENSILE STRENGTH FOR 7 DAYS CURING CYLINDERS



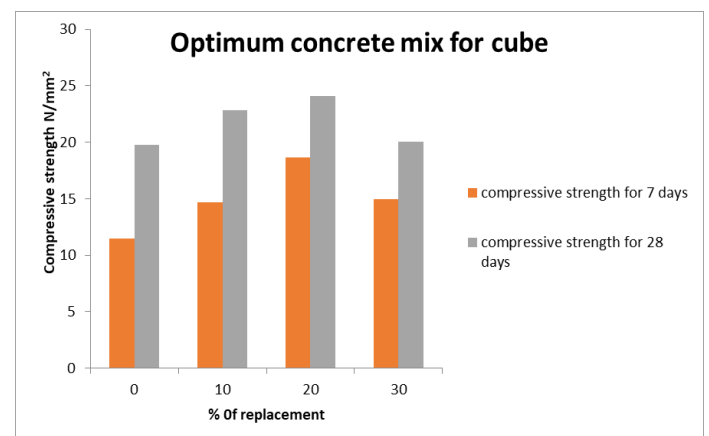
13. OPTIMUM CONCRETE MIX FOR CUBES:

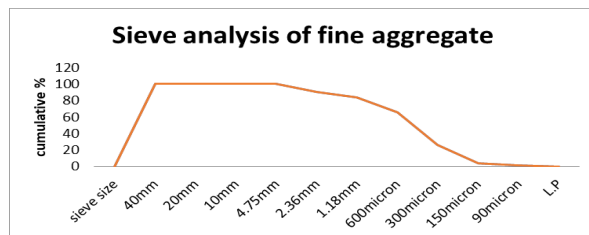
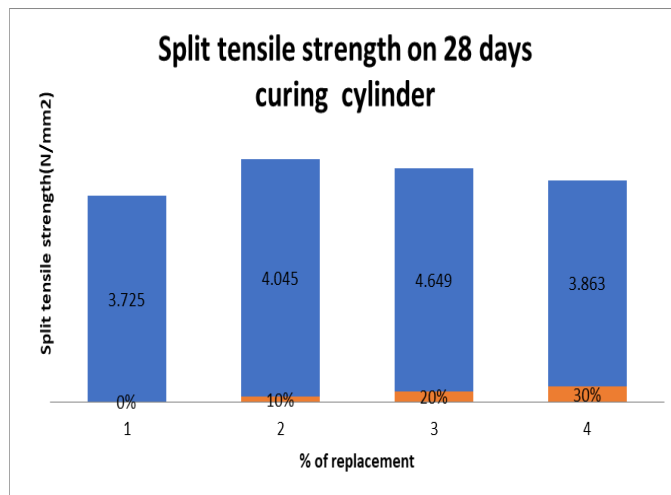
Among the various proportions, the optimum level of concrete mix was determined. The Fig shows that 20% concrete mix showed high compressive strength than the other concrete mix proportions. The 30% concrete mix was also showed better results than the control concrete mix.

14. SPLIT TENSILE STRENGTH

Concrete cylinders of age at 7 days and 28 days were tested. The split tensile strength values were tabulated. The split tensile strength was increased at 10% ,20% concrete mix than the control concrete mix (100% mix). As the proportion of mix was increased, the split tensile strength values were decreased at both 7 days and 28 days curing cubes. Among these two, the 20% concrete mix showed better result at both 7 days and 28 days curing cylinders as shown in Fig. The split tensile strength was increased relatively at 28

SPLIT TENSILE STRENGTH FOR 28 DAYS CURING CYLINDERS





15. CONCLUSION:

From this study, it is concluded that the use of coke breeze can reduce the use of coarse aggregate. The compressive strength, split tensile strength of concrete seems to increase with the increase in coke breeze in the concrete mix. At 10% and 20% mix of coke breeze proportion of concrete is higher than that of control. Above 30% mix of coke breeze proportion of concrete the strength substantially decreases.

Only up to 20% coke breeze substitution was adequate for use in structural concrete, etc. The cost analysis indicated that percent coarse aggregate reduction decreases cost of concrete, but at the same time strength also decreases.

This project produces new valuable information that the industrial waste materials were used as an alternative for civil construction works and also reduced the cost of construction and also saved the cost of waste disposal.

This research concludes that coke breeze can be innovative supplementary coarse aggregate construction Material but judicious decisions are to be taken by engineers.

% of replacement	Specimen 1 Load (kN)	Specimen 2 Load (kN)	Specimen 3 Load (kN)	Average Load (kN)	Split tensile strength (N/mm²)
0%	235.1	268.4	286.0	263.2	3.725
10%	289.6	273.5	294.2	285.7	4.045
20%	368.2	331.0	286.2	328.4	4.649
30%	280.3	272.6	265.8	272.9	3.863

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