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Reduce, Reuse and Recycle of Coarse Aggregate

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***Abstract*— At present due to rapid urbanization and infrastructural development need for new construction and waste management become major problem. Concrete is a leading material resource for the construction because of its strength ability to be moulded in any shape its resistance to fire and weather. Now-a-days the Amount of material waste such as Tyre-Rubber, Fly Ash, Demolished concrete, Coconut shell, etc. has been dramatically increased in the last decades. In this Research work various material like Rubber from dumping places, fly-Ash from power plant, Jute from grain godown, demolished concrete from construction site, Coconut Shells from different Temples are tested for M20 concrete with replacement 5% , 7% and 10% with coarse aggregate 9 cubes of each material are casted except the Jute material. Jute is replaced by 1%, 2%, and 3%. By using 3R Reduce, Reuse and Recycle serves dual purpose - it doesn't just make the waste reusable, but also prevent pollution to some extent.**

Keywords*— Brick Bats, Coarse aggregate, Coconut Shells, Demolished concrete, Fly Ash, Jute, Tyre Rubber, 3R Reduce, Reuse and Recycle

I. INTRODUCTION

The concept of Reduce, Reuse and Recycle are three tools for sustainable development. Sustainable development is "development that meets need of present without compromising the ability of Future generation to meet their own needs."

Around half of all non renewable resources are consumed by the construction industry and 50% of water consumption, 50-55% of energy, 60% of ozone depletion, more than 60% of waste is being generated from this industry. For reducing bad impact of construction and construction industry there is need of reducing demand and reusing and recycling of available resources.

It is essential to find new sources but we cannot generate new sources, optimization of the resources can be one of the remedial measures. There are many materials like demolished concrete, used rubber, Brick bats, coconut shells, fly ash which are considered as a waste but we can utilize it as a resource up to some extent.

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II. MATERIALS

Materials which are replaced with coarse aggregate are demolished concrete, rubber, coconut shells, and Fly ash, brick bats. These materials are replaced by 5%, 7% and 10% by the weight of coarse aggregate. Jute is replaced by1%, 2% and 3%.

Fig. 1**.** Coconut Shells, Fly Ash and Rubber

Fig. 2. Brick bat and Demolished Concrete

III. EXPERIMENTAL WORK

The testing was done on concrete cube of150mmX150mmX150mm concrete cube under CTM (Compression testing machine).

A. Methodology for carrying experimental work

STEP 1: MATERIAL COLLECTION

STEP 2: BATCHING

STEP 3: MIXING

STEP 4: PLACING

STEP 5: COMPACTING

STEP 6: CURING

STEP 7: TESTING

B. Materials used for casting cubes

Cement: OPC 53grade free lumps
Sand: natural river sand free from dust
Coarse aggregate- Having maximum size 20mm.
Proportion of Materials: 1:1.5:3
Water: water used for mixing and curing was potable water free from injurious quantities alkalis, acidic oils, salts, sugar, organic matter etc.

C. Experiment regarding Figure,sObservation tables and charts for various Replaced Materials showing strength variation.

Fig. 3. Shows the of concrete Cubes before Testing

Fig. 4. Shows of concrete Cubes the After Testing

TABLE I. COMPRESSIVE STRENGTH TEST RESULT IN N/MM^2
REPLACED MATERIAL: RUBBER

% Replacement with Coarse Aggregate	7 days	15days	28days
5	12.62	14.18	18.90
7	11.60	13.58	17.64
10	11.12	13.21	16.67

TABLE II. COMPRESSIVE STRENGTH TEST RESULT IN N/MM^2
REPLACED MATERIAL: COCONUT SHELL

% Replacement with Coarse Aggregate	7 days	15days	28days
5	14.79	18.46	19.64
7	14.63	18.06	19.11
10	14.23	17.12	18.33

TABLE III. COMPRESSIVE STRENGTH TEST RESULT IN N/MM^2
REPLACED MATERIAL: FLY ASH

% Replacement with Coarse Aggregate	7 days	15days	28days
5	12.60	15.63	17.23
7	11.86	14.27	16.80
10	11.66	13.07	16.63

TABLE IV. COMPRESSIVE STRENGTH TEST RESULT IN N/MM^2
REPLACED MATERIAL: DEMOLISHED CONCRETE

% Replacement With Coarse Aggregate	7 Days	15days	28days
5	14.73	16.59	19.33
7	14.38	16.13	18.98
10	12.06	14.64	15.80

TABLE V. COMPRESSIVE STRENGTH TEST RESULT IN N/MM^2
REPLACED MATERIAL: BRICK BATS

% Replacement With Coarse Aggregate	7 Days	15days	28days
5	13.28	17.42	19.29
7	12.13	16.94	18.39
10	11.50	14.76	18.13

TABLE VI. COMPRESSIVE STRENGTH TEST RESULT IN N/MM^2
REPLACED MATERIAL: JUTE

% Replacement With Coarse Aggregate	7 Days	15days	28days
1	12.60	14.30	18.2
2	11.17	13.70	17.28
3	10.53	12.66	14.19

IV. DISCUSSION

- From following Charts it is clear that four materials perform satisfactory up to some percentage of replacement. . Coconut shell, Demolished Concrete, Brick bat and Rubber.
- In case of Coconut Shell highest strength 98.2% (Compared with Characteristic Compressive Strength for M20) of concrete is achieved due to replacement of 5% coconut shell after 28 days of curing but as the percentage of coconut shell increases the strength of concrete decreases. But still it gives satisfactory strength for 7% and 10% replacement it gives 95.55% and 91.65% respectively (Compared with Characteristic Compressive Strength for M20).
- In case of Brick bats highest strength 96.45 %(Compared with Characteristic Compressive Strength for M20) for the 7% of replacement it gives 91.95% strength and compressive strength reduces to 90.65 %(Compared with Characteristic Compressive Strength for M20) when the percentage of replacement increase to 10% (Compared with Characteristic Compressive Strength for M20).
- In case of Rubber highest strength 94.5 %(Compared with Characteristic Compressive Strength for M20) is achieved due to replacement of 5%. Rubber after 28 days of curing but as the percentage of Rubber increases the strength of concrete decreases. But strength for 7% and 10% replacement with rubber it gives 88.20% and 83.35% respectively
- In case of demolished concrete highest strength 96.65 % (Compared with Characteristic Compressive Strength for M20) due to replacement of 5% coconut shell after 28 days of water curing .For the 7% of replacement it gives

94.9% strength and compressive strength reduces to 79 %(Compared with Characteristic Compressive Strength for M20) when the percentage of replacement increase to 10%.

- For fly ash strength 86.15% , 84% and 79% strength (Compared with Characteristic Compressive Strength for M20) respectively for 5%,7% and 10% replacement.
- In case of jute as the percentage of jute increases required water cement ratio is also need to be increase.

Chart 1: Variation of Compressive Strength after 28 Days

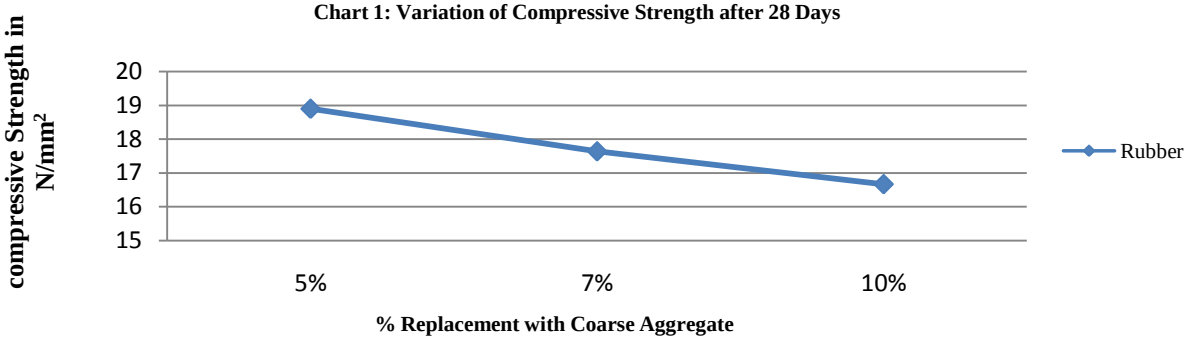


Chart 2: Variation Of Compressive Strength after 28 Days

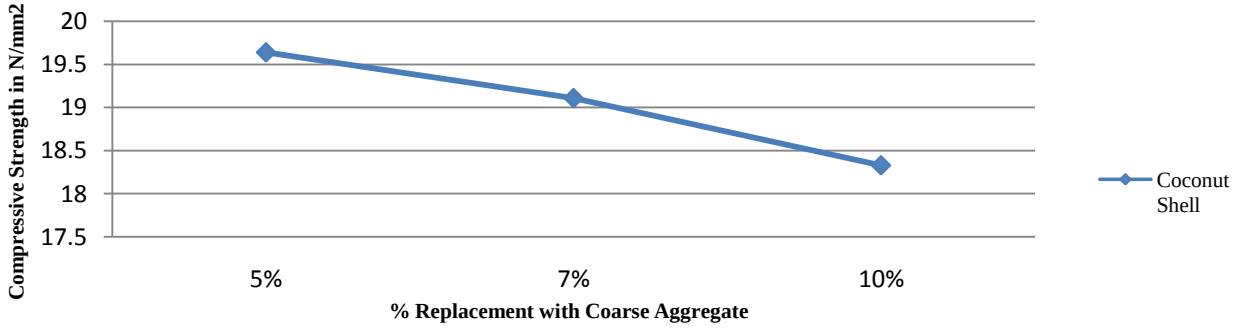


Chart 3: Variation Of Compressive Strength after 28 Days

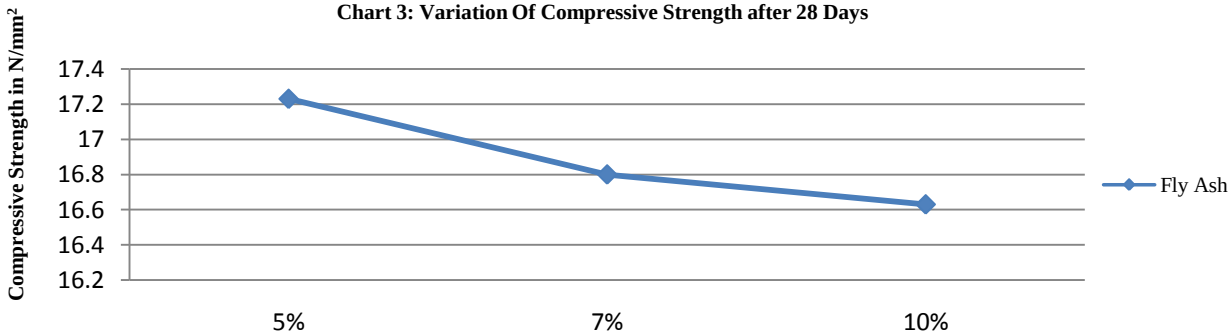


Chart 4: Variation Of Compressive Strength after 28 Days

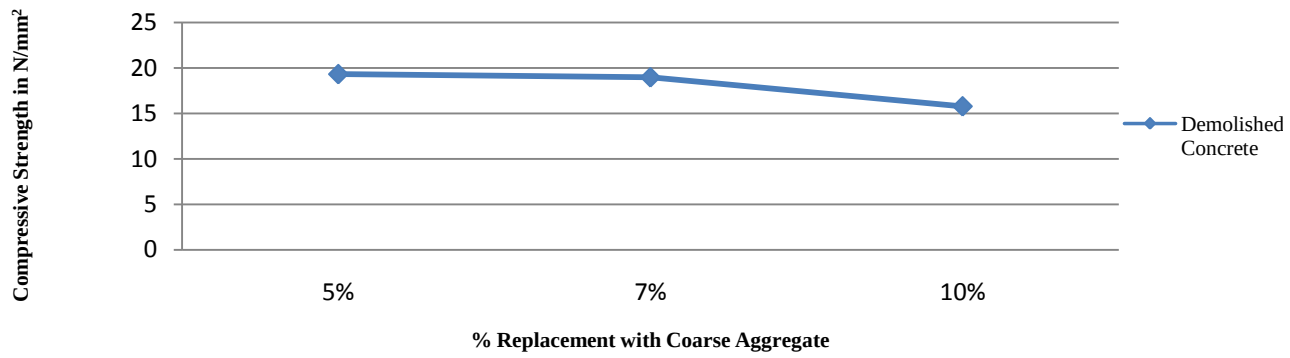


Chart 5: Variation Of Compressive Strength after 28 Days

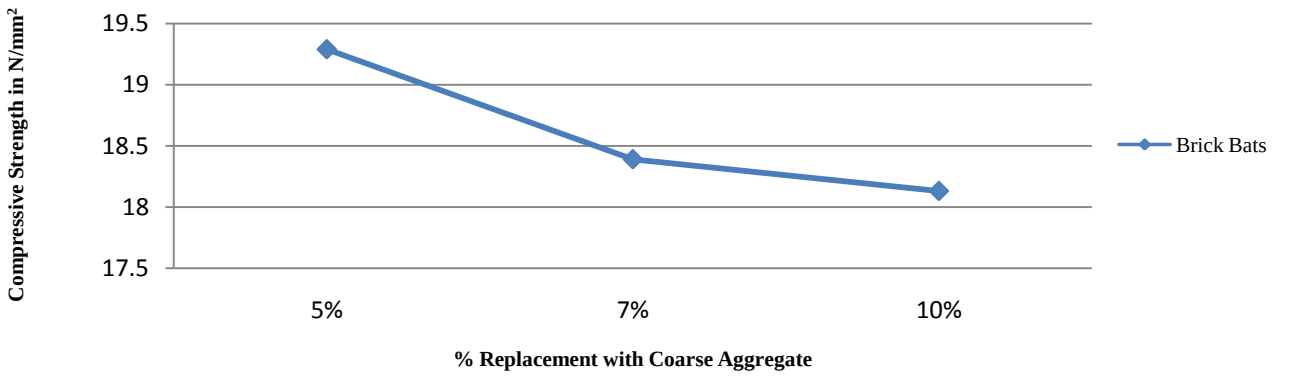


Chart 6:Variation of Compressive Strength after 28 Days

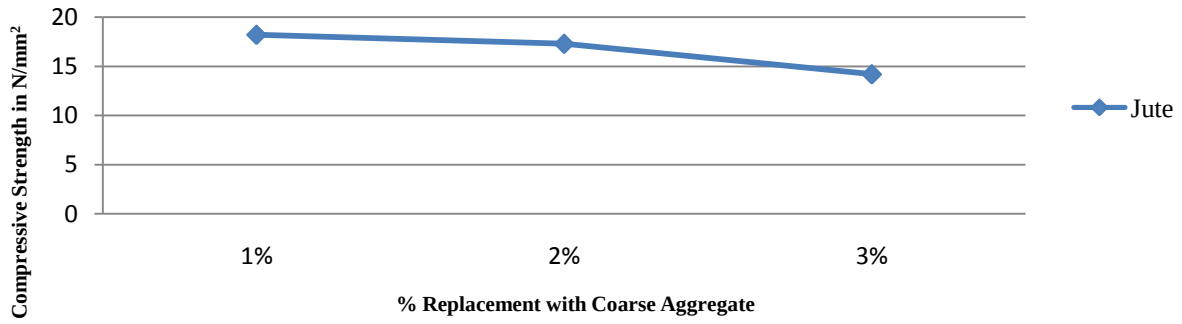
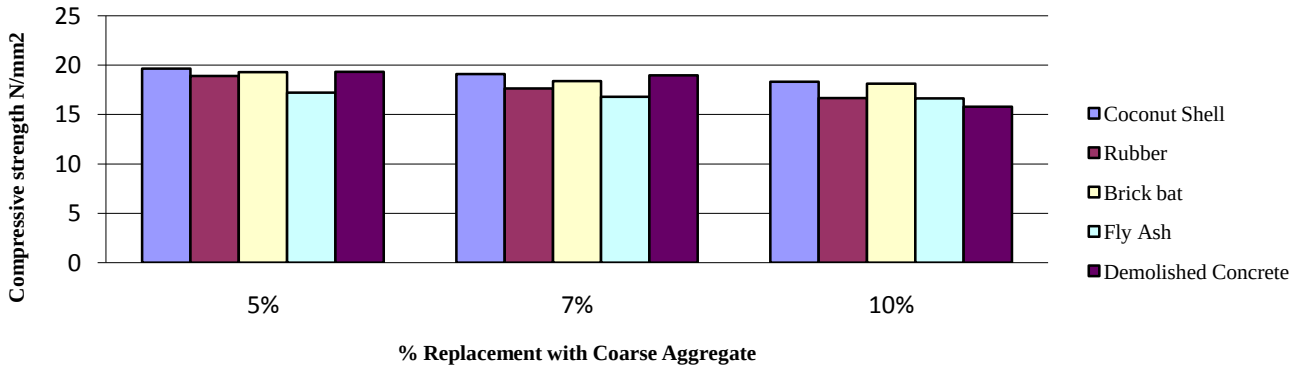


Chart 7: Compressive Strength after 28 Days in N/mm2



V. CONCLUSION

- As per the experimental results and discussion it can be concluded that, there is reduction in strength with increase in percentage of replacement for various materials.
- With the urge of development the consumption of resources is also increasing, however it is not possible to stop the growth but measures can be used to reduce the consumption of resources.
- One such measure is to reuse, reduce and recycle of waste materials. Thus by making proper use and recycling the optimization of resources can be achieved.
- Reuse, reduce and recycle serves dual purpose - it doesn't just make the waste reusable, but also prevent pollution to some extent.
- The use of waste materials in construction works will reduce environmental pollution, and reduce the cost as well as solving the problem of construction-waste management by putting into use this waste.

VI. LIMITATIONS

- Lack of awareness about high extends of pollution and its impact on present and future generations to come.
- Conventional Thinking/ Resistance against change
- Lack of Knowledge about resource consumption condition as well as potential use of waste materials.
- Lack of Rules and regulations from local, state and Central government bodies.
- Ignorance towards matter of high concern.
- Limited source of suppliers and industrial sector in reuse and sustainable material.
- Lack of Research work on long term effect of such materials which leads to the comment on durability of such replaced materials i.e. time barrier.

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