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Research Paper

EXPERIMENTAL ANALYSIS OF ECO-FRIENDLY CONCRETE WITH RECYCLED COARSE AGGREGATES

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Abstract- Recycled aggregates are comprised of crushed, graded inorganic particles processed from the materials that have been used in the constructions and demolition debris. The aim for this on – going project is to determine the strength characteristic of recycled aggregates for application in high strength structural concrete, which will give a better understanding on the properties of concrete with recycled aggregates, as an alternative material to coarse aggregate in structural concrete. The capacity of this project is to decide and balance the high strength concrete by using special percentage of recycled aggregates.

The study was carried out using workability test, compressive test, not direct tensile test and modulus of flexibility test. There were total of eight batches of concrete mixes, consists of each 20% increase of cast-off aggregate substitute from 0% to 100%. in addition, 100% of recycled aggregate mix batches included fly ash, water/cement ratio of 0.36 and 0.43. The workability of concrete significantly reduced as the amount of recycled aggregate increased. This was evaluated during normal slump test and compacting factor test. For power individuality, the results showed that a regularly falling in compressive strength, tensile might and modulus of stretch as the percentage of recycled aggregate used in the specimens increased.

I. INTRODUCTION

When structures made of concrete are demolished or renovated, concrete recycling is an increasingly common method of utilizing the rubble. Concrete was once routinely trucked to landfills for disposal, but recycling has a number of benefits that have made it a more attractive option in this age of greater environmental awareness, more environmental laws, and the desire to keep construction costs down.

Concrete aggregates gathered from obliteration destinations is put through a devastating machine. Smashing offices acknowledge just uncontaminated solid, which must be free of junk, wood, paper and other such materials. Metals, for example, rebar are acknowledged, since they can be expelled with magnets and other arranging gadgets and softened down for reusing somewhere else. The staying total lumps are arranged by estimate. Bigger lumps may

experience the crusher once more. Subsequent to squashing has occurred, different particulates are sifted through an assortment of techniques including hand-picking and water buoyancy.

Squashing at the real building site utilizing versatile crushers diminishes development costs and the contamination created when contrasted with transporting material with and from a quarry. Extensive street convenient plants can squash cement and black-top rubble at 600 tons for each hour or more. These frameworks typically comprise of a rubble crusher, side release transport, screening plant, and an arrival transport from the screen to the crusher gulf for reprocessing oversize materials. Minimized, independent smaller than expected crushers are additionally accessible that can deal with up to 150 tons for every hour and fit into more tightly regions. With the approach of crusher connections - those associated with different development hardware, for example, excavators - the pattern towards reusing nearby with littler volumes of material is developing quickly. These connections include volumes of 100 tons/hour and less.

Recycled demolished concrete are contained pounded, reviewed inorganic particles handled from the materials that have been utilized in the developments and obliteration garbage. These materials are for the most part from structures, streets, spans. With the sharp improvement of development and increment of individuals' familiarity with ecological assurance, squander control and administration winds up one of the immense difficulties of current society for the mission of practical advancement.



Recycled Aggregate

Objectives of the study

From this study the following objectives are made

1. The main objective of this research is to replace the natural coarse aggregates by recycled coarse aggregates for M30 Grade concrete.
2. The main aim of this work is utilization of construction and demolition (C&D) wastes as Coarse aggregates which are mixed with Concrete to investigate the affect of these waste materials on various parameters of concrete grade i.e. M40.
3. To evaluate and compare the results of workability, compressive strength, split tensile strength, flexural strength and durability of M40 grade of concrete by using construction and demolition (C&D) wastes with standard concrete.
4. To compare the engineering properties of so improved concrete for M40 specimens with controlled mix concrete.
5. To check the durability of concrete by using construction and demolition (C&D) wastes.

II. LITERATURE REVIEW

Gurpreet Singh and Rafat Siddique (2011) carried performed an experiment to test the strength and durability of concrete mixes in which natural sand was partially replaced with artificial sand (WFS). Natural sand was substituted with five percent (0, 5 percent, 10%, 15%, and 20%) WFS by weight. At the ages of 7, 28, and 91 days, compression and splitting tensile strength tests were performed to determine the strength qualities of concrete. The use of WFS as a partial replacement for fine aggregate in plain concrete resulted in a modest gain in strength qualities.

Neelam Pathak and Rafat Siddique(2012) When subjected to extreme temperatures, the effects of spent foundry sand and fly ash on the parameters of Self-Compacting-Concrete (SCC), including compressive strength, splitting tensile strength, modulus of elasticity, fast chloride permeability, porosity, and mass loss. The characteristics of SCC are examined using fly ash as a partial replacement for cement and wasted foundry sand as a partial replacement for sand. When the fly ash percentage was reduced from 50% to 30% in Ordinary Portland cement, there was a 24–25% improvement in compressive strength and an 18–22% rise in splitting

tensile strength after 28 days. At higher temperatures and with a larger proportion of fly ash, the rate of splitting tensile strength and modulus of elasticity loss was faster than the rate of compressive strength loss.

III. MATERIALS USED FOR THE RESEARCH

Portland cement

Ordinary Portland cement (OPC) of 53 Grade (UltraTech cement) from a single lot was used throughout the course of the investigation. It was fresh and without any lumps. The physical properties of the cement are determined from various tests conforming to Indian Standard IS: 8112:l1989 are listed in table below Cement is carefully stored to prevent deterioration in its properties due to contact with moisture.



OPC 53 Grade Cement

Aggregates

Aggregates constitute the bulk of a concrete mixture and give dimensional stability to concrete. To increase the density of resulting mix, the aggregates are frequently used in two or more sizes. The most important function of the fine aggregate is to assist in producing workability and uniformity in mixture.

Coarse aggregates

Those particles that are predominantly retained on the 4.75 mm (No. 4) sieve and will pass through 3-inch screen, are called **coarse aggregate.** The coarser the aggregate, the more economical the mix. Larger pieces offer less surface area of the particles than an equivalent volume of small pieces. Use of the largest permissible maximum size of coarse aggregate permits a reduction in cement and water requirements.



Coarse aggregates

Fine aggreagtes

Those particles passing the 9.5 mm (3/8 in.) Sieve, almost entirely passing the 4.75 mm (No. 4) sieve, and predominantly retained on the 75 µm (No. 200) sieve are called fine aggregate. For increased workability and for economy as reflected by use of less cement, the fine aggregate should have a rounded shape. The purpose of the fine aggregate is to fill the voids in the coarse aggregate and to act as a workability agent.



Fine aggregates

Recycled aggregates

The demolition and construction trash come from a nearby structure that was dismantled and rebuilt. The aggregates that pass through an IS sieve of 20mm and are held on a 12.5mm sieve are collected. Tile aggregates have a specific gravity of 2.64 and a fineness modulus of 7.358. The bulk densities of the loose and compacted materials are 1356 kg/m3 and 1510 kg/m3, respectively, with a water absorption of 0.55 percent. The aggregate crushing value (percentage) and aggregate impact value (percentage) of coarse aggregate are respectively 29.58 and 18.36.



Recycled coarse aggregates

Water

Generally potable water ought to be used. This is to make sure that the water is cheap unfastened from such impurities as suspended solids, organic depend and dissolved salts, which may additionally adversely affect the residences of the concrete, especially the placing, hardening, energy, sturdiness, pit fee, and many others.

Admixture

To acquire workability of clean Concrete, Sulphonated napthalene polymer based totally wonderful plasticizer Conplast SP430 in the shape of a brown liquid right away dispersible in water, Use of superplasticizer lets in the discount of water to the quantity up to 30 percentage without lowering the workability, in assessment to the feasible reduction up to fifteen percentage in case of plasticizers. The use of superplasticizer is practiced for production of flowing, self leveling, self compacting, and for production of excessive strength and high performance concrete.

MIX DESIGN

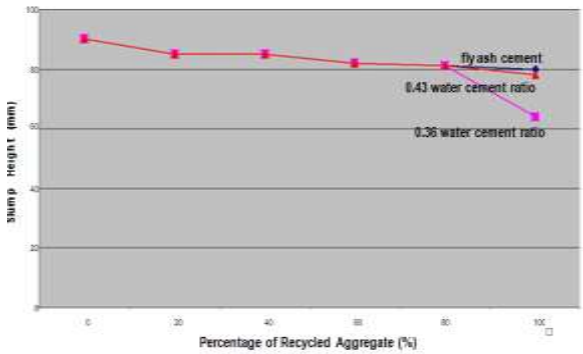
Final trial mix for M40 grade concrete is 1:1.63:2.54 at w/c of 0.45

Mix Trials used for the study

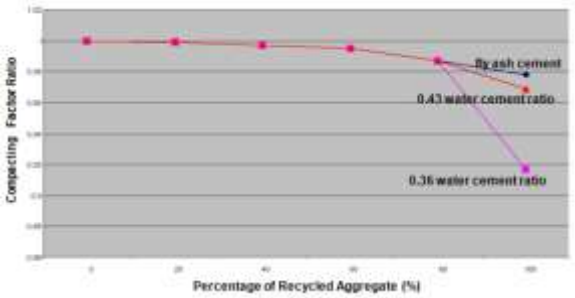
M0	-	0%RCA
M1	-	20%RCA
M2	-	40%RCA
M3	-	60%RCA
M4	-	80%RCA
M45	-	80%RCA

IV RESULTS AND ANALYSIS

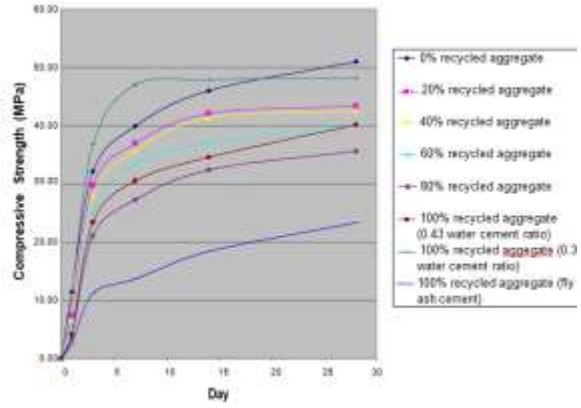
Slump cone test



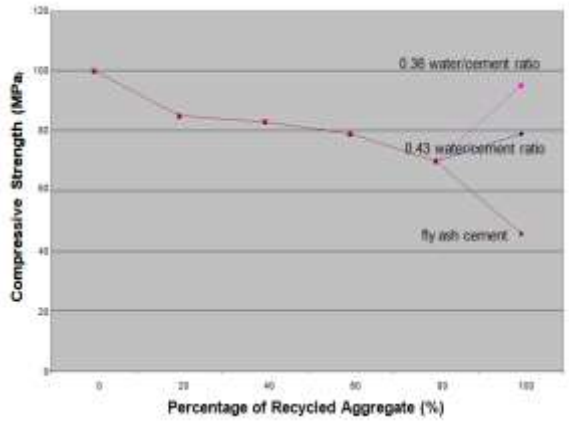
Compaction factor test



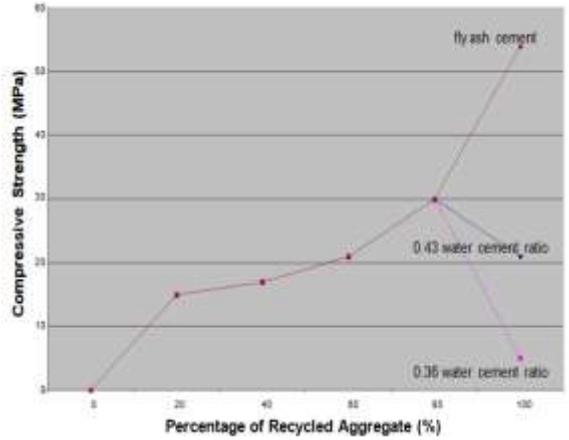
Compressive strength



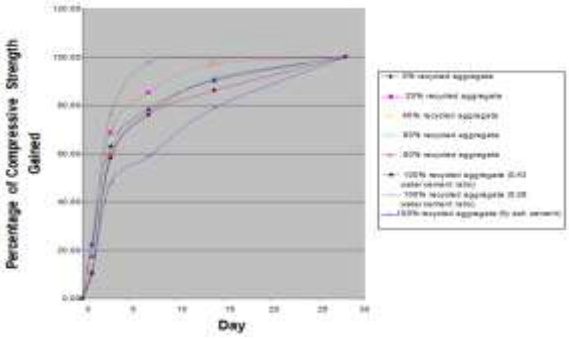
Compressive strength variation with different



Percentage of Compressive Strength Remained

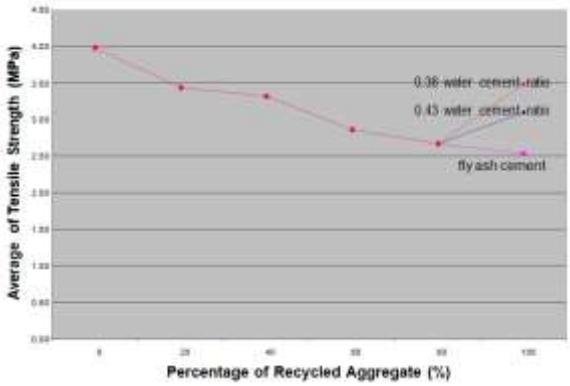


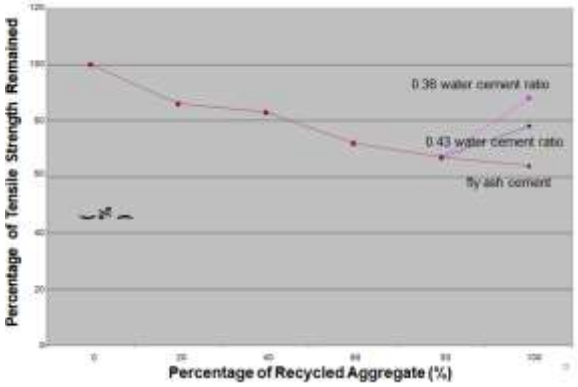
Percentage of Decreasing in Compressive Strength



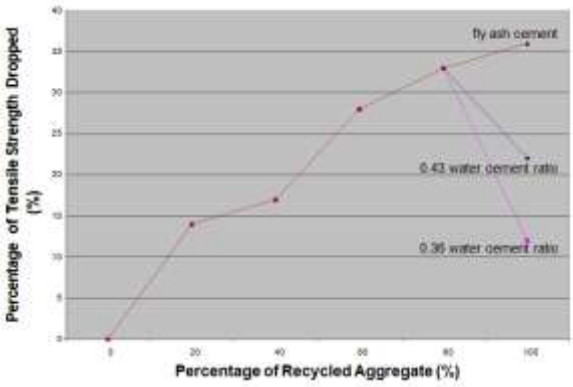
Variation of Compressive Strength Gained with Time

Split tensile strength



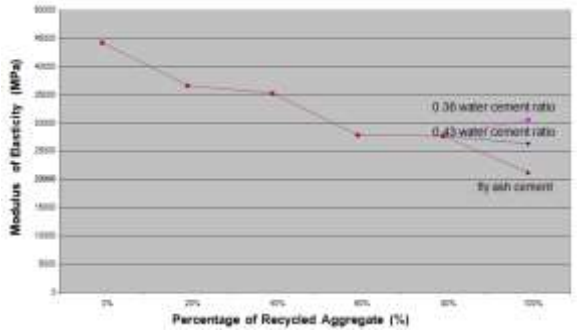


Percentage of Tensile Strength Remained

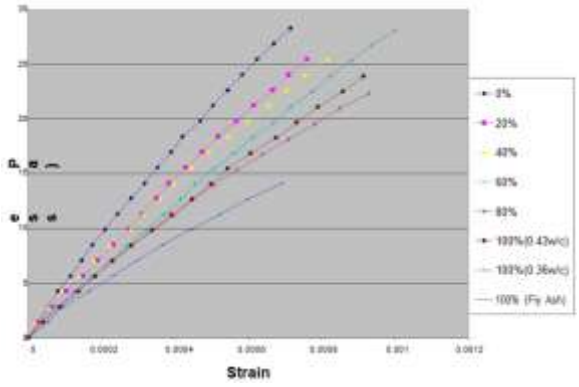


Percentage of Tensile Strength Dropped

Modulus of Elasticity Result



Variation of Modulus of Elasticity



Stress and Strain Relationship

concrete. The study shows that when the water/cement ratio was decreased, the compressive strength can reach 48MPa. This is classified as high strength concrete and they can be applied in the infrastructures, which need compressive strength up to 40MPa. Furthermore, with the cheaper price of recycled aggregate compared to natural aggregate, the builders can carry out the construction task with lesser material costs.

Another result found in this research is that when reducing the water amount used in recycled aggregate mixes, tensile strength and modulus of elasticity are also improved. This will give an improvement in general strength characteristics of structural building.

Although recycled aggregate can be applied in the high strength structure, but one issue must not be neglected as recycled aggregate with reduce water content would have low workability. Whenever recycled aggregate is applied, water content in the concrete mix has to be monitored carefully due to the water absorption capacity of recycled aggregate will vary. This type of concrete can only be used under the condition that does not involve a lot of handling works.

V CONCLUSIONS

From the experimental investigation on recycled

Investigate on the convention of waste production materials is extremelysignificant due to the equipment waste is steadilygrowing with the improved of residents and increasing of town development. The reasons that many investigations and analysis had been made on recycled aggregate are because recycled aggregate is easy to obtain and the cost is cheaper than virgin aggregate. Virgin aggregate need to mine but recycled aggregate can ignore this process.

This on-going research project is to determine the strength characteristics of recycled aggregate for potential application in the high concrete structural

REFRENCES

1. A. Naga Sai , P.P.V. Kishore, “An Experimental Study on Strength Properties of Concrete using Recycled Aggregate as Replacement in Coarse Aggregate”, International Journal for Research in Applied Science & Engineering Technology (IJRASET), Volume 6 Issue II, February 2018- Available at www.ijraset.com.
2. Goudappa Biradar, “An Experimental Study on Recycled Coarse Aggregates”, International Journal on Emerging Technologies (Special Issue on NCRIET-2015) 6(2): 174-177(2015).
3. N.K.Deshpande, Dr.S.S.Kulkarni,H.Pachpande, “Strength Characteristics Of Concrete With Recycled Aggregates And Artificial Sand”, N.K.Deshpande, Dr.S.S.Kulkarni, H.Pachpande / International Journal of Engineering Research

and Applications (IJERA), Vol. 2, Issue 5, September- October 2012, pp.038-042.

4. Visakh Suthan Pallath , G.Gangha, N.Ganapathy Ramasamy, "EXPERIMENTAL STUDY ON STRENGTH CHARACTERISTICS OF CONCRETE WITH RECYCLED AGGREGATES AND ANALYSIS OF ITS EFFECTIVE USES IN ROAD WORKS", IJRET: International Journal of Research in Engineering and Technology, Volume: 04 Issue: 03 | Mar-2015, Available @ http://www.ijret.org.
5. Apurva A. Fursule, Prof.V.S.Shingade, "Experimental Study of Mechanical Properties of Concrete using Recycled Aggregate with Nano Silica", International Research Journal of Engineering and Technology (IRJET), Volume: 04 Issue: 08 | Aug -2017.
6. Surendra . B.V, Rajendra T N, "A Study on Strength Properties of Concrete Replacing Partially the Natural Coarse Aggregates with Recycled Aggregates", International Research Journal of Engineering and Technology (IRJET), Volume: 04 Issue: 02 | Feb -2017.
7. N.Sivakumar, S.Muthukumar, V.Sivakumar, D.Gowtham, V.Muthuraj, "Experimental Studies on High Strength Concrete by using Recycled Coarse Aggregate", International Journal of Engineering And Science Vol.4, Issue 01 (January 2014), PP 27-36.
8. Adil Gul , Er.Ravi Kumar, "Characteristics of Recycled Coarse Aggregates with Partial Replacement of Cement by Fly Ash", International Journal of Innovative Research in Science, Engineering and Technology, Vol. 6, Issue 6, June 2017, Website: www.ijirset.com