A STUDY ON STRENGTH PROPERTIES OF CONCRETE REPLACING PARTIALLY THE NATURAL COARSE AGGREGATES BY RECYCLED AGGREGATES

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ABSTRACT

Disposal and treatment of construction and demolition (C&D) wastes are often costly and hazardous to the environment. Their recycling could lead to a greener solution to the environmental conservation and pave the way towards sustainability. This study utilizes demolished concrete as coarse aggregate often termed as recycled coarse aggregate (RCA) for producing industry quality concrete. Large scale recycling can substantially reduce the consumption of natural aggregate and help preserve the environment. However, in near future, it can raise new challenges. The use of "repeated recycled coarse aggregate" in concrete production can be a viable solution to the growing problem regarding the C&D waste disposal. During the development of new generation product like recycled and repeated recycled coarse aggregate concrete, it is essential to investigate the fresh, hardened, and durability properties of concrete to promote and escalate its application in the construction industry.

In this study Coarse aggregates is replaced Recycled coarse aggregates, and then concrete was prepared. The replacement ratios which have been studied were 0.0%, 10%, 20%, 30%, 40%, and 50% by weight to check the compressive strength concrete, Split tensile and flexural strength at 7days, 14days and 28 days and durability of concrete . On fresh concrete slump test was preformed to check workability of concrete and after then compressive strength, Split tensile flexural strength and durability was checked for M30 Grade concrete.

I. INTRODUCTION

Gigantic amounts of development materials are required in creating nations because of proceeded with infrastructural development and furthermore tremendous amounts of development and devastation squanders are produced each year in creating nations like India. The transfer of this squander is an intense issue in light of the fact that on one side it requires enormous space for its transfer while on the opposite side it dirties the earth. It is additionally important to secure and save the common assets like stone, sand and so on. Nonstop utilization of characteristic assets, similar to waterway and sand is another significant issue and this builds the profundity of stream bed bringing about drafts and furthermore changing the climatic conditions. In this way, the economical idea was acquainted in development industry due with developing worry about the eventual fate of our planet, since it is an immense purchaser of common assets and in addition squander maker.

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. Development and destruction (C&D) squander constitutes one noteworthy bit of aggregate strong waste created on the planet, including wrecked solid, blocks, and brick work, limestone, artistic and different materials. Structures incorporate structures of numerous types, both private and nonresidential, and also streets and scaffolds. Segments of C&D flotsam and jetsam regularly incorporate solid, black-top, E-squander, wood, metals, gypsum wallboard and material

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. M30.
3. To evaluate and compare the results of workability, compressive strength, split tensile strength, flexural strength and durability of M30 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 M30 specimens with controlled mix concrete.
5. To check the durability of concrete by using construction and demolition (C&D) wastes.

II. LITERATURE REVIEW

A. Naga Sai , P.P.V. Kishore et al.,(2018)

This examination will endeavor to watch the mechanical properties and toughness properties of solid utilizing Recycled Aggregate (RA) in solid examples like 3D shapes, chambers and bars. So Recycled Aggregate is taken in tests regarding Natural Coarse Aggregate (NCA) in rate premise like 0%, 20%, 40%, 60%, 80% and 100% substitution. From this investigation it was inferred that Recycled course total (RCA) is supplanted with Natural course total (NCA) in rate premise like 0%, 20%, 40%, 60%, 80% and 100%. The test outcomes will demonstrate that up to 20 to 40% substitution of RCA will give better outcomes.

Goudappa Biradar, et al.,(2015)

From this examination it was reasoned that the compressive quality of reuse total is observed to be not as much as the common total. A considerable measure of examinations have been made to explore the quality conduct of reused total solid utilizing devastation squander. Tests results demonstrate that conduct of solid like functionality, variety of quality made with reused total is pretty much like regular cement.

III. MATERIALS AND METHODOLOGY

Cement

Normal Portland concrete of 53 review from the nearby market was utilized and tried for physical and concoction properties according to Seems to be: 4031 – 1988and observed to accommodate different particulars according to IS: 12269-1987.

Cement

Fine aggregates

In the present examination fine total is characteristic sand from neighborhood showcase is utilized. The physical properties of fine total like particular gravity, mass thickness, degree and fineness modulus are tried as per IS :2386.

Fine aggregates

Coarse aggregates

The crushed coarse aggregate of 12.5 mm maximum size rounded obtained from the local crushing plant, used in the present study. The physical properties of coarse aggregate like specific gravity, bulk density, gradation and fineness modulus are tested in accordance with IS ; 2386.

Coarse aggregates

Demolished aggregates

Recycled coarse aggregates concrete are included pounded, evaluated inorganic particles prepared from the materials that have been utilized in the developments and obliteration flotsam and jetsam. These materials are by and large from structures, streets, spans. With the sharp improvement of development and increment of individuals' attention to natural assurance, squander control and administration winds up one of the considerable difficulties of present day society for the mission of economical advancement. Development and destruction (C&D)

Demolished aggregates

Mix Design

Mix design of M30 Grade concrete is

Water: Cement: Fine aggregate: Coarse aggregate 0.50: 1: 1.86: 2.89

IV. EXPERIMENTAL INVESTIGATION

CASTING OF CUBES AND CYLINDERS

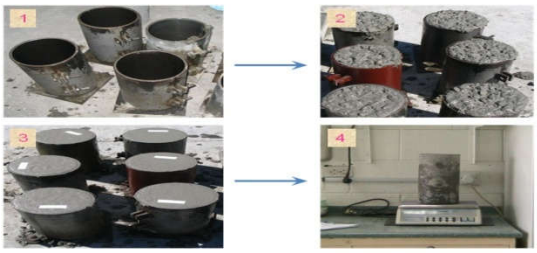
Casting of cube shapes and barrels as improved the situation M30 Grade concrete, the blend extent is for

which we are throwing cubes for typical cement, with the incomplete substitution of cement

After the sample has been prepsred, promptly fill the shape forms and smaller the solid, either by hand or by vibration. Any air caught in the solid will lessen the quality of the shape. Thus, the 3D cubes must be completely compacted. Notwithstanding, mind should likewise be taken not to over minimized the solid as this may cause isolation of the totals and bond glue in the blend. This may likewise lessen the last compressive strength.

Filling the mould and Compacting the concrete in the cube mould

Finishing



Cylindrical moulds

Curing of cubes and cylinders

Tests to be conducted on concrete

Workability

Compaction factor test

Compressive strength of concrete

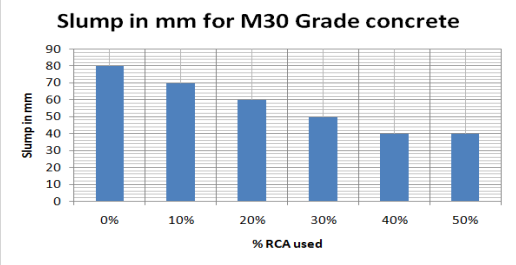
Split tensile strength

Flexural strength of concrete

V. RESULTS AND ANALYSIS

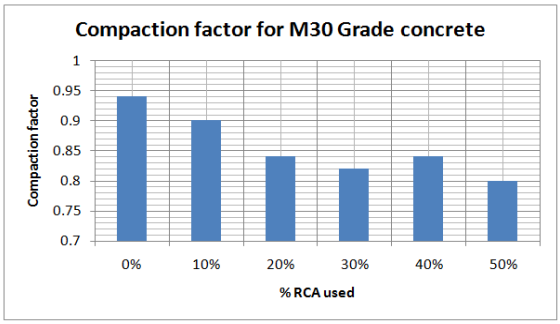
Slump cone test

S.no	% RCA used	Slump in mm
1	0%	80
2	10%	70
3	20%	60
4	30%	50
5	40%	40
6	50%	40



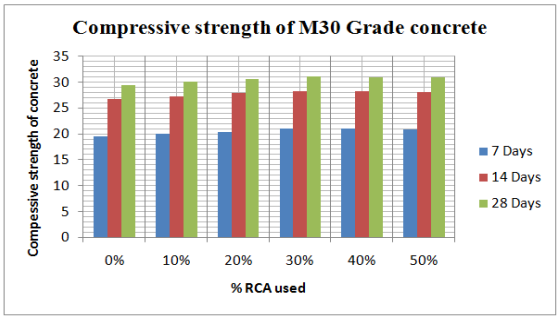
Compaction factor test

S.no	% RCA used	Compaction factor
1	0%	0.94
2	10%	0.90
3	20%	0.84
4	30%	0.82
5	40%	0.84
6	50%	0.80



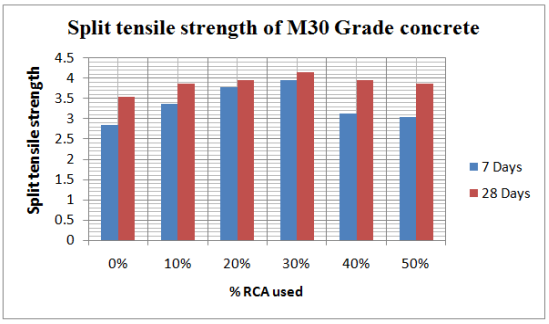
Compressive strength of concrete

S.no	% RCA used	Compressive strength of M30 Grade concrete		
		7 Days	14 Days	28 Days
1	0%	19.5	26.80	29.40
2	10%	20.06	27.18	30.14
3	20%	20.44	27.86	30.56
4	30%	21.04	28.32	31.10
5	40%	20.98	28.24	31.02
6	50%	20.86	28.10	30.92



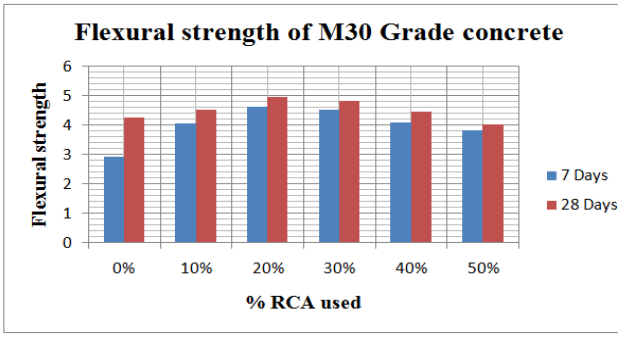
Split tensile strength of concrete

S.no	% RCA used	Split tensile strength of M30 Grade concrete	
		7 Days	28 Days
1	0%	2.84	3.54
2	10%	3.38	3.86
3	20%	3.78	3.96
4	30%	3.96	4.16
5	40%	3.12	3.96
6	50%	3.04	3.86



Flexural strength of concrete

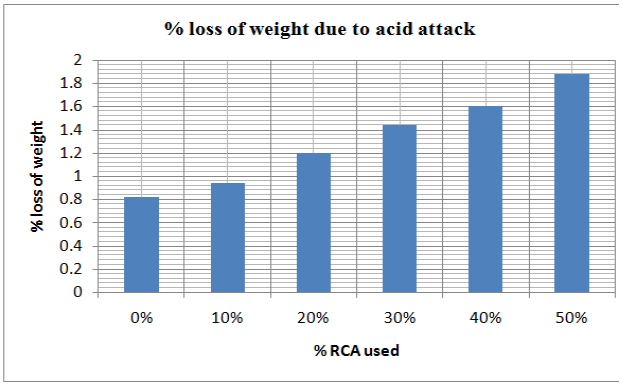
S.no	% RCA used	Flexural strength of M30 Grade concrete	
		7 Days	28 Days
1	0%	2.94	4.28
2	10%	4.06	4.54
3	20%	4.64	4.98
4	30%	4.54	4.82
5	40%	4.10	4.46
6	50%	3.82	4.04

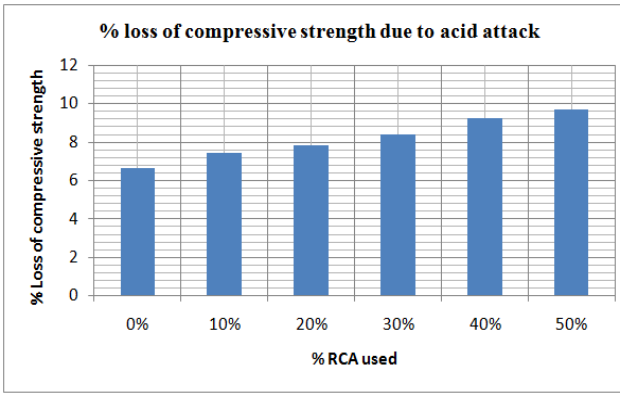


Durability of concrete

Acid attack

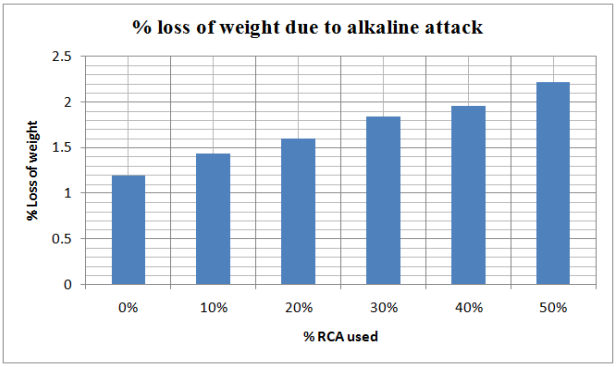
Sl.no	% RCA used	Initial weight of cube after 28days curing in grams	Final weight of cubes after 90days curing in grams	% loss of weight due to acid attack	Compressive strength of cube after 28days curing	Compressive strength of cubes after 90days curing	% loss of compressive strength due to acid attack
1	0%	2261	2242	0.82	29.40	27.44	6.64
2	10%	2340	2318	0.94	30.14	27.91	7.40
3	20%	2351	2323	1.20	30.56	28.18	7.80
4	30%	2234	2202	1.44	31.10	28.48	8.40
5	40%	2394	2356	1.60	31.02	28.16	9.20
6	50%	2260	2218	1.88	30.92	27.92	9.68

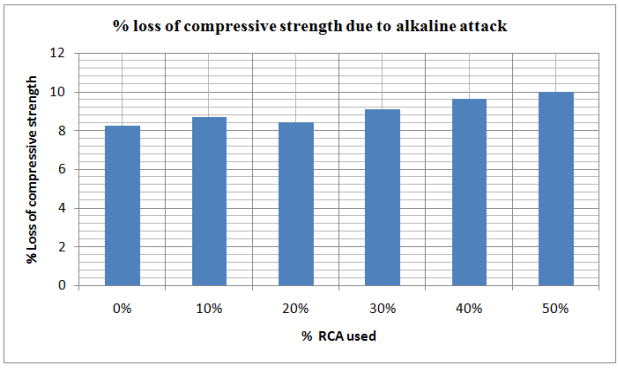




Alkaline attack

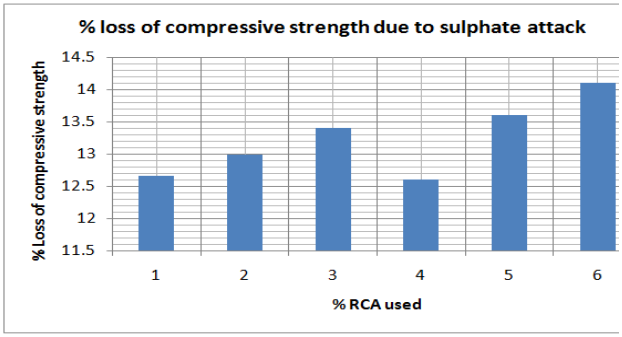
Sl. No	% RCA used	Initial weight of cube after 28days curing in grams	Final weight of cubes after 90days curing in grams	% loss of weight due to alkaline attack	Compressive strength of cube after 28days curing	Compressive strength of cubes after 90days curing	% loss of compressive strength due to alkaline attack
1	0%	2286	2259	1.20	29.40	26.98	8.23
2	10%	2340	2306	1.44	30.14	27.52	8.68
3	20%	2280	2244	1.60	30.56	27.98	8.42
4	30%	2310	2268	1.84	31.10	27.27	9.10
5	40%	2296	2251	1.96	31.02	28.03	9.62
6	50%	2312	2261	2.22	30.92	27.83	9.98





Sulphate attack

Sl.no	% M Sand used	Compressive strength of cube after 28days curing	Compressive strength of cubes after 90days curing	% loss of compressive strength due to sulphate attack
1	0%	29.40	25.68	12.66
2	10%	30.14	26.22	12.98
3	20%	30.56	26.46	13.4
4	30%	31.10	27.18	12.6
5	40%	31.02	26.80	13.6
6	50%	30.92	26.28	14.10



CONCLUSIONS

From the above study the following conclusions were made

1. The value of slump for the concrete decreases with increasing the percentage of Recycled Coarse aggregates for M30 Grade concrete. The value of compaction factor for the concrete decreases with increasing the percentage of Recycled Coarse aggregates for M30 Grade concrete.
2. Compressive strength for 7days, 14days, and 28days for the concrete increases initially up to 30% Recycled Coarse aggregates than decreases with increasing the percentage of Recycled Coarse aggregates. The optimum value for the compressive strength was obtained at 30% Recycled Coarse aggregates.
3. Split tensile strength and flexural strength for 7days, and 28days for the concrete increases initially up to 30% Recycled Coarse aggregates than decreases with increasing the percentage of M Sand. The optimum value for the compressive strength was obtained at 30% Recycled Coarse aggregates.
4. The addition of Recycled Coarse aggregates significantly increased the compressive, tensile and flexural strengths of concrete with maximum strengths in each case being achieved at 30% Recycled Coarse aggregates.
5. The percentage loss of weight and percentage loss of compressive strength is increases with in increasing the percentages in all cases in durability studies in Recycled Coarse aggregates concrete. So, the concrete is durable up to 30% replacement.

So the replacement of 30% of Recycled Coarse aggregates is generally useful for better strength values in M30 grade of concrete.

REFERENCES

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