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BEARING STRENGTH OF RECYCLED AGGREGATE FIBER REINFORCED CONCRETE

B.Naga Niranjan kumar Asst.professor of civil engineering, Dr.K.V.Subba Reddy Institute of Technology. Kurnnol, A.P, India

S.Sudheer kumar Asst.professor of civil engineering, Dr.K.V.Subba Reddy Institute of Technology. Kurnnol, A.P, India

V.Divya Student of Civil Engineering Department, Dr.K.V.Subbareddy Engineering College, Kurnool, Andhra Pradesh, India

ABSTRACT Cementations materials have been used by mankind for construction from time immemorial. The every rising functional requirement of the structures and the capacity to resist aggressive elements has necessitated developing new cementations materials and concrete composites to meet the higher performance and durability criteria. The environmental factors and pressure of utilizing waste materials from industry have also been the major contributory factors in new developments in the field of concrete technology.

Concrete is an artificial material in which the aggregates both fine and coarse are bonded together by the cement when mixed with water. The concrete has become so popular and indispensable because of its inherent in concrete brought a revolution in applications of concrete. Concrete has unlimited opportunities for innovative applications, design and construction techniques. Its great versatility and relative economy in filling wide range of needs has made it very competitive building material. At present there is depletion for both fine and coarse aggregates. The too much usage of good qualities of materials for concrete works is scares for future generation. Hence there is a search for other second grade and novel material to produce desired strength concrete. In this connection an attempt has been made, the use of recycle aggregate (replacing of granite aggregate by recycle aggregate in proportion of 20, 40, 60 ,80 and 100%) for concrete works with and without steel fibres in the concrete mix. Here an attempt made to use of recycle aggregate in concrete to evaluate the workability, compressive and bearing strengths.

KEYWORDS : Recycled aggregate, coarse aggregate,fine aggregate and

1. INTRODUCTION

Currently there is acute demolition waste disposal problem. Since concrete accounts for about 75% by weight of all construction materials used, it follows that concrete will account for three quarters of all demolition waste. Disposal of demolition waste is becoming difficult and expensive due to shortage of dumping grounds and increasingly critical environmental requirements. Under the pressure of shortage of aggregate and environmental problems in waste disposal, recycled concrete is identified as a viable source of coarse and fine aggregate.

2. PROBLEM STATEMENT

There are many places in the country where local rock sources are not available or inaccessible for processing coarse and fine aggregate. Urban expansion and enforcement of environmental laws have led to closing of several aggregate plants, resulting in fetching them from long distances at high cost. It is now widely recognized that there is a limit on the availability of natural minerals for making concrete of coarse and fine aggregate, increase in demand and decrease in supply for concrete production, result in need to identify new sources of coarse and fine aggregate for replacing conventional aggregate

3. AIM AND OBJECTIVE

1. To find the efficacy of the recycle aggregate for civil constructions.
2. To know the fresh concrete properties of recycle aggregate concrete.
3. To know the behavior of compressive strength of recycle aggregate
4. To evaluate the bearing strengths of concrete

4. SCOPE OF THE STUDY

The scope of the study will be focused on the performance of concrete using recycled aggregateas a partial replacement of granite agrregate. In this study the recycled aggregate is taken from the demolished buildings, Kurnool district, Andhra Pradesh, India.

5. MIX DESIGN

Mix design can be defined as the process of selecting suitable ingredients of concrete and determining their relative propositions with the object of producing concrete of certain minimum strength and durability as economically as possible. The mix design is based on as IS: 10262-2009.

Water	Cement	Fine aggregate	Coarse aggregate
186	372	711	1181
0.5	1	1.91	3.17

6. TEST ON MATERIALS

6.1 Cement

OPC 33 Grade of pozzolana Portland cement was used in this study. The following physical test should be conduct in the laboratory as per IS codes

SL. NO.	PHYSICAL TESTS	OBTAINED RESULTS	REQUIREMENTS AS PER IS CODES
1	Fineness	2.25%	Not >10% as per IS 4031 part 1
2	Standard Consistency	33%	IS 4031 part 4
3	Initial Setting time	45min	Not less than 30 minutes as per IS 4031 part 5
4	Final setting time	360 min	Not more than 600 minutes as per IS 4031 part 5
5	Soundness	2 mm	Not>10mm as per IS 4031 part 3
6	Specific gravity	3.05	IS 2720 part 3

Table – 2: Physical Test results of cement

6.2 Aggregates

The aggregate used in this study was clean river sand and crushed stone aggregate collected from near Kurnool.

Sl. No	Physical Tests	Obtained results	Requirements as per IS 383
1	Impact Test	19.74%	Not more than 45%
2	Los Angeles Abrasion Test	9.89%	Not more than 50%
3	Specific gravity		

	a) Coarse Aggregate	2.5	2.6-2.9
	b) Fine Aggregate	2.5	2.6-2.8
4	Water absorption		Not>2%as per IS:2386-Part 3
	a) Coarse Aggregate	0.6%	
	b) Fine Aggregate	0.3%	

Table – 3: Physical Test of aggregates

7. Tests on concrete

7.1 Slump test

SL.NO.	RECYCLED AGGREGATE CONCRETE MIX	SLUMP CONE (MM)
1	0%	49
2	20%	48
3	40%	46
4	60%	46
5	80%	40
6	100%	39

Table – 4: Shows the slump values of recycled aggregate concrete mix

SL.NO.	RECYCLED AGGREGATE CONCRETE MIX WITH 1% FIBER	SLUMP CONE (MM)
1	0%	47
2	20%	31
3	40%	31
4	60%	30
5	80%	28
6	100%	27

Table – 5: Shows the slump values of recycled aggregate concrete mix with 1% fiber.

SL.NO.	RECYCLED AGGREGATE CONCRETE MIX WITH 2% FIBER	SLUMP CONE (MM)
1	0%	32
2	20%	24
3	40%	23
4	60%	22
5	80%	19
6	100%	17

Table – 6: Shows the slump values of recycled aggregate concrete mix with 2% fiber.

7.2.1 Compressive strength of recycled aggregate concrete

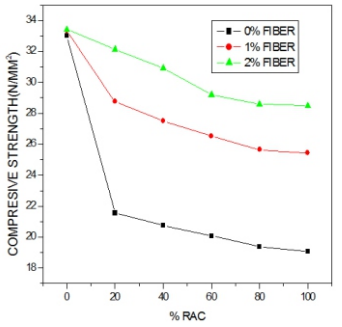
PERCENTAGE OF REPLACEMENT	AVERAGE ULTIMATE LOAD(KN)	AVERAGE COMPRESSIVE STRENGTH(N/MM2)
0%	743	33.01
20%	485	21.55
40%	467	20.75
60%	452	20.08
80%	436	19.37
100%	429	19.06

7.2.2 Compressive strength of recycled aggregate concrete with 1% fiber

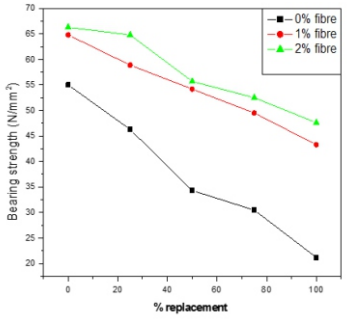
PERCENTAGE OF REPLACEMENT	AVERAGE ULTIMATE LOAD(KN)	AVERAGE COMPRESSIVE STRENGTH(N/MM2)
0%	746	33.33
20%	647	28.75
40%	619	27.51
60%	596	26.54
80%	577	25.64
100%	572	25.42

7.2.3 Compressive strength of recycled aggregate concrete with 2% fiber

PERCENTAGE OF REPLACEMENT	AVERAGE ULTIMATE LOAD(KN)	AVERAGE COMPRESSIVE STRENGTH(N/MM2)
0%	752	33.33
20%	723	28.75
40%	696	27.51
60%	673	29.19
80%	645	28.6
100%	641	28.48



Compressive strength vs % of RAC



Bearing Strength vs. % replacement

8. RESULTS AND DISUSSIONS

7.2.3 Bearing strength of recycled aggregate concrete with 1% and 2% fiber.

Nomenclature	Bearing Strength of 0% fiber	Bearing Strength of 1% fiber	Bearing Strength of 2% fiber
0	76.3	90.1	92.2
20%	64.5	81.8	90.02
40%	47.7	60.3	77.4
60%	41.2	66.8	71
80%	29.2	59.6	65.5
100%	27.3	57.4	61.4

9. CONCLUSIONS:

1. The slump values decreased as the % of recycle aggregate increases.

2. The compressive and bearing strengths are decreases as the RA content increase in the conventional concrete mix.

3. The compressive and bearing strengths decreased about 2 to 14%and 3 to 12% with RA content of 20 to 100% respectively

5. The fibre volume with 1% can be used effectively without change in design mix.

6. The Maximum permissible limit for recycle aggregate content with 2% fibre volume is 40%.

7. For RAC with 1% fibre volume the compressive and bearing strengths decreased about 13 to 23% and 8 to 19% with RA content of 0 to 100% respectively when compared with conventional concrete.

8. For RAC with 2% fibre volume the compressive and bearing strengths decreased about 2 to 14% and 19to 27% with RA content of 0 to 100% respectively when compared with conventional concrete.

9. With incorporation of steel fibres (i.e., 1 and 2%) the compressive and bearing strengths were increased when compared with respective replacement of recycled aggregate aggregate.

10. From the results it concluded that the presence of steel fibres in concrete mix showed good performance up to 40% replacement i.e. it is as good as natural aggregate concrete. So the designer can be take the concrete mix with recycle aggregate up to 40% replacement with 1 and 2% of fibers.

REFERENCES:-

1. Nixon PJ., "Recycled concrete as an aggregate for concrete – a review", Material and Structures, RILEM 1978, 11(65), pp. 371 – 378.
2. Hansen T.C, H. Narud, "Strength of recycled concrete made from crushed concrete coarse aggregate", Concrete International, vol. 5, No 1, (1983), pp. 79– 83, pp. 120 – 135.
3. Hansen T.C, "Recycled aggregate and recycled aggregate concrete, second state-of-the-art report", velopments from 1945–1985, Materials and Structures, 19(111) (1986), pp. 201 – 246.
4. Bairagi N.K, R. Kishore, "Behavior of concrete with different proportions of natural and recycled aggregates", Resources, Conservation and Recycling, 9(1993), pp. 109 – 126.
5. Oliveira M, Barra de, Vazquez E., "The influence of retained moisture in aggregates from recycling on the properties of new hardened concrete", Waste Management, 1996, 16, pp. 113 – 117.
6. Salem R.M, E.G. Burdette, "Role of chemical and mineral admixtures onphysical properties and frost-resistance of recycled aggregate concrete", ACI Materials Journal, 95 (5) (1998 October), pp. 558 – 563.
7. Giaccio G, Zerbino R., "Failure mechanism of concrete: combined effects of coarse aggregates and strength level", Adv Cement Based Materials, 1998, 7(1), pp. 41 – 48.
8. Limbachiya M. C., Leelawat T. and Dhir R. K., "Use of recycled concreteaggregate in high-strength concrete", Materials and Structures constructions,Vol.33, November 2000, pp. 574 - 580.
9. Otsuki, N., Miyazato, S., and Yodsudjai, W., "Influence of recycled aggregate on interfacial transition zone, strength, chloride penetration and carbonation of concrete" Journal of Materials in Civil Engineering, 2003, Vol.15, No.5, pp. 443- 451.
10. Lin Yong-Huang, Tyan Yaw-Yauan, Chang Ta-Peng, Chang Ching-Yun., "An assessment of optical mixture for concrete made with recycled concrete aggregates", Cement and Concrete Research, 34 (2004), pp. 1373 – 1380.
11. Kheder G.F, Al-Windawi S.A., "Variation in mechanical properties of natural and recycled aggregate concrete as related to the strength of their binding mortar", Materials and Structures (RILEM), 38 (Aug-Sep 2005), pp. 701 – 709.
12. Shi Cong Kou., Poon C.S., Chan D., "Influence of fly ash as cement replacement on the properties of recycled aggregate concrete", Journal of materials in Civil Engineering, 2007, pp. 709 – 717.
13. Ann K.Y., Moon H.Y., Kim Y.B., Ryou J., "Durability of recycled aggregate concrete using pozzolanic materials", Waste Management, 28 (2008), pp. 993 -999.
14. Chakradhara Rao M, S. K. Bhattacharyya, and S. V. Barai, (2015) "Influence of field recycled coarse aggregate on properties of concrete," Materials and Structures, vol. 44, PP. 205–220, 2015.
15. Kani GN. How safe are over large concrete beams?. J Am Concrete InstProc1967; 64:128-41
16. Chen, W.F., and carson,J,L., Bearing Capacity of fibre reinforced concrete, ACI SP-44, 1973, pp.209-221