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RECYCLED AGGREGATE CONCRETE

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ABSTRACT

A comparative analysis of the experimental results of the properties of fresh and hardened concrete with different replacement ratios of nature with recycled aggregate is presented in the paper. Recycled aggregate was made by crushing the waste concrete of laboratory test cubes and precast concrete columns. In this project, the different test are carried out on recycle aggregate and mix design of concrete of grade M20 by using IS1260:2000.

Compare the strength of recycled aggregate concrete for 100% and 75% of recycled aggregates for 7, 14, 21 days and also find the modulus of elasticity and splitting tensile strength of test specimens load testing of reinforced concrete beams made of the investigated concrete beams made of the investigated concrete type is also presented in the paper. Regardless of the replacement ratio, recycled aggregate concrete had a satisfactory performance, which did not differ significantly from the performance of control concrete in this experiment research. However for this to be fulfilled, it is necessary to use quality recycled concrete coarse aggregate and follow the specific rule for design and production of this new concrete type.

I. INTRODUCTION

Recycled aggregate are comprised of crushed, graded inorganic particles processed from the materials that have been used in the construction and demolition debris. These materials are generally from building, road, bridges and sometimes even from catastrophes, such as wars and earthquakes. Recycled aggregate is generally produced by two stages crushing of demolished concrete, screening and removal of contaminants such as reinforcement plastic etc.

Concrete made with such aggregates is called as recycled aggregate concrete. Demolition of old and deteriorated buildings and traffic infrastructure, and their substitution with new ones, is a frequent phenomenon today in a large part of the world.

Reuse of waste concrete is beneficial from the view point of environmental protection and resources reservation. The most common method of managing this material has been through its disposal in landfills. In this way, hug deposits of construction waste are created, consequently becoming a special problem of human environment pollution.

II. LITERATURE SURVEY

Limbachiya and leelawat (2000) found that recycled aggregate concrete had 7 to 9% lower relative density and 2 times higher water absorption than natural aggregate.

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III. EXPERIMENTAL METHODOLOGY: PROCESSING OF RAC

In this project, the recycled concrete aggregate are obtained from the big concrete blocks which are kept in structural lab, NMRC Saidpur. These blocks are first crushed by using crusher. Due to this the recycled aggregates are wet they are dried by keeping in oven for 24 days. The different tests are carried out on finally obtained recycled aggregates and mix design of concrete of grade M20 by using IS 1260:2009 and IS 456:2000.

Fig. 1: Particle Size Distribution

IV RESULTS AND DISCUSSION

i. Properties of RAC

Sum of cumulative percentage retained=533.8

Fineness modulus = 533.8/100 = 5.338

Table:- Particle size distribution

IS Sieve	Weight Retained (kg)	Cumulative Weight Retained (kg)	Cumulative Percentage Weight Retained (%)	Cumulative Percentage Passing (%)
40mm	0	0	0	100
20mm	0.1750	0.170	3.4	96.6
10mm	2.475	2.645	52.9	47.1
4.75mm	1.806	4.451	89.02	10.98
2.36mm	.23	4.681	93.62	6.38
1.18mm	0.15	4.831	96.62	3.38
600micron	0.10	4.931	98.62	1.38
150micron	0.05	4.981	99.62	0.38

Table 2: Properties of RAC.

Properties	Recycled Aggregate concrete
specific gravity	2.57
water absorption	1.21%
aggregate impact value	30.69%
Aggregate crushing	29.865

IV. MIX PROPORTIONS

The compressive strength increased with a decrease in w/c ratio and is directly proportional to strength of blended aggregate. However, when used at higher level of replacement, the higher water absorption ability of recycled aggregate resulted in the higher total water demand. We know that, Target strength for M20 Mix proportional is 20 + (1.65x4) as equal to 26.6MPa and the ratio of cement : sand : aggregate was arrived at as 1:2.65:3.92. The result are tabulated under table 3.

Table 3: Mix proportion

Cement	300kg/m*3
Water	148.8kg/m*3
Fine aggregate	796kg
Coarse aggregate	1173.462kg
Water – cement ratio	0.50
Fine aggregate to cement ratio	2.65
coarse aggregate to cement ratio	3.92
Slump	50mm

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V. SLUMP TEST

Table 4: Variation of slump with percentage of RAC.

Percentage of Recycled Aggregate (%)	Slump (mm)
100% recycled aggregate	48
75% recycled aggregate	55

Slump test was used to determine the workability of fresh concrete. The slump less than 25mm indicates a very stiff concrete and a slump that more than 125mm indices a running concrete. The results indicated 48mm for 100% recycled aggregate and 55 mm for 75% recycled aggregate.
The results are tabulated under Table 4.

VI. COMPRESSION TEST

A concrete mix having cement, fine aggregate and coarse aggregate in the ratio of 1:2.65:3.92 was prepared . The components were mixed using machine in adding water cement ratio of 0.50 during the process . The concrete mix was filled in 9 cube moulds kept for 24 hours. After 24 hours the specimens were demoulded and kept immersed in water for 7, 14, and 21 days after which they were removed for testing . The results are tabulated under table 5.

Fig. 2: Test specimen in compression testing machine.

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Fig. 3: Test specimen at failure

Tables 5: Variation of compressive strength.

Percentage of recycled aggregate concrete	Compressive strength for 7days (MPa)	Compressive strength for 14days (MPa)	Compressive strength for 21days (MPa)
100%	21.24	23.62	24.88
75%	23.70	24.98	25.99

VII. MODULUS OF ELASTICITY TEST

Moulded test specimens (cylinders) were of the size 150x300mm. 3such specimens were prepared using same concrete mix design as compressive strength and tested after 21days of curing.

VIII. SPLITTING TENSILE STRENGTH TEST OF CONCRETE

Table 6: variation of splitting tensile strength with ultimate Load.

Specimens	Weight of cylinder (kg)	Ultimate Load P(KN)	split tensile strength (MPa) 2P (nDL)
1	12.56	190	190
2	12.46	180	2.54
3	12.60	195	2.75

Figure 4: Concrete specimen in splitting testing Machine

Figure 5: Testing Specimen in failure.

IX. CONCLUSION

Using recycled fine aggregate in concrete can prove to be better however in less quantity and can be recommended for lower grade application like lower layers of roads such sub base course and base course.

By using recycled aggregates in construction it will maximize the economic and environment benefits. The compression strength of concrete will decrease with increase in percentage of recycled aggregates for 7, 14, 21 days. The modulus of elasticity of concrete also affects its strength. Characteristics strength of concrete is E=5000 fck. Splitting tensile strength test is simple and gives uniform results. The Average tensile strength is 2.65MPa for 21days test specimen. Average compressive strength for 100% of recycled aggregate at 21days specimen is 24.98MPa. Average compressive strength for 75% of recycled aggregate at 21days specimen is 25.99MPa.

REFERENCES

Limbachiya M.C., Leelawat T.and Dhir R.K.; use of recycled concrete aggregate in high strength concrete, Materials and Structures