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Analysis of Strength on Recycled Concrete Using PP Fiber

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Abstract:- It is the analysis of strength on Recycled Aggregate Concrete (RAC) when it is compared with the Natural Aggregate on account of its properties. We are discussing the use of Recycled Aggregate Concrete in the concrete and the effect on its strength by progressively replacing the Natural Aggregate (NA) with Recycled Aggregate. Cubes having dimensions 150x150x150 mm3 were cast using Recycled Aggregate by replacing the Natural Aggregate by 0%, 25%, 50% & 75% and corresponding results of compressive strengths and tensile strength is being noted. The values of compressive strength and tensile strength is being noted by crushing the cube and cylinder after curing at 7, 14, and 28 days respectively with a water-cement ratio of 0.5 and ratio mix of M20. It has been found that the strength of concrete by replacing Natural Aggregate with Recycled Aggregate is quite similar to conventional concrete with 0% and 25% but with 50% and 75% replacement, the strength of resulting concrete has been decreased.

Keywords:- *RAC, Compressive Strength, Tensile Strength, Recycled Concrete, Natural Aggregate, Cement.*

I. INTRODUCTION

Concrete is a mixture of material which consist of aggregate, sand, water and cement which harden with time. Some time suitable admixtures are added with concrete to obtain required physical and chemical properties. According to IS: 456-2000 three grades of concretes are considered.

Ordinary concrete (M10-M20)
Standard concrete (M25-M65)
High strength concrete (M60-M80).

In the construction of building and other types of structures concrete plays the rightful role and a large quantum of concrete is being utilized. It is crushed the reinforcement bar is removed and the material is screened for **M20** size. Recycled coarse and fine aggregates are formed by crushing concrete obtained from construction debris and demolition of abandoned structure like old buildings, bridge, tunnel, etc.

II. LITERATURE REVIEW

Recycled Aggregate concrete (RAC) for building structure, its properties has been compared with those of Natural Aggregate concrete (NAC). The Research as have replaced the Aggregate by RA up to the 50% only with the good results in strength, cost, and durability at other property according to conventional. Since only 50% of replacement has done, so in this thesis the 75% of aggregate replacement has done to analysis the strength properties.

III. MATERIAL AND METHODOLOGY

The physical and chemical properties of the materials are studied in detail. Based on these properties material selection for different purpose concrete is performed. After the preparation of concrete and curing it for different time frame various tests are also performed on it to check its compressive strength, tensile strength, slump cone test, durability etc.

Fig 1. Fine Aggregates

Fig 2. Recycled Aggregate Concrete

Fig 3. Water

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Coarse aggregates are the stone pieces which are obtained by crushing the stones in a crusher or from the river banks. Coarse aggregates are retained by 4.75 mm of IS sieve.

Concrete Grade	Weight of FA and CA in 50 kg of cement	FA:CA	Weight of water (in kg) per 50 kg of cement
M5	800	Generally 1:2 but subject to an upper limit of 1:1.5 and a lower limit of 1:1.25	60
M7.5	625		45
M10	480		34
M15	330		32
M20	250		30

Table:1 Proportion of Nominal Mix as per IS 456:2000

Usually to achieve strength of 300 kg/cm^2 aggregates of size 40mm are used and for strength of 200 kg/cm^2 aggregates of size 20 mm are used.

Exposure Condition	Minimum Cement Content (in kg/m^3)	Maximum free Water cement ratio
Mild	300	0.55
Moderate	300	0.50
Severe	320	0.45
Very Severe	340	0.45
Extreme	360	0.40

Table:2 Minimum cement content and maximum water cement ratio based on exposure conditions

Tensile Strength

Concrete strong is very strong in compression, intermediate in shear and weak in tension. Direct tensile strength of concrete is approximately 7 to 15% of compression. Tensile strength of concrete is measured by the following methods.

A) Flexural tensile strength test.
B) Split Cylindrical test

Compressive Strength

The compressive strength for hardened concrete is determined by using compression machine. Strength of concrete is commonly considered its most valuable property in the mechanical properties. If the water required by one bag of cement is 30 liters, the water-cement ratio is equal to 0.6. A proper measure of uni-axial compressive stress can be obtained (load / cross sectional area) only if stress in uniformly distributed across the cross section of longitudinal.

IV. RESULTS AND ANALYSIS

Based on the analysis proposed the usage of recycled aggregate along with natural aggregate in tested proportion without compromising the quality and strength of the structures.

Mix Design For M20

Grade of concrete : M20
Degree of Workability : 0.85CF
Type of cement : PPC
Size of aggregate : 25mm

Replacing %	CA (kg.)	RAC (kg)	FA (kg)	Cement(kg)	Water (lit.)
0%	64.68	0	29.71	20	9.74
25%	48.51	16.17	29.71	20	9.74
50%	32.34	32.34	29.71	20	9.74
75%	16.17	48.51	29.71	20	9.74

Table 3: Composition For Different % Of CA Replace by RAC

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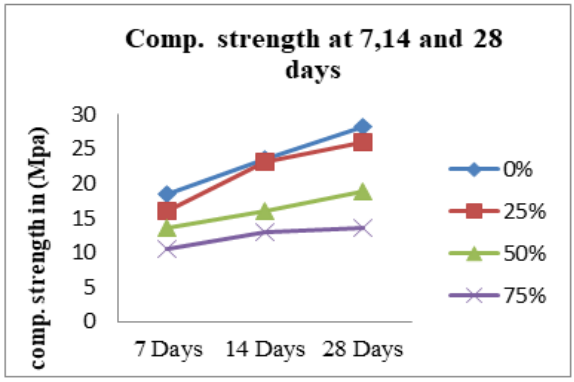
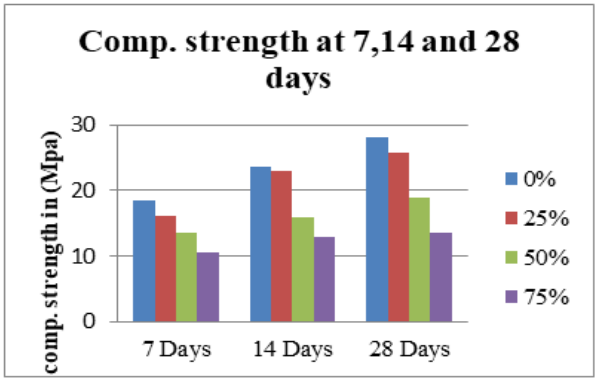
Compressive Strength of Cube

Concrete mix	7-days Comp. strength (MPA)	Average Comp. Strength (MPA)	14-days Comp. strength (MPA)	Average Comp. strength (MPA)	28-days Comp. strength (MPA)	Average Comp. strength (MPA)
0%	16.8 15.9 16.6	18.4	23.9 24.3 22.6	23.6	27.9 28.2 28.4	28.17
25%	15.6 16.7 15.9	16.07	23.4 23.2 22.6	23.07	26.8 25.8 25.1	25.9
50%	13.9 13.7 13.1	13.57	15.8 16.3 15.8	15.97	18.2 18.8 19.8	18.93
75%	10.9 10.8 10.1	10.6	13.6 12.9 12.5	13.0	13.5 13.7 13.6	13.6

Table 4: Average variation in the Compressive Strength of cube



Graph 1. Compressive Strength (Linear Variation)



Graph 2. Compressive Strength (Bar Variation)

The Compressive Strength of RAC where Aggregate is replaced by Recycled Aggregate with proportion 0%, 25%, 50% and 75% on 28 days curing is 28.17 Mpa, 25.9 Mpa, 18.93 Mpa 13.6 Mpa respectively.

TENSILE STRENGTH TEST

Replacing %	Failure load after 7 days (KN)	Failure load after 14 days (KN)	Failure load after 28 days (KN)
0%	39.22	50.43	56.04
25%	37.62	48.37	53.74
50%	28.79	37.02	41.13
75%	21.47	27.60	30.67

Table:5 Load failure of Cylinder

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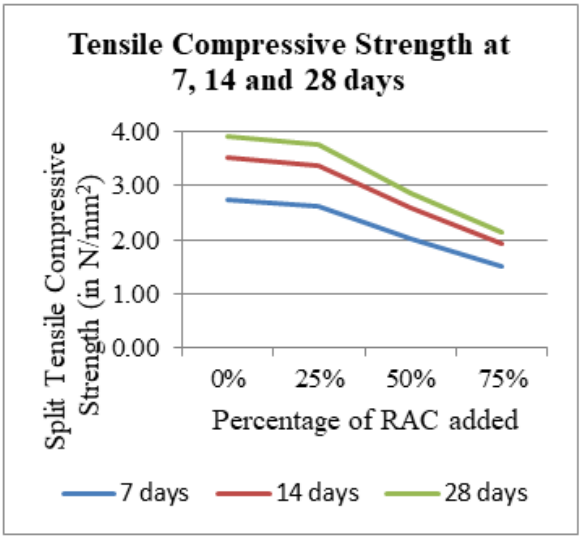
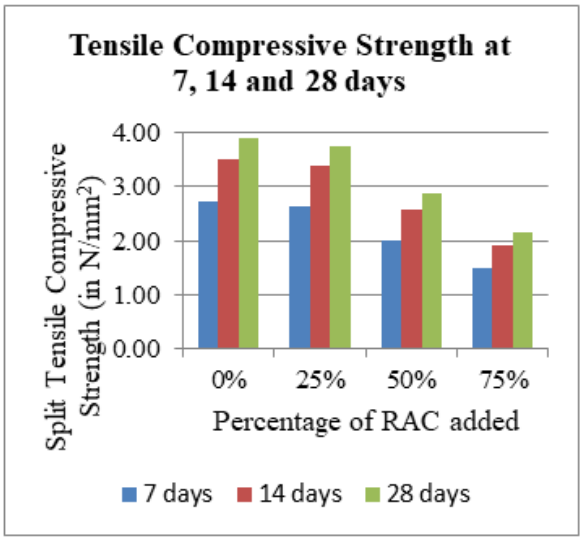
Concrete mix	7-days Tensile Strength (MPA)	Average tensile Strength (MPA)	14-days Tensile Strength (MPA)	Average Tensile, Strength (MPA)	28-days Tensile Strength (MPA)	Avg. Tensile. Strength (MPA)
0%	2.74 2.79 2.74	2.76	3.59 3.54 3.54	3.56	3.89 3.96 3.94	3.93
25%	2.67 2.65 2.63	2.65	3.66 3.46 3.40	3.51	3.75 3.79 3.78	3.77
50%	2.08 2.04 1.99	2.04	2.62 2.58 2.59	2.60	2.85 2.95 2.88	2.89
75%	1.49 1.58 1.49	1.52	1.98 1.96 1.94	1.96	2.14 2.19 2.17	2.17

Table 6: Average variation in the Tensile Strength of cube



Graph 3. Tensile Strength (Linear Variation)



Graph 4. Tensile Strength (Bar Graph Variation)

The Split Tensile Strength of RAC where aggregate is replaced by Recycled Aggregate in proportion 0%, 25%, 50% and 75% on 28 days curing is 3.93 Mpa, 3.77 Mpa, 2.89 Mpa and 2.17 Mpa respectively.

V. CONCLUSION

Based on the experimental work performed under the valuable guidance, the behavior of concrete having recycled aggregate as a substitute was studied closely and following conclusions have been drawn:

1. The result of Compressive Strength shows that the Compressive Strength of Concrete is reduced as the percentage of Recycle Aggregate increases.Though the Compressive Strength is keeps on reducing still we can say 25% replacement is better because it reduces the cost of construction by giving the strength of **M-25.**
2. The Compressive Strength of the RAC is comparable to NCA if the proportion of Recycled Aggregate added is up to 25-30%. After this, decrease in the Compressive Strength is observed.
3. The result of Split Tensile Compressive Strength shows that strength of concrete is reduced as the percentage of Recycle aggregate increases. Though the Split Tensile Compressive Strength is keeps on reducing still we can say 25% replacement is better because it reduces the cost of construction by giving the strength of **M-25.**
4. By using the Recycled Aggregate in the Concrete the problem of dumping of demolition debris and construction waste is resolved to a great extent.
5. It will helps in keeping our environment clean and safe. It will help in maintaining the fertility of soil which in turn is good for vegetation and maintain the level of ground water.
6. From the outcomes of the experimental work it can be advised that upto 25-30% of RAC can be used for construction of low rise buildings, pavements, roads, drainage structure.

FUTURE SCOPE

1. The Recycle aggregate has used up to 75% only thus the analysis can be done for more than 75% of aggregate by RA.
2. In addition to recycled aggregate fiber can also be use as reinforcement. The replacement of cement can also be done by substitute material with recycled aggregate.
3. Self compacting concrete can be analyzed by replacing aggregate with RA.

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