EXPERIMENTAL INVESTIGATION ON PARTIAL REPLACEMENT OF RECYCLED AGGREGATE IN MULTISTOREY BUILDING

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ABSTRACT

'Recycled aggregate concrete is one of the developing technology in the constructions. Though the growth and need of the building is increased the need for resources are also in demand. Hence inorder to avoid the demand and to reduce the wastage of materials, recycled aggregate concrete is introduced. In the comparison of recycled aggregate concrete to conventional concrete the RAC (recycled aggregate concrete) gives effective result in workability .The 28 days result of compressive test of recycled concrete aggregate is comparatively satisfactory with conventional concrete. In the case of the partial replacement of the RAC(recycled aggregate concrete)the compressive strength of the concrete is tested for 7,14,28 days and the result obtained is the lower than conventional concrete but depending upon the partial replacement the strength of recycled aggregate will give the expected result. The partial replacement is done from 20% to 50% the strength of recycled aggregate decreases.

Keywords: *Recycled aggregate concrete, Recycled aggregate, demolished waste, Compressive strength,*

I. INTRODUCTION

In the modern evaluation of buildings and technologies, people tend to move to the development through modernized building. Hence, the refreshment of the building is done either demolishing or renovating the structures for ten years once, In this case the cost of materials, labor cost, etc., increase due to amelioration. Hence by keeping the economy cost in the mind, and also in order to avoid the wastage of materials recycled aggregate concrete is introduced. In the developing world, the number of high rise buildings also gets increase and the regular method of renovation of multi storey building is done by demolishing it.

Demolishing or renovating the buildings results in lots of material wastage. Also, reconstructing the same building requires more cost. Crushing and recycling the demolished materials will reduce the cost as well as the material wastage. Replacing the RAC in place of normal aggregate materials will be satisfactory because the demolished aggregate materials are used to be in the field for more than 10 years hence already it will obtain the maximum strength therefore by replacing the recycled aggregate will only increase the strength, but in the rare case they also decrease the compressive strength in those case fibers and chemical admixtures are added. Due the pores and the water absorption will leads to decrease the strength

Also the recycled aggregate can only replace by certain percentage, because full replacement of recycled aggregate to normal coarse aggregate which tends to decrease the strength which leads to failure in the concrete, therefore replacement is done only upto 30%. The replacement of recycled aggregate concrete with other fibers like steel, glass fiber, polypropylene etc. can be used but only motive is by only using the recycled aggregate concrete we can obtain the maximum and expected strength.

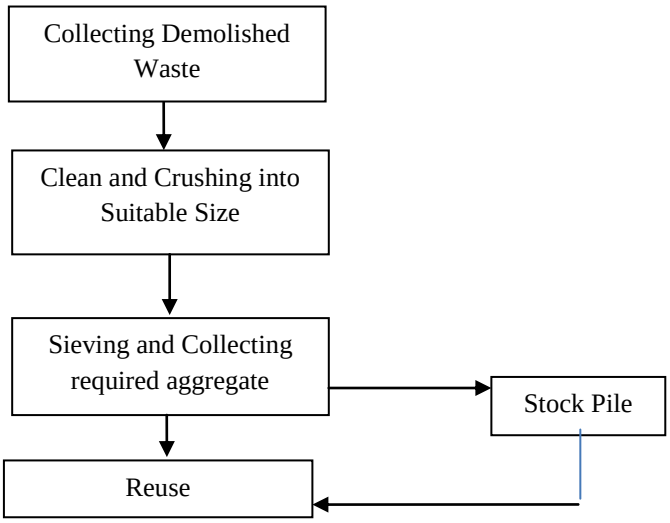
The process of recycled aggregate is quite simple process, the raw materials from the demolished site should be separated from size where small sized raw material can be avoided, and then they are proceeding to the recycling procedure.

Once they are separated the raw material are send to the vibrating feeder which also help to separate the raw materials according to the size they those materials are send to the jaw crusher which the primary crushing process of aggregate once the primary is finished they are send to secondary crushing machine which impact crusher where they are crushed neatly and they send to vibrating screen which is used to help the recycled aggregate to separate according to size then the recycled aggregate is ready for the construction.

II. OBJECTIVE

The main objective of the project is avoid the wastage of demolished waste of construction site and used those materials as a recycled aggregate as a partial replacement of coarse aggregate in the high rise building.

III. METHODOLOGY



IV EXPERIMENTAL INVESTIGATION AND TEST RESULT

Slump cone test and compaction factor test

The slump test is perhaps the most widely used, primarily because of the simplicity of the apparatus required and the test procedure. The internal surface of the mould was thoroughly cleaned and free from superfluous moisture and any set concrete before commencing the test. The mould was placed on a metal pan which was smooth, horizontal, rigid and non-absorbent. The mould was carefully filled in four layers, each approximately one quarter of the height of the mould. Each layer was stamped with the tamping rod. The strokes were distributed in a uniform manner over the cross section of the mould and for the second and subsequent layers penetrated into the under lying layer. The bottom layer was tamped throughout the depth. After the top layer was rotted, the concrete was struck off level with a trowel such that the mould was exactly filled.

The mortar which has leaked out between the mould and base plate was cleaned away. The mould was removed from the concrete immediately by raising it slowly and carefully in a vertical direction. This allowed the slump to subside and the slump was measured immediately by determining the difference between the height of the mould and that of the highest point of the specimen being tested. The slump measured was recorded in terms of mm of subsidence of the specimen during the test.

The apparatus consist of 2 hopper vessels A and B provided with hinged doors at their bottom. A cylindrical vessel B is opened so that the concrete falls into the vessel B. after this; hinged door of the vessel B is opened so that the concrete will fall into the cylinder C. The surplus concrete from this cylinder is struck off with steel floats. The contents of the cylinder are again filled with the sample in 5 cm layers. The concrete being compacted by ramming and vibrating and then weighed. Let the weight of the compacted concrete be W2

Sample	Slump Value	Compaction Factor
NAC	35	0.913
20% Replacement of RAC	23	0.89
30% Replacement of RAC	20	0.885
40% Replacement of RAC	19	0.88
50% Replacement of RAC	15	0.86

Compressive strength test

As per IS 516:1959 Compression test was carried out on cube specimens. The sizes of the specimens are 100mm x 100mm x 100mm. The three samples in each proportion were tested and the strength was obtained as an average. The individual variation of specimens was not more than ± 15 percent of the average. The specimens stored in water were tested immediately on the removal from grid were wiped off the specimens and any projecting pins removed. The dimensions of the specimens and their weight were recorded before testing.

Compressive strength result for 7 days

Cube.No	Curing Days	NAC	20% - Replacement	30% - Replacement
1	7	16.34	15.79	14.80
2	7	16.79	14.84	14.63
3	7	17.54	15.30	15.90
	Average	**16.89**	**15.31**	**15.11**

Cube.No	Curing Days	40% Replacement	50% Replacement
1	7	12.96	13.56
2	7	14.13	13.32
3	7	13.79	12.82
	Average	**13.63**	**13.23**

Compressive strength result for 14 days

Cube.No	Curing Days	NAC	20% - Replacement	30% - Replacement
1	14	18.88	16.78	16.17
2	14	18.12	17.62	17.03
3	14	18.71	17.44	16.87
	Average	**18.57**	**17.28**	**16.69**

Cube.No	Curing Days	40% Replacement	50% Replacement
1	14	15.22	14.27
2	14	15.65	15.07
3	14	16.23	14.82
	Average	**15.70**	**14.72**

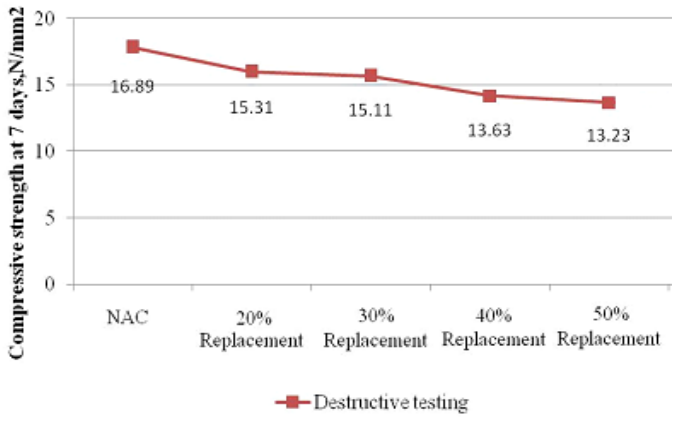
Compressive strength result for 28 days

Cube.No	Curing Days	NAC	20% - Replacement	30% - Replacement
1	28	26.02	22.86	22.56
2	28	25.27	23.71	22.89
3	28	25.75	23.36	23.58
	Average	**25.68**	**23.31**	**23.01**

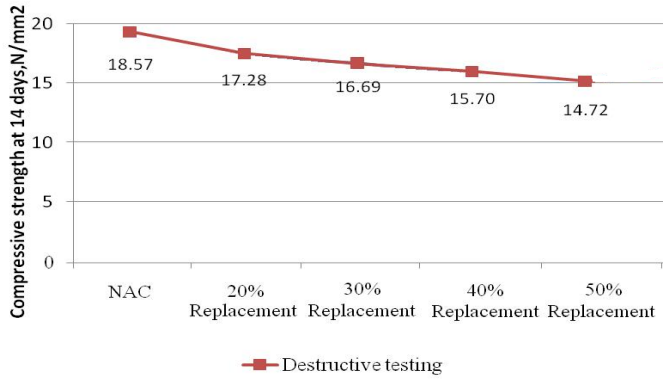
Cube.No	Curing Days	40% Replacement	50% Replacement
1	28	21.15	19.76
2	28	20.23	20.25
3	28	20.51	20.44
	Average	**20.63**	**20.15**

The above tables are the details explanation of compressive test result for 7, 14 and 28 days which clearly explains that the replacement of 20% of Recycled aggregate is the optimum level for partial replacement and also increase in the replacement of RAC decrease the strength of the concrete. Hence the tensile strength for cylinder and the flexural strength for the beam the test has been done for optimum level of replacement and the graphical representation of the compressive strength result has been given below

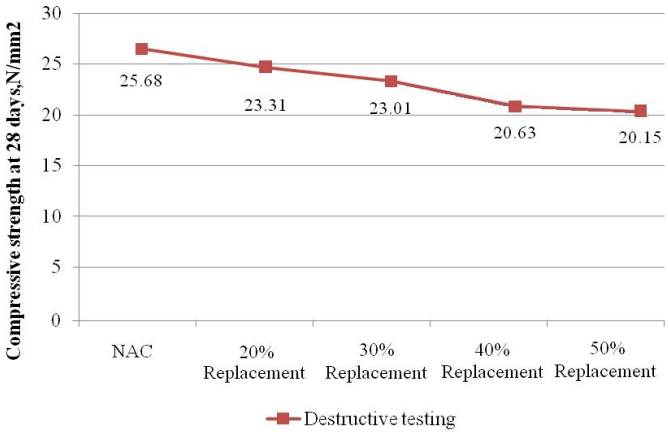
Graphical representation of compressive test result of 7 days



Graphical representation of compressive test result of 14 days



Graphical representation of compressive test result of 28 days



Tensile strength test

The cylindrical specimens were tested for split tensile strength at 28 days. The specimen were submerged in clean fresh water in a curing tank and kept there until taken out just prior to test. The specimens are not to be allowed to become dry at any time until they have been tested. The specimens are tested immediately on removal from the water whilst they are still in a wet condition. The dimensions of the specimens and their weight were recorded before testing. Three specimens were tested for 28days average was taken. Two packing strips of plywood 3mm thick were provided between the specimen and the platen, one at top and another at bottom. One of the plywood strips was centered along the centre of the lower pattern. The specimen was placed on the plywood strip and aligned so that, the central horizontal axis of the specimen is exactly perpendicular to the load applying axis. The second plywood strip was placed length wise on the cylinder and the top platen was brought down till it touched the plywood. The load was applied without shock and increased continuously until the resistances of the specimen to the increasing load broke down and no greater load can be sustained. The maximum load applied was then recorded. Any unusual type of failure was noted. According to IS-5816-1999 Split Tensile Strength of Concrete Method of Test, the split tensile strength was determined. The size of the specimen is 10cm diameter and 20cm height.

Split Tensile strength result for 7 days

Cylinder.No	Curing Days	NAC	20% - Replacement
1	7	1.56	1.00
2	7	1.62	1.02
3	7	1.71	1.03
	Average	**1.63**	**1.16**

Split Tensile strength result for 14 days

Cylinder.No	Curing Days	NAC	20% - Replacement
1	14	1.96	1.61
2	14	2.01	1.85
3	14	1.95	1.71
	Average	**2.00**	**1.72**

Split Tensile strength result for 28 days

Cylinder.No	Curing Days	NAC	20% - Replacement
1	28	2.34	1.86
2	28	2.21	1.92
3	28	2.15	1.77
	Average	**2.23**	**1.85**

Flexural strength test

In reinforced concrete construction the strength of the concrete in compression is only taken into consideration. But the design of concrete beams is often based on flexural strength of the concrete. Therefore, it is necessary to access the flexural strength of the concrete. Here we are calculating the flexural strength of the sand with bagasse ash concrete.

The bagasse ash concrete beam is prepared and it is placed in the mould after applying the mould releasing agent. Then the specimens are removed after 24 hours and are placed at the room temperature for curing for 28 days. When the curing period is over, the specimens are taken out and the moisture should be removed. The specimen is tested under two point loads in a UTM with 0.40 MN capacities. The specimen sizes are 100 x 100 x 500 mm

Flexural strength result for 28 days

Beam.No	Curing Days	NAC	20% - Replacement
1	28	8.12	7.47
2	28	8.24	7.18
3	28	7.98	7.62
	Average	**8.11**	**7.42**

V. RESULT AND CONCLUSION

The main aim of this project work is to establish the compressive strength, split tensile strength for the optimum result and flexural strength for the optimum result in comparison with Partial replacement of Recycled Aggregate in Concrete and Natural Aggregate Concrete (NAC) and to study the effect of amount of replacement (i.e. some percentage of natural coarse aggregate is replaced by the recycled coarse aggregate) on the compressive strength and also the workability aspect of fresh concrete has also been reviewed.

1. The compressive strength obtained is less than the mean target strength obtained in the mix design.

2. The 20% replaced NAC is having optimum value i.e. its value is near to the compressive strength value of NAC.

3. The compressive strength decreases with increase in amount of replacement of natural aggregate by recycled aggregate.

4. The spilt tensile strength and flexural strength is found out for NAC and 20% optimum replacement.

5. The partial replacement (20% - optimum) of recycled aggregate in concrete can be used as structural elements like columns, beams, slabs etc… in multi storied buildings.

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