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"Experimental Investigation of Green Concrete in Construction Industry by Using Recycled Aggregate"

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***Abstract:** In this study the natural aggregate replaced by recycled aggregate in different percentages (0%, 20%, 40%, 60%, 80%, 100%). The percentage of recycled aggregate mixed in the definite proportion it improves the property of fresh and hardened concrete like slump test, compressive strength test up to optimum percentage. From the laboratory test results indicates that the compressive strength of these mixtures goes on decreasing, however up to the 20% replacement level, it achieves target mean strength. Hence, for the structural concrete Natural Aggregate can be replaced by the Recycled Aggregate up to 20% range.*

I. INTRODUCTION

Due to the high amount of concrete produced and the high amount of waste generated by the demolition of old buildings, recycling of concrete has become necessary. New designs, production processes and wear and tear are causing the destruction of concrete structures. It is important to manage this waste in an environmentally friendly way to save space in landfills and storage areas. The recycling process begins with the careful management of recycled materials. Then comes the crushing stage, which can be done in many ways. The most common method is jaw crushers, but cone crushers and large impact crushers are also used. Sometimes the stone may need to be crushed several times to achieve the desired consistency. After crushing, the products are inspected. A coarse screen separates dirt and foreign matter, while a fine screen separates small particles from large ones. Additional cleaning processes such as water flotation, manual separation, air separation and electromagnetic separation help recycle minerals. In addition to waste disposal, wet concrete from precast concrete also poses a disposal problem. Between 700 million and 10 billion cubic meters of concrete are produced worldwide each year, of which approximately 50 million cubic meters are not used on construction sites. To solve this problem, cement manufacturer Mapei created ReCon Zero (short for "zero coverage" for reconstruction). ReCon Zero has the ability to form new aggregates when mixed with wet recycled concrete. Transporting aggregates over long distances causes environmental stress. Using RAC helps preserve these natural resources because many of these resources are located in urban areas, making them extremely valuable and useful. Additionally, many older buildings no longer meet current standards and need to be demolished, increasing the amount of waste rock. By integrating recycled concrete into buildings, we can reduce waste, conserve natural resources, and promote urban growth.

II. MATERIAL USED

Cement: In this research work, OPC conforming to IS: 8112-1989 is used. The properties of cement used are shown in Table 1.

Table1:Properties of cement.

Physical Property	Result
Fineness of cement	9%
Normal Consistency	27%
Initial setting time(minutes)	35
Final setting time (minutes)	370
Specific Gravity	3.14

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Sand: Locally existing sand with 4.75 mm maximum dimension is used as FA, having specific gravity, fineness modulus and unit weight as given in Table 2.

Table2:Properties of sand (FS)

Physical Property	Result
Fineness modulus	3.2
Specific Gravity	2.67
Surface Texture	Even
Particle shape	Curved

Natural Aggregate: Crushed stone with 20 mm maximum size having specific gravity, fineness modulus and unit weight as given in Table 3 are used as natural aggregate.

Table3: Properties of Aggregate (FA)

Physical Property	Result
Fineness modulus	7.56
Specific Gravity	2.70
Particle shape	Angular

Recycled Aggregate: The RAC passing through 20mm and retained on 4.75mm size aggregate is used.

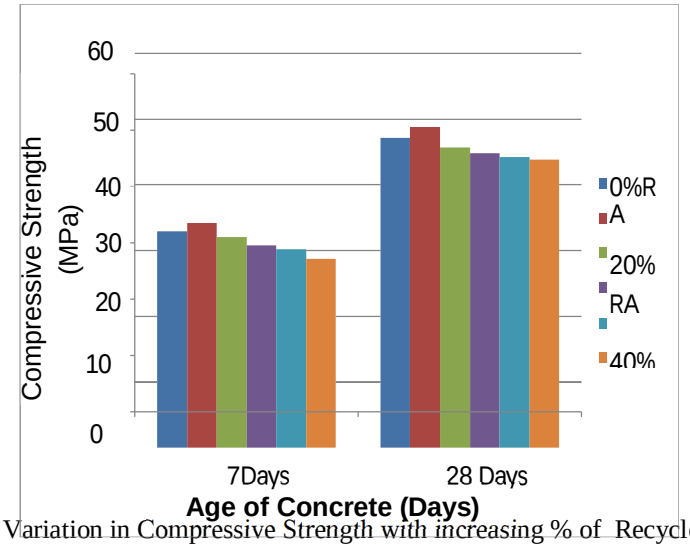
III. EXPERIMENTAL WORK & RESULT

A. Testing of Concrete

Compressive Strength: The compressive strength test by Compression Testing machine shows an increasing trend of the compressive strength with age of the concrete specimens. Table-4 below shows the increase of the compressive strength with age recorded during the test.

Table4: Variation of compressive strength with

% of RA	0%	20%	40%	60%	80%	100%
7 Days	32.96 MPa	34.16 MPa	32.07MPa	30.81 MPa	30.21MPa	28.81MPa
28 Days	47.18MPa	48.81MPa	45.70MPa	44.81MPa	44.22MPa	43.88MPa



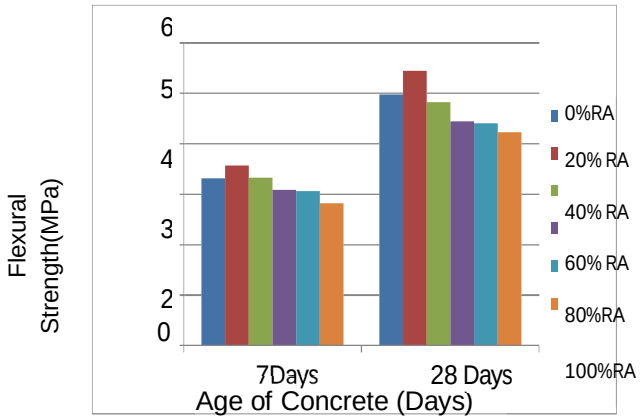
Graph1: Variation in Compressive Strength with increasing % of Recycled Aggregate

B. Flexural Strength

Flexural strength test is performed on 2 beams of each batch mix for 7 days & 28 days. There are 6 batch mixes and each one having 9 beams. Of these 9 beams, 3 beams are tested for 7 days & 28 days each. An average of 3 values as tabulated in table 5, are considered for discussions

Table5: Variation of flexural strength with age

% of RA	0%	20%	40%	60%	80%	100%
7 Days	2.62 MPa	3.33MPa	3.28MPa	2.87MPa	2.69MPa	2.43MPa
28 Days	5.26MPa	5.64MPa	5.10MPa	4.70MPa	4.60MPa	4.48MPa



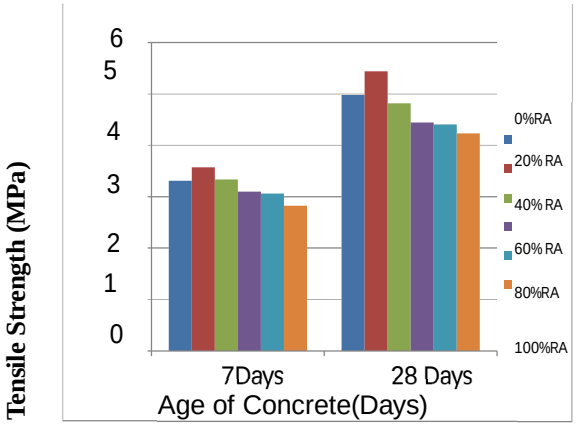
Graph2: Variation in Flexural Strength with increasing % of Recycled Aggregate

C. Split Tensile Strength

Split Tensile Strength is performed on 3 cylinders of each batch mix for 7 days & 28 days. There are 7 batch mixes and each one having 9 cylinders. Of these 9 cylinders, 3 cylinders are tested for 7 days & 28 days each. An average of 3 values as tabulated in table 6, are considered for discussions

Table6: Variation of Split Tensile strength with age

% of RA	0%	20%	40%	60%	80%	100%
7 Days	3.31MPa	3.57 MPa	3.33MPa	3.09MPa	3.06MPa	2.82MPa
28 Days	4.98MPa	5.44MPa	4.82MPa	4.44MPa	4.40MPa	4.23MPa



Graph3: Variation in Tensile Strength with increasing% of Recycled Aggregate

IV. CONCLUSION

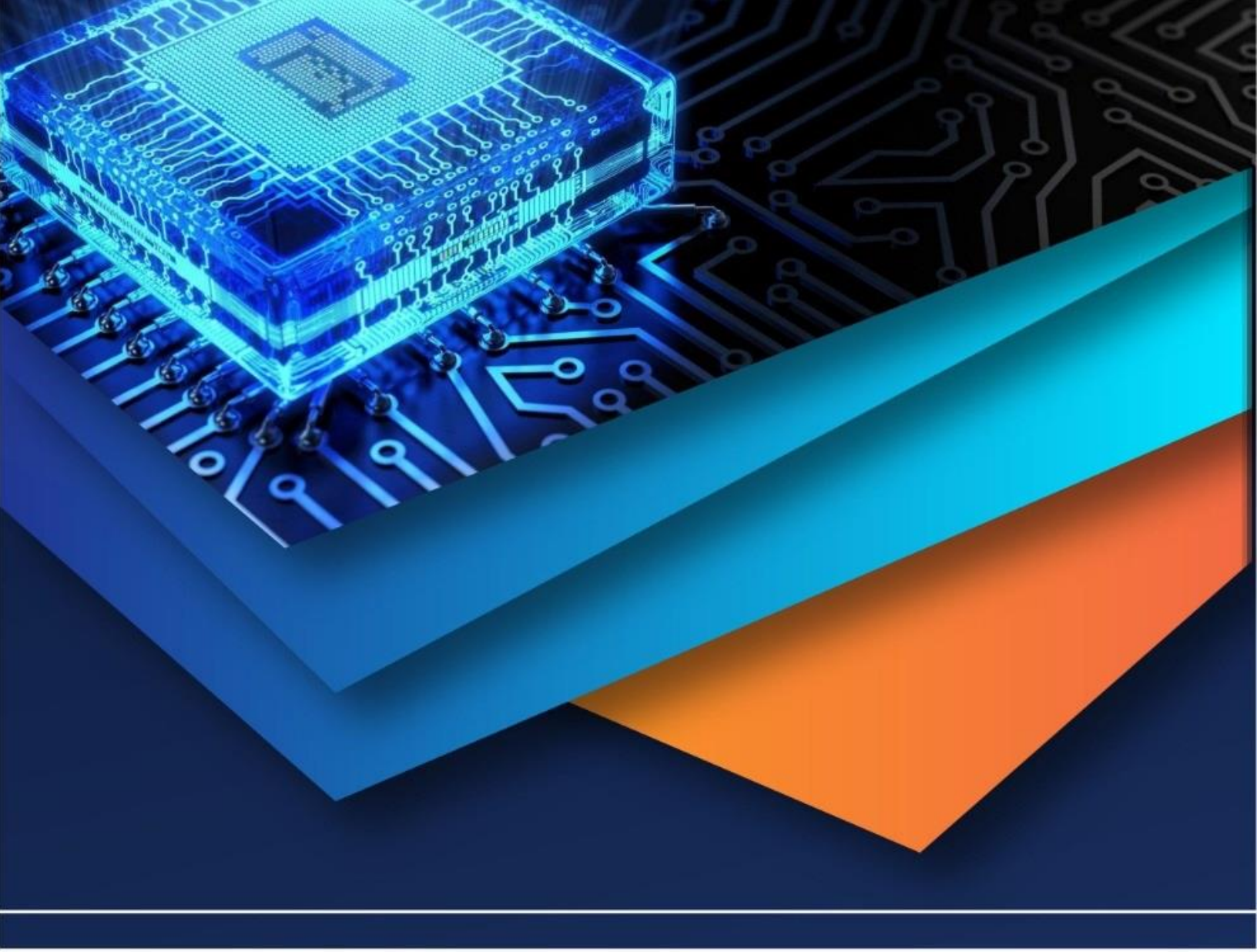
Based on experimental observations, following conclusions can be drawn

1) Optimum compressive strength observed when recycled aggregate replacement is about 20%.
2) Maximum split tensile strength was observed when recycled aggregate replacement is about 20%.
3) Maximum flexural strength was observed when recycled aggregate replacement is about 20%.
4) Before testing, it is observed that there is increase in weight of concrete specimen when it has been cured under water for 7 and 28 days.

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