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Experimental Study on Recycled Aggregate Concrete

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Abstract: ***The use of recycled concrete aggregate (RCA) in concrete as partial replacements of natural coarse aggregate is growing interest in the modern construction industry. As it reduces the demand of for virgin aggregate.In addition, the use of RCA leads to possible solution to the environment problem caused by concrete waste and reduces the negative environmental impact of the aggregate extraction from the natural resources.This experimental studies presents a comprehensive review on the use of recycled coarse aggregates (RCA) are discussed in this report. However, more emphasis has been given to discuss the effect of RCA on fresh concrete and hardened concrete properties and durability of concrete.***
Keyword: Modern, Comprehensive, Durability, Discussed, Demand.

I. INTRODUCTION

Construction aggregates make up more than 80 % of the total aggregate market, and are used mainly for building constructions and pavements.

By the construction activities increasing enormously, and we falling short of construction aggregates it has become necessary to find an alternate source for the material. Projections for building material necessity for the housing sector indicate an inadequacy of aggregates to the extent of about 55,000 million m3. Approximately about 750 million m3 additional aggregates would be required for achieving the targets of the road sector. At this stage the concept of utilization recycled aggregate has proved to be a good mutually exclusive.

II. OBJECTIVE OF THIS STUDY

The study taken up for this dissertation has been covered

A. Many types of general bulk fills;
B. Bank protection;
C. Base or fill for drainage structures;
D. Road construction;
E. Making embankments;
F. Construction of low rise buildings;
G. Manufacture of paving blocks & tiles

III. LITERATURE REVIEW

Dabhade et al. (2014) state that Crushing Value of an aggregate is the Resistance offered by aggregate under a gradually applied compressive load. Crushing value of the recycled coarse aggregate is higher than that of natural coarse aggregate.

G. Shinde et al. (2013) Examine that Impact test is the good indicator of strength and durability. Impact value of RA was found to be more than NA and other type of RA. So the recycled aggregate are relatively weaker than natural aggregate.

Hiren A. Rathod et.

Al (2013) state that, Specific gravity is the ratio of the mass of a solid to the mass of an equal vol.no. of water at the same temperature. Specific gravity of recycled aggregate concrete is less than that of natural coarse aggregate.

Ms. Manjushree et al. conclude in 2013 that water absorption of recycled aggregate is about 3 to 5% higher than Natural Aggregate. It is therefore important that water absorption of RA is determined carefully prior to their use in concrete as the strength of concrete decreases with increase in water absorption.

Preeti Saini(2015) studied that more than 50% of recycled aggregate have adhered mortar paste. In almost all the cases this paste is identified to be of poorer quality than the new paste.

IV. Mix DESIGN

Based on trial mixes for different proportion of ingredients the final mix was selected for M20 grade of concrete. The mix design was done according to the IS: 10262- 2009 .All the mixes are designed by keeping the water content constant. Once the optimum mix was determined for each grade, it was used to produce concrete with 0%, 10%, 20%, 30%, 40% and 50% RAC by weight replacement of natural coarse aggregate. The mix proportions were designed by assuming the aggregates in saturated surface dry condition.

A. Mix Design for M20 grade

Design stipulation: Characteristic compressive strength required in field at 28 days is 20 N/mm2; Maximum size of aggregate is 20 mm (angular); Degree of workability is 0.90C.F; Degree of quality control is Good; Type of exposure is Mild.

B. Selection of Water and Sand Content

For aggregate size 20mm, water content including surface water, per cubic meter of concrete is 186kg. Sand content as percentage of total aggregate of absolute vol.no. is 35%

C. Determination of Cement Content

Water cement ratio = 0.50
Water = 191.6 lit
Cement = 191.58/0.50 =383.16 kg/m3

Table 4.1 Mix Proportion for Controlled Sample for W/C=0.50

Mix Designation	NAC	RAC 10	RAC 20	RAC 30	RAC 40	RAC 50
Cement (kg/m^3)	383	383	383	383	383	383
Natural fine aggregate (kg/m^3)	580	580	580	580	580	580
Natural coarse aggregate(kg/m^3)	1217	1095.3	973.6	851.9	730.2	608.5
Recycled coarse aggregate(kg/m^3)	0	121.7	243.4	365.1	486.8	608.5
Water in total (lit)	191.58	191.58	191.58	191.58	191.58	191.58
Water Cement ratio	0.50	0.50	0.50	0.50	0.50	0.50

V. TEST CONDUCTED ON SPECIMENS

In this section test setup for compressive test, and split tensile strength were discussed.

A. Compressive Strength Test

Various cubes of 150mm x 150 mm x 150 mm were casted for conducting compressive strength test for prepared mix. The compressive strength carried out as per IS code 516-1959. This test was carried out at the end of 7days and 28 days of curing. The compressive strength was calculated by failure load divided by cross sectional area. The Compressive strength can be calculated by dividing the max load applied to the area of the cube.

Fig. 5.1 Compressive strength of concrete cube setup

B. Split Tensile Strength Test

Various cylindrical specimens of 150 mm dia. x 300mm long were casted for conducting split tensile strength test for prepared mix. This test was carried out at the end of 7 days and 28 days of curing.

Figure 5.2 Split tensile strength of cylinder setup

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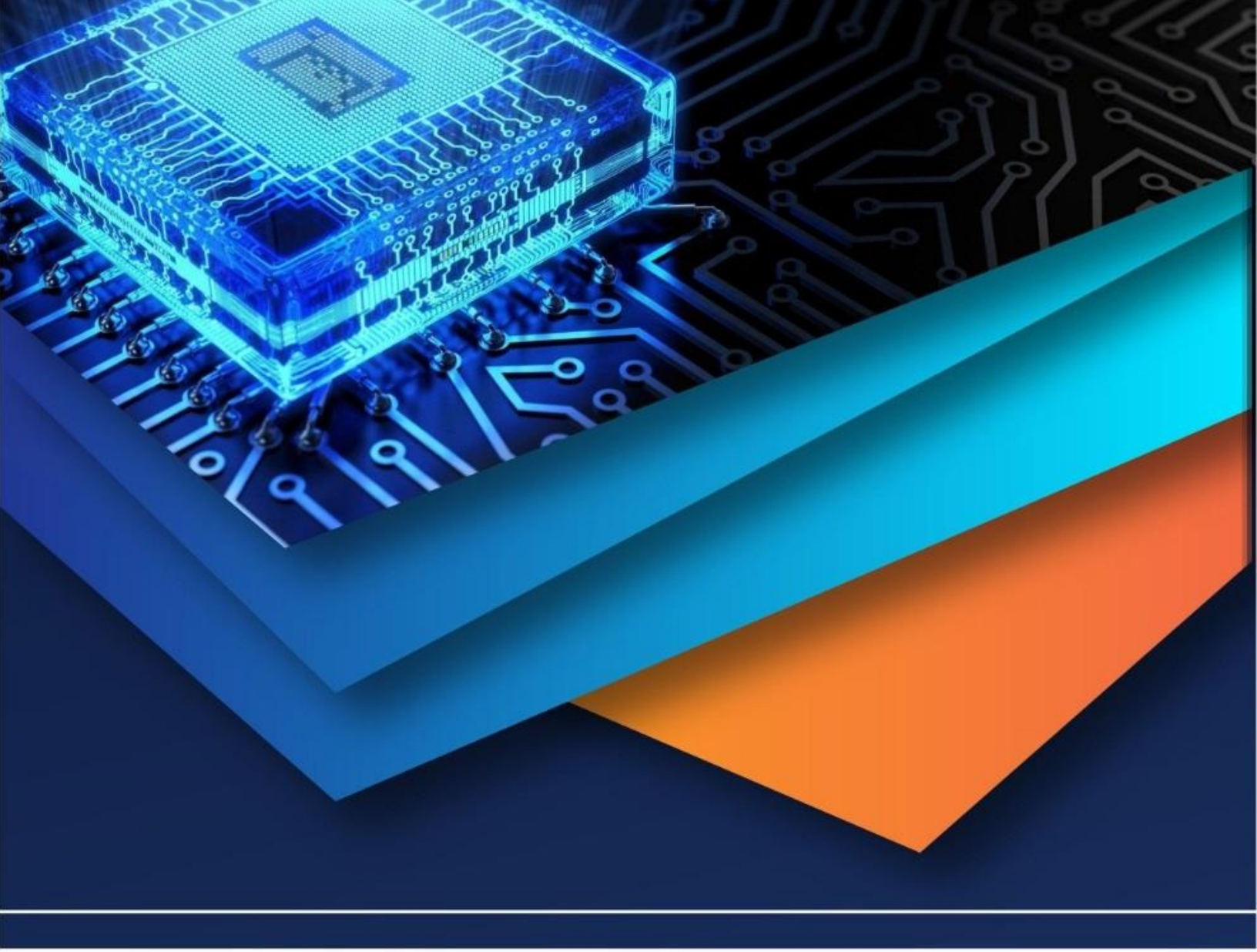

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