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Experimental Investigation of Self curing Concrete using Recycled Aggregate

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Abstract: Use of recycled aggregate in concrete can be useful for environmental protection. Recycled aggregates are the materials for the future. The application of recycled aggregate has been started in a large number of construction projects of many European, American, Russian and Asian countries. Many countries are giving infrastructural laws relaxation for increasing the use of recycled aggregate. This report shows the strength and durability properties of recycled coarse aggregate & also compares these properties with natural aggregates.As water is becoming a scarce material day-by-day, there is an urgent need to do research work pertaining to saving of water in making concrete and in constructions. Curing of concrete is maintaining satisfactory moisture content in concrete during its early stages in order to develop the desired properties. Curing of concrete plays a major role in developing the concrete micro structure and pore structure and hence improves its durability and performance. Keeping importance to this, an attempt has been made to develop Self Curing Concrete by using wax based external curing as self curing agents. Compressive strength and durability of concrete containing self curing agents is investigated and compared with conventionally cured concrete. Self curing agent increases the water retention capacity of the concrete by reducing evaporation of water from concrete.
Keywords: Recycled Aggregate (RA), Self Curing Concrete (SCC), Water Scarcity, Recycled Aggregate Concrete (RAC), Concure WB

I. INTRODUCTION

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. The main reasons for this situation are changes of purpose, structural deterioration, rearrangement of a city, expansion of traffic directions and increasing traffic load, natural disasters (earthquake, fire and flood), etc. In India 27% of the total waste generated is construction and demolition waste (C&DW), and of this concrete represents 25%, i.e. 7% of the total waste Many countries have recycling schemes for C&DW to avoid dumping to landfill, as suitable landfill sites are becoming scarce particularly in heavily populated countries. The most common method of managing this material has been through its disposal in landfills. In this way, huge deposits of construction waste are created, consequently becoming a special problem of human environment pollution. For this reason, in developed countries, laws have been brought into practice to restrict this waste in the form of prohibitions or special taxes existing for creating waste areas.

On the other hand, production and utilization of concrete is rapidly increasing, which results in increased consumption of natural aggregate as the largest concrete component. A possible solution to these problems is to recycle demolished concrete and produce an alternative aggregate for structural concrete in this way. Recycled concrete aggregate (RCA) is generally produced by two-stage crushing of demolished concrete, and screening and removal of contaminants such as reinforcement, paper, wood, plastics and gypsum. Concrete made with such recycled concrete aggregate is called recycled aggregate concrete (RAC).

Recycling or recovering concrete materials has two main advantages - it conserves the use of natural aggregate and the associated environmental costs of exploitation and transportation, and it preserves the use of landfill for materials which cannot be recycled. But Concrete with aggregate from recycled materials, which enables saving sources of natural aggregate, is considered to have generally worse mechanical properties than common concrete. So the idea to increase strength of concrete mixture with recycled aggregate will change material properties of such concrete was researched, which would in turn improve the behavior and bring about new types of applications.

II. LITERATURE REVIEW

In Mohammed Shafeeque and et.al**.** Paper aim of this investigation was to study about the strength properties of concrete using water soluble Polyethylene Glycol as the self-curing agent. The optimum dosage of PEG600 for maximum strength (compressive and tensile) was found to be 1% for both M20 and M25 grade.

N.Sivakumar and et.al. (2014)Result found in this research paper is that when the percentage of RCA replacement was increased, compressive strength gets reduced. However when water/cement ratio of mix was decreased, the compressive strength increases. The target compressive strength (40MPa) can be achieved for 30 to 40 % of RCA replacement by decreasing the water cement ratio and adjusting the admixture content of mix. The percentage loss in weight of concrete cubes after the conduct of acid resistance test is negligible for 30 to 40% RCA replacements.

V. Bhikshma and K. Divya (2012) Result found in this research paper is that The compressive strength of recycled aggregate for each grade increases till 20% fly ash and decreases for 30% addition of fly ash. The permeability of natural aggregate is less than the recycled aggregate without the addition of fly ash. But when compared to the recycled aggregate concrete with addition of fly ash the natural aggregate concr ete has more permeability because fly ash provides dramatic lubricating effect which greatly reduces water demand (2% to 10%).

Mr. Tushar R Sonawane and Prof. Dr. Sunil S. Pimplikar (2013) Result found in this research paper is that Use of recycled aggregate up to 30% does not affect the functional requirements of the structure as per the findings of the test results. Various tests conducted on recycled aggregates and results compared with natural aggregates are satisfactory as per IS 2386. Due to use of recycled aggregate in construction, energy & cost of transportation of natural resources & excavation is significantly saved. This in turn directly reduces the impact of waste material on environment.

III. METHODOLOGY

A. All the materials were obtained on site. The proportion of materials to be used was calculated as per the concrete mix design for M25 grade.
B. Recycled concrete aggregate replacement was done by various percentage by weight of coarse aggregate 20 mm in respective proportions.
C. Then crushing and sieving were done on site. Crushed sand was used as a fine aggregate.
D. The percentage of admixture were decided as per trial and error basis and final percentage of admixture was 0.5%, 1%, 1.5% by weight of Cement.
E. The mixing was done in a mixer. Firstly dry mixing of aggregates, cement is done.
F. Water was added during the process of mixing. After adding 80% water, Admixture was added gradually and after that remaining 20% water were added. Mixing process was done within 1 minute. After mixing slump cone test on fresh concrete were taken. Then concrete was poured in 3 layers in well-greased moulds. Hand tamping was adopted as per specifications in the IS code for proper compaction.
G. After 25 blows on each layer moulds were kept on vibrating table to avoid voids.
H. Three specimen of cubes of different replacement levels for different tests were casted.
I. After 24 hours, the demoulding is done and the self curing paste is applied on the surface of cubes in 2 layers and kept in shade for 7 days for curing. With proper curing of 7 days the composite was taken for testing.
J. The compressive strength test was carried out on hardened concrete.
K. Before testing, weights of all composites were noted.
L. Cube moulds were of size 150mm conforming to IS: 10086-1982.
M. Cubes were tested on a Universal Testing machine. Gradual load was applied and readings were noted at failure.
N. Testing of 7 days curing were carried out for different replacement levels 0% (conventional curing), 0.5%, 1%, 1.5% (self curing).

O. Concrete Mix Design (Is: 13920-2009)

Specific gravity of cement = 3.15
Specific gravity of coarse aggregate = 2.89
Specific gravity of fine aggregate = 2.77
STEP 1: Target strength for mix proportioning.

$$f_{ck}' = f_{ck} + 1.65\, s$$

Where,

fck'= target average compressive strength at 28 days,

fck = characteristic compressive strength at 28 days, and

s = standard deviation.

STEP 2: Selection of water-cement ratio.

Assume w/c ratio = 0.32 < 0.45 (From Table 5 of IS 456)

STEP 3: Selection of water content.
Maximum water content =186 liter (for 25 to 50 mm slump range) for 20 mm aggregate.
Estimated water content for 100 mm slump = 186 + 6
As superplasticizer is used, reduce water content by 20 %.
New water content = 197 liter
STEP 4: Calculation of cement content.
Water cement ratio = 0.32
Cement content = 157.72
STEP 5: Proportion of volume of coarse aggregate and fine aggregate content.
Volume of coarse aggregate corresponding to 20 mm size aggregate and fine aggregate (Zone II) .For water-cement ratio of 0.50 = 0.62.
In the present case water-cement ratio is 0.32. Therefore volume of coarse aggregate is required to be increased to decrease the fine aggregate content.
As the water-cement ratio is lower by 0.20, the proportion of volume of coarse aggregate is increased by 0.04 (at the rate of -/+ 0.01 for every ± 0.05 change in water-cement ratio).
Therefore, corrected proportion of volume of coarse aggregate for the water-cement ratio of 0.32 =.
Volume of fine aggregate content =
STEP 6: Mix calculations.
Volume of concrete = 1 m3
Mass of coarse aggregate = *f* x Volume of coarse aggregate x Specific gravity of coarse Mass of fine aggregate = *e* x Volume of fine aggregate x Specific gravity of fine agg.
STEP 7: Mix proportions.
Cement : F.A: C.A: Water

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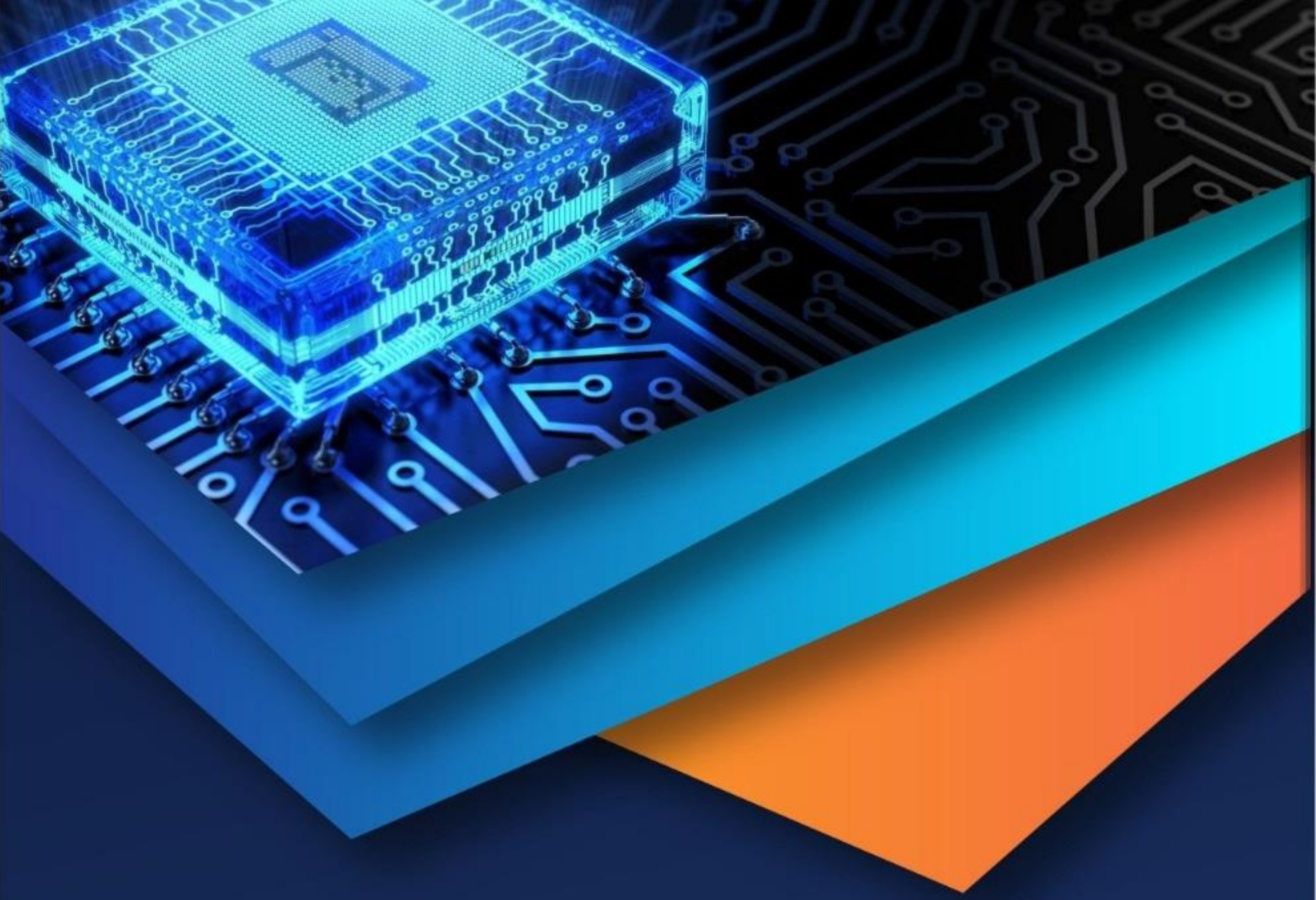

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