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The Effect on the behavior of Concrete by using Recycled Aggregate Concrete

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Abstract This research review represents the collection of data from various previous studies done on the behavior and properties of recycled aggregate concrete. Construction industry generates large amount construction & demolition waste. This waste may be in the form of debris & building materials such as broken bricks, mortar, concrete, steel. At the same time foundry industry also generates large amount of waste sand. The foundry sand is sand used for the formation of moulds essential in the casting process. After the completion of its usefulness,it is dumped in open areas or low laying areas. The waste from construction & demolition are also dumped in open land & low laying areas. This process disturbs the environment & pollutes the ground water. Recycled aggregates concrete utilizes materials from concrete and masonry constructions. Reuse of demolition waste avoids the problem of waste disposal and is also helpful in reducing the gap between demand and supply of fresh aggregate. Many researchers state that the recycled aggregates that are obtained from concrete specimen make good quality concrete. For improving the quality of recycled coarse aggregate, various surface treatment methods such as washing the recycled aggregates with water and diluted acid were investigated. Strength properties of the treated and untreated coarse aggregate were compared. The results indicated that the compressive strength of recycle aggregate is found to be less than the natural aggregate. A lot of experiments have been made to investigate the strength behaviour of recycled aggregate concrete using demolition waste. The behaviour of concrete like workability, variation of strength made with recycled aggregate is more or less similar to conventional concrete. A comparative analysis of the experimental results of the properties of fresh and hardened concrete with different replacement ratios of natural with recycled coarse aggregate is presented in the paper. Recycled aggregate was made by crushing the waste concrete of laboratory test cubes and precast concrete columns. Three types of concrete mixtures were tested: concrete made entirely with natural aggregate (NAC) as a control concrete and two types of concrete made with natural fine and recycled coarse aggregate (50% and 100% replacement of coarse recycled aggregate).

Keywords: Construction material, demolition waste, recycled coarse aggregate, compressive strength, Acids.

1. INTRODUCTION

Concrete is the world's second most consumed material after water, and its widespread use is the basis for urban development. It is estimated that 25 billion tonnes of concrete are manufactured each year. Concrete is the premier construction material across the world and the most widely used in all types of civil engineering works, including infrastructure, low and high-rise buildings, defence installations, environment protection and local/domestic developments. Concrete is a manufactured product, essentially consisting of cement, aggregates, water and admixture. Among these, aggregates, i.e. inert granular materials such as sand, crushed stone form themajor part. Traditionally aggregates have been readily available at economic price. On the other hand over 1 billion tonnes of construction and demolition waste is generated every year worldwide. Crushed concrete is available nowadays in large quantities, which also results from the demolition of old structures and waste concrete from new structures. Every year, it is estimated that 2% to 10% (average of 5%) of the estimated ready mixed concrete produced is returned to the concrete plant which is also of great concern to dispose off. The use of the recycled aggregates created from construction and demolition waste in new construction has become more important over the last two decades. Waste minimization and reducing the burden on landfills is a global issue. Extensive research has been carried out worldwide on the use of recycled aggregate in concrete. The reuseof hardened concrete as aggregate is a proven technology - it can be crushed and reused as a partial replacement for natural aggregate in new concrete construction. Recycling construction waste is vital both in order to reduce the amount of open land needed for land filling and to reduce depletion of raw materials. 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 formaterials which cannot be recycled. Many attempts to develop high-grade uses of construction waste, i.e., as aggregate for the manufacturing of new concrete, are made in last few decades. A decrease in the compressive strength was generally observed in all concretes in which the natural coarse aggregate was replaced with recycled aggregate prepared by the crushing of old concrete. In the current paper

we are going to study the feasibility of Recycled Aggregate in concrete manufacturing when it is blended with different proportions of fly ash and admixtures. We are going to study strength characteristic of concrete made with optimum proportions of ingredients.

II. LITERATURE REVIEW

LIMBACHIYA AND LEELAWAT (2000)[1], found that recycled concrete aggregate had 7 to 9% lower relative density and 2 times higher water absorption than natural aggregate. according to theirtest results, it shown that there was no effect with the replacement of 30% coarse recycled concrete aggregate used on the ceiling strength of concrete. it also mentioned that recycled concrete aggregate could be used in high strength concrete mixes with the recycled concrete aggregate content in the concrete.

Sagoe, Brown and Taylor (2002)[2],stated that the difference between the characteristic of fresh and hardenedrecycled aggregate concrete and natural aggregate concrete is relatively narrower than reported for laboratory

crush recycled aggregate concrete mixes. There was no difference at the 5% significance level in concrete compressive and tensile strength of recycled concrete and control normal concrete made from natural aggregate.

Akansha Tiwari (2015)[3], studied about water absorption of RCA and founded that water absorption is higher than the natural aggregate also the compressive strength of concrete containing 50% of RCA has strength approximately to that of normal concrete. Also her study tells that Concrete has good tensile strength when replaced up to 25-30%.

Vinod Sunhere and Rajesh Joshi (2015) [4],studied and their test results suggest that as the percentage of Natural Aggregate decreases by replacing the Recycled Concrete Aggregate, the corresponding strength goes on decreasing, yet up to 60% replacement it achieves target mean strength.

N.Sivakumar (2014)[5], et al studied the percentage of RCAreplacement and founded that when RCA replacement increases, its compressive strength gets reduced. However when water/cement ratio of mix was decreased, the compressive strength increases. In their study results show that 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.

Prof. Dharmesh K. Bhagat et al(2014)[6], from their study concludes that the, recycled coarse aggregate has comparatively less specific gravity than Natural coarse aggregate. Water absorption of Recycled coarse aggregate was found greater then Natural coarse aggregate, because of adhesive property in cement mortar and cement paste. Result shows that the compressive strength for the use of Recycled coarse aggregate up to 40% can affect the stability requirements of concrete structures.

Yong.P.C and Teo,D.C (2009)[7], performed experiment in which the 28 day strength concrete cubes were crushed to suitable size and reused as recycled coarse aggregate. The w/c used in all mixes is 0.41. The proportion of cement: sand: gravel is 1: 1.11: 2.07. And they concluded that RAC can achieve high compressive strength, split tensile strength as well as flexural strength.

Parekh.D.N.,et al., (2009)[8], reported the basic properties of recycled fine aggregate and recycled coarse aggregate. Basic concrete properties like compressive strength, flexural strength, workability etc were explainedhere for different combinations of recycled aggregate with natural aggregate. And concluded that RA can be used in concrete and that there are few (if any) applications issues related to its use.

III. MATERIAL USED

Ordinary Portland Cement (OPC) is the most common cement used in general concrete construction when there is no exposure to sulphates in the soil or groundwater.OPC is a gray coloured cement powder. It is capable of bonding mineral fragments into a compact whole when mixed with water. This hydration process results in a progressive stiffening, hardening and strength development.

Recycled aggregate is produced by crushing concrete, and sometimes asphalt, to reclaim the aggregate. Recycled aggregate can be used for many purposes. The primary market is road base. For information on recycling asphalt pavement into new asphalt pavement.

IV. CHARACTERISTICS OF MATERIALS

Durability of Recycled Aggregate (RA) can be influenced by coarse aggregate replacement ratio, concrete age, w/c ratio, and moisture content; generally, a lower w/c ratio generates a more durable concrete mix. RAconcrete is less durable due to high porosity of recycled aggregate. However, lower resistance to ingress of certain agents might be compensated by the combination of recycled aggregate with CO_2 and chlorides which reduces their penetration rates. SCM are used to improve strength and durability of RA concrete

50 to 100 % replacement of virgin aggregates with recycled aggregate decreases the compressive strength by 5to 25 %. However, it was found that up to 30 % virgin aggregate can be substituted with RCA without any effects on concrete strength

Recycled aggregate has marginal influence on flexural strength, some studies showed that flexural strength reduction is limited to 10 % in RA concrete. Others indicated that RA concrete has very similar flexural behavior with virgin aggregate concrete.

Shrinkage and creep deformation of RA concrete are higher than those of conventional concrete, 25 and 35 % higher, respectively. Percentage of substitution, size and source of parent aggregate, mixing procedure, curing, SCM and chemical admixture affect shrinkage and creep of the RA concrete. Recent studies showed improved behavior could be achieved by mix proportioning, low w/c ratio and curing.

V. NECESSITY FOR THE RE-USE OF RECYCLED AGGREGATE CONCRETE(RAC)

Recycling and reuse of building wastes have been found to be an great idea in solving problems of dumping hundreds of thousands tons of debris accompanied with shortage of natural aggregates. Due to need of sustainable development and limited natural resource we need to put 3R concept into use. We have to follow theconcept behind it that is Reduce, Reuse and Recycle. This will promote sustainable development. Sustainability is generally recognized as a foundation for resource and energy – saving technology developments in many fields including that of construction. The term sustainable construction materials has increasingly been adopted throughout the concrete industry; but usually incorrectly as a synonym for recycled materials.

With Evolution recycled aggregates in concrete can proves to be valuable building materials in technical, environment and economical respect. Considering the cost of Recycled aggregate negligible as compare to natural aggregate they possess relatively lower bulk density, workability, crushing and impact values and higher water absorption. However, more research and initiation should be there for application of RCA and modifying our design codes, specifications and procedure for use of recycled aggregate concrete.

VI. CONCLUSION

Experimental investigations were conducted to determine the Characteristics and Strength of concrete byreplacing of coarse aggregate with Recycled Aggregates. Concrete specimens were casted and tested to determine the Compressive strength, Split tensile strength and Flexural strength. Based on the test results it was inferred, which percentage gave better results than the conventional concrete with respect to 7,14 and 28 days Compressive strength, Split tensile strength and Flexural strength when replaced with Recycled Aggregates.

From various study it is clear that recycled aggregate can be used with natural aggregates. Natural aggregate can be used with Recycle aggregate with a ratio of 80:20, 75:25 and 70:30.Higher ratio of Recycle aggregate can worsen the properties and strength of mix. Due to use of recycled aggregate in construction industry it can slow the impact of waste on environment. It will promote sustainable growth. It will reduce burden on natural aggregate i.e. natural aggregate can be used for other important purpose.

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