Review on Performance of Normal Aggregate Concrete With Recycled Aggregate Concrete

Dr. A. A. Malokar[1], Prof. S. H. Ingle.[2], Ms.Priyanka Parde.[3], Mr.Gaurav Raut.[4], Mr.Gaurav Kunte.[5]
[1, 2, 3, 4, 5] Dept of Civil Engineering
[1, 2, 3, 4, 5] PADM. Dr. v.b.kolte college of engg.malkapur

Abstract- *Recycled aggregates are comprised of crushed, graded inorganic particles processed from the materials that have been used in the constructions and demolition debris. The aim for this project is to determine the strength characteristics of recycled aggregates for ap-plication in high strength structural concrete, which will give a better understanding on the properties of concrete with recycled aggre-gates, as an alternative material to coarse ag-gregate in structural concrete. The scope of this project is to determine and compare the high strength concrete by using different per-centage of recycled aggregates.*

Recycled aggregate is also the type of artificial aggregate which is obtained from Construction and demolition (C&D) wastes. Constructions and demolitions are processes that go hand in hand. The demolished building rubble in India generally goes to waste in landfills. Recycling of these concrete waste materials from building demolition can provide a solution to this problem.

The investigation was carried out us-ing workability test, compressive test and indi-rect tensile test flexural test. There were total of six batches of concrete mixes, consists of every 20% increment of recycled aggregate replacement from 0% to 100% for each grade of concrete. The workability of concrete consi-derably reduced as the amount of recycled aggregate increased. This was evaluated through standard slump test. For strength cha-racteristics, the results showed that a gradual-ly decreasing in compressive strength, tensile strength as well as flexural strength as the percentage of recycled aggregate used in the specimens increased.

Conservation of natural resources and protection of environment is the key to sus-tainable development. Construction engineers and the researchers have to share this critical responsibility. Research is in progress to ex-plore new civil engineering materials which can contribute to the sustainable development. The environmental impact of production of raw ingredients of concrete (such as cement and coarse aggregates) is considerable. The scale of the problem makes it prudent to investigate other sources of raw materials in order to reduce the consumption of energy and available natural resources. In this project program was undertaken which contains a brief analysis of properties of coarse recycled aggregates and judged its effectiveness in use of concrete

Keywords- Recycled aggregate, artificial aggregate

I. INTRODUCTION

1.1 Introduction of Recycled Aggregate

Recycled aggregate is generally produced by two stages crushing of demolished concrete, screening and removal of contaminants such as reinforcement, wood, plastic etc. Concrete made with such aggregates is called as Recycled aggregate.

Recycling is the act of processing the used material for use in creating new product. The usage of natural aggregate is getting more and more intense with the advanced development in infrastructure area. In order to reduce the usage of natural aggregate, recycled aggregate can be used as the replacement materials. Recycled aggregate are comprised of crushed, graded inorganic particles processed from the materials that have been used in the constructions and demolition debris.

1.2 Applications of Recycled Aggregate

Traditionally, the application of recycled aggregate is used as landfill. Nowadays, the applications of recycled

aggregate in construction areas are wide. The applications are different from country to country.When structures made of concrete are to be demolished, concrete recycling is an increasingly common method of disposing of the rubble. Concrete debris was once routinely shipped to landfills for disposal, but recycling has a number of benefits that have made it a more attractive option in this age of greater environmental awareness, more environmental laws, and the desire to keep construction costs down.

II. METHODOLOGY

2.1 Literature Review of Recycled Aggregate

The applications of recycled aggregate in the construction area are very wide. There are many testing based on the recycled aggregate have been carried out all around the world. Hanson and Torben (1986) stated that since 1945, the research on recycled aggregate had been carried out in many countries. Some of the literature reviews on recycled aggregate are shown as below.

The main aim that testing the recycled aggregate is to find out the result of the strength characteristic on it and analysis whether recycled aggregate is suitable to apply in the construction area. According to Rammamurthy and Gumaster(1998), the compressive strength of recycled aggregate concrete was relatively lower and variation was depended on the strength of parent concrete from the obtained aggregate.

Mandal[(1)]stated that adjusted the water/cement ratio when using recycled concrete aggregate during the concrete mixing can improved the strength of the recycled aggregate concrete specimens. From the obtained result, recycled aggregate concrete specimens had the same engineering and durability performance when compared to the concrete specimens made by natural aggregate within 28days design strength.

Sagoe, Brown and Taylor[(2)]stated that the difference between the characteristic of fresh and hardened recycled 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. In the same year, poon (2002) reported that there were not much effect of the compressive strength of brick specimens with the replacement of 25% and 50% of recycled aggregate. But when the percentage of recycled aggregate replacement increased, the compressive strength of the specimens was reducing.

III. TESTING OF AGGREGATE

3.1 Water Absorption of Coarse Aggregate

Test Procedure of Coarse Aggregate

The following apparatus and equipments used were complied with IS 2386 (part III) - 1963.

The test procedure was according to IS 2386 (part III) - 1963. The procedures were as below:

1. Immersed the aggregate in the water at room temperature with the 20mm height of water above the top of aggregate. The aggregate was stirred occasionally to dislodge the air bubbles. The aggregate was immersed for one day (24hours).
2. The aggregate was transferred to the basket and immersed in the water contained in a bath below the balance. The basket was jiggled to dislodge the air bubbles. Then attaché the basket to the hanger balance. The basket and aggregate in the water was weighted and recorded.
3. The basket and aggregate was then removed from the water and let them to drain. All the aggregate was transferred to a dish. The aggregate was dried out after determined the particle density and water absorption.
4. The empty basket was put into the water bath and jiggled to dislodge the air bubbles. The basket was weighted in the water to the nearest 1g and recorded.
5. Surface dried the aggregate by rolling on a dry cloth. The aggregate was spread one stone deep over a dry cloth and allowed it to surface dry. Continue drying until all visible films of water had been removed but the surface of aggregate still damp.
6. The aggregate was dried in the oven at the temperature of 105ºC to 110ºC to get the constant mass.

Table No. 3.1: Water absorption of aggregate.

Sr.No.	Particulars	Natural aggregate	Recycled aggregate
1	Oven dried wt. = W_1	5000 gm	5000gm
2	Surface dried wt. = W_2	5025 gm	5200gm
3	% water absorption	0.5%	4%

The results shows that about 3% difference between natural aggregate and recycled aggregates. The water absorption capacity of recycled aggregate is higher than natural aggregate. The average water absorption rate of recycled aggregate is around 3%, but water absorption rate of

natural aggregate is only 0.9%. This shows that water absorption of recycled aggregate is around 4.5 times of natural aggregate. This result shows that more water needed to be added when using recycled aggregate in the concrete mixing to get an acceptable workability.

3.2 Sieve Analysis

Sieve analysis is used to find the amount of different size of aggregate used in a concrete mix. It is carried out to let the aggregate pass through a series of sieves. The sieve analysis can be done either by hand or sieve machine. It is recommended that using sieve machine will give more accurate result and can use several sieves in one time.

3.2 Aggregate Impact Value (AIV) –

Aggregate Impact Value of a sample is obtained according to IS: 2386 (Part IV). For aggregate impact value test, the sample of the aggregate is placed in a cylindrical container where a standard hammer falling 25 times under its own weight. The impact value is determined as a percentage passing on 2.36mm size sieve.

The high value percentage denotes a low performance of aggregate in concrete or the strength of concretes in the field.

The test Procedure was according to IS 2386 (part IV) - 1963. The procedures were as below:

- The impact machine shall rest without wedging or packing upon the level plate, block or floor, so that it is rigid and the hammer guidecolumns are vertical.
- The cup shall be fixed firmly in position on the base of the machineand the whole of the test sample placed in it and compacted by a singletamping of 25 strokes of the tamping rod.
- The hammer shall be raised until its lower face is 380 mm abovethe upper surface of the aggregate in the cup, and allowed to fall freelyon to the aggregate. The test sample shall be subjected to a total of 15such blows each being delivered at an interval of not less than one second.
- The crushed' aggregate shall then be removed from the cup andthe whole of it sieved on the 2.36-mm IS Sieve until no further significantamount passes in one minute. The fraction passing the sieve shall beweighed to an accuracy of 0.1 g (Weight. e). The fraction retained onthe sieve shall also be weighed (Weight C) and, if the total weight (E+Y)is less than the initial weight (Weight A) by more than one gram, the resultshall be discarded and a fresh test made.

IV. CONCLUSIONS

Research on the usage of waste construction materials is very important due to the materials waste is gradually increasing with the increased of population and increasing of urban development. The reasons that many investigations and analysis had been made on recycled aggregate are because recycled aggregate is easy to obtain and the cost is cheaper than natural aggregate. Natural aggregate need to mining but recycled aggregate can ignore this process.

This on-going research project is to determine the strength characteristics of recycled aggregate for potential application in the structural concrete. The study shows that concrete up to 60% replacement of coarse aggregate with recycled coarse aggregate performed well in both cases. From all the results it was found that, the 60% replacement of coarse aggregate is with natural aggregate is gives satisfying result in both cases or in grades. So, conclusion is that from research is recycled aggregate can be used in certain limit in concrete.

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