A Performance of Normal Ag-Gregate Concrete With Re-Cycled Aggregate Concrete

Dr. A. A. Malokar[1], Ms. Priya Barhate[2], Ms Mariya Kibtiya[3], Ms. Pooja Tayade[4]
[1, 2, 3, 4]Dept of civilengg.
[1, 2, 3, 4]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 application in high strength structural concrete, which will give a better understanding on the properties of concrete with recycled aggregates, as an alternative material to coarse aggregate in structural concrete. The scope of this project is to determine and compare the high strength concrete by using different percentage of re-cycled 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 using workability test, compressive test and indirect 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 con-crete considerably reduced as the amount of recycled aggregate increased. This was evaluated through standard slump test. For strength characteristics, the results showed that a gradually 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 sustainable de-velopment. Construction engineers and the researchers have to share this critical responsibility. Re-search is in progress to explore new civil engineering materials which can contribute to the sustaina-ble development. The environmental impact of production of raw ingredients of concrete (such as ce-ment 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.

Codal Provisions

Tests to be done as per IS : 2386-1963 Methods of test for aggregates for concrete

Part-I Particle size and shape

1) SIEVE ANALYSIS -

This method covers the procedure for the determination of particle size distribution of fine, coarse and all-in-aggregates by sieving or screening.

2) DETERMINATION OF FLAKINESS INDEX-

This method of test lays down the procedure for determining the flakiness index of coarse aggregate.

The flakiness index of an aggregate is the percentage by weight of particles in it whose least dimension (thickness) is less than three-fifth8 of their mean dimension. The test is not applicable to sizes smaller than 6.3 mm.

3) DETERMINATION OF ELONGATION INDEX-

This method of test lays down theprocedurefor determining the elongation index of coarse aggregate. The elongation index of an aggregate is the percentage by weight of particles whose greatest dimension (length) is greater than one and four-fifths times their mean dimension. Normally, the properties of interest to the engineer are sufficiently covered by the flakiness or angularity tests. The elongation test is not applicable to sizes smaller than 6.3 mm.

4) DETERMINATION OF ANGULARITY NUMBER-

This method of test lays down the procedure for determining the angularity number of coarse aggregate.

Angularity or absence of rounding of the particles of an aggregate is 8 property which is of importance because it 8ffeCts the ease of handling of n mixture of aggregate and binder, for example the workability of concrete, or the st8bility of mixtures that rely on the interlocking of. the particles. It is emphasized that this is e laboratory method intended for comparing the properties of different aggregates for mix, design purposes.

Since considerably more effort is used then in the test for bulk density end voids [see IS : 2336 (Part III)-1963 1, the results of the two tests are different. Also weaker 8ggreg&es may be crushed during compaction, end the angularity number test does not apply to any aggregate which breaks down during the test.

Part -III Specific gravity, density, voids, absorption and bulking.

1) Determination of specific gravity and water absorption-

This test covers the procedures for determining the specific gravity, apparent specific gravity and water absorption of aggregates.

Three main methods are specified for use according to whether the size of the aggregate is large than 10 mm (Method I) between 40 mm and 10 mm (Method I or II may be used); or smaller than 10 mm (Method III). An alternate method (Method IV) is al.30 permitted.

The water absorption test will not always be reproducible with aggregate of high porosity.

2) Determination of Bulk Density and Voids-This method of test covers the procedure for determining unit weight or bulk density and void of aggregates.

The bulk density is the weight of material in a given volume, and for the purpose of this standard it is measured in kilograms per liter. The bulk density of an aggregate is affected by several factors, including the amount of moisture present and the amount of effort introduced in filling the measures. It is emphasized that this is a laboratory test intended for comparing properties of different aggregates. It is not generally suitable for use as a basis for quoting mix design conversion factors.

Part IV Mechanical Properties

1) Determination of aggregate crushing value-

This method of test covers the procedure for determining the aggregate crushing value of coarse aggregate. The 'aggregate crushing value' gives a relative measure of the resistance of an aggregate to crushing under a gradually applied compressive load. With aggregate of 'aggregate crushing value' 30 or higher, the result may be anomalous, and in such cases the 'ten percent fines value' should be determined instead. The standard aggregate crushing test shall be made on aggregate passing a 12.5-mm IS Sieve and retained on a 10-mm IS Sieve. If required, or if the standard size is not available, other sizes up to 25 mm may be tested

but owing to the non-homogeneity of aggregates the results will not be comparable with those obtained in the standard.

2) Determination of Aggregate Impact Value

This method of test covers the procedure for determining the aggregate impact value of coarse aggregate. The 'aggregate impact value' gives a relative measure of the resistance of an aggregate to sudden shock or impact, which in some aggregates differs from its resistance to a slow compressive load.

3) Determination of Aggregate Abrasion Value-

This test covers the following two methods of determining the abrasion value of coarse aggregate:
a) By the use of Deval machine and
b) By the use of Los Angeles machine

Tests to be done as per IS: 516 – 1959-Methods of tests for Strength of Concrete

This standard covers tests for the determination of compressive strength, flexural strength of cement concrete
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III. TESTS PERFORMED

The purpose of this chapter is to present the methodology followed for collecting characteristic data on mortar cubes and concrete cubes. The information collected from these measurements will serve as calibration data to identify correlations that have not been extensively analyzed previous to this study. 3.1 Experimental Baseline: A baseline is needed to establish an experimental design to conduct testing and observations for future development and research. All the baseline mortar and concrete material used in this study : Experimental Baseline Sr. no. Baseline Element Type 1 Cement L & T 43 grade Ordinary Portland Cement. 2 Sand Standard Sand 3 Coarse Aggregate 20mm- 4.75 mm size coarse aggregate. 4 Fine Aggregate 4.75 mm- 2.36 mm size fine aggregate. 3.2 Test Program: The research task involved some important measurements of material characteristics through the tests outlined in table . Table 11: Test Program: Sr. no. Test Name Instruments 1 Fineness Modulus I S sieve, balance, sieve shaker. 2 Abrasion Test Los Angeles Testing Machine. 3 Consistency test Vicat's Apparatus. 4 Setting Time test Vicat's Apparatus. 6 Workability Measurement Slump Cone, Flow table apparatus, Compacting Factor apparatus, Vee-Bee consistometer. 7 Strength test Compression Testing Machine. 48 3.3 TESTS PERFORMED: Test on cement 1) Standard consistency test 2) Setting time test 3) Specific gravity 3.1) Specific gravity of cement. 3.2)Specific gravity of sand 3.3)Specific gravity of aggregates. 4) Determination of compressive strength of concrete. 3.3.1 Standard consistency test: Procedure: Testing was done as per IS code 4031-1988. (part -4) Fig2. Apparatus for Vicat's 1) Weigh about 400 gm of cement was taken and mixed 25% of clean water. The paste was prepared and formed in to ball. 2) The mould was placed on glass plate with large end down and the was placed by trowel. The surface was leveled by trowel. 3) Mould was placed under Vicat's plunger was attached to apparatus with smaller end at top and was placed by trowel. 49 4) The Vicat's plunger was attached to apparatus and was placed such that bottom of plunger was flush with the top surface of cement paste. 5) The test was repeated with new cement sample with increasing water contents @ 2% till the plunger penetrated by 33 to 35 mm from top. Such water content was noted as standard consistency. Result: - Normal consistency was found to be 23% on the Vicat's apparatus. (Testing was done as per IS code 4031-1988)

IV. CONCLUSIONS AND RESULT

Testing methods: Experimental investigation of fresh mix properties of fly ash concrete was conducted based on IS: 516 - 1959using a slump cone. Compressive strength of each specimen was determined using IS: 516 - 1959 Compressive strength were measured 7, 28 and 90 Days. Specimens were cube with a 150 mm side for compressive strength. 4.1Slump Test Slump test is used to determine the workability of fresh concrete. The test is simple and cheap. It is suitable to use in the laboratory and also at site. Although the test is simple, but the testing has to be done carefully due to a huge slump may obtain if there is any disturbance in the process. Logic Sphere mentioned that the slump test will give a reasonable indication of how easily a mix can be places although it does not directly measure the work needed to compact the concrete. It also mentioned that a slump less than 25mm will indicate a very stiff concrete and a slump that more than 125mm will indicates a very runny concrete. Table 15: Slump for M20 grade of concrete.HOPPER NO. NO FA (%) M20 Slump (mm) 3 D 00.00 70 D5 12.50 80 D6 25.00 39 D4 37.50 70 4 D 00.00 70 S5 12.50 70 S6 25.00 68 S7 37.50 69 D 00.00 70 58 5 S16 12.50 72 S17 25.00 68 S15 37.50 69 Graph. 1. Slump Test for M20 grade Concrete. Above graph shows that the Slump of M25 Grade of concrete in hopper no.3,4,5 fly ash. And Highest slump is for 12.50% replacement for hopper no.

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