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Use of Demolished Concrete Waste in Partial Replacement of Coarse Aggregate in Concrete

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ABSTRACT: *Construction and demolition waste constitute one of the major components of waste generated worldwide. Very large quantities of aggregates are used in construction. When the useful life of the structure is over it will be demolished and all the demolished wastes just find their way to landfills. Finding large areas for landfills is becoming very difficult. On the other hand continuous extraction and quarrying of natural aggregates for construction is causing depletion of natural resources. There cycling of demolished construction waste aggregates to be used in new engineering application provides a promising solution to both problems. So in order to reduce construction cost and resolving housing problems faced by the lows income communities of the India. This project/research includes an experimental study on concrete by taking partial replacement of course and fine aggregate with demolished waste to determine the compressive strength hand flexural strength and results are compared with normal concrete.*

Keywords: *Demolished Aggregate Concrete, Demolished Concrete Aggregate, Course Aggregate, Demolished Waste, Compressive Strength, Slump Cone Test.*

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I. INTRODUCTION

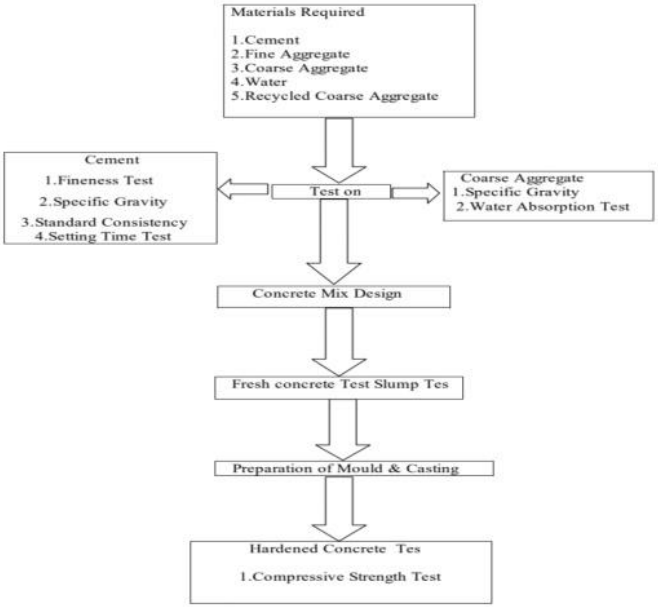
Concrete is the prime construction material used in practice. Constituents of concrete are binding material (cement), fine aggregate and coarse aggregate and water. Aggregates are naturally available and depleting day by day due to over exploitation for the sake of development activities. Owing to growing demand aggregates will not be available in plenty in near future as their stack is limited. It is worthwhile to seek alternative for naturally available aggregate. Owing to growing construction activities and renovation of structures, demolition wastes are produced in large quantities which are kept in abundance in low lying area or at disposal sites. The land, over which the demolition wastes are disposed, deprives further land use forever for other purposes. This increased quantities of demolition debris, the continuing shortage of dumping sites, and increase in the cost of disposal and transportation and above all the concern about environmental degradation. Construction and demolition wastes constitute one of the major components of wastes generated worldwide. Very large quantities of aggregates are used in concrete production and in construction. When the useful life of the structure is over it will be demolished and all the demolished wastes just find their way to landfills. Finding large areas for landfills is becoming very difficult. Finding large areas for landfills is becoming very difficult. On the other hand continuous extraction and quarrying of natural aggregates for construction is causing depletion of natural resources. The recycling of demolished construction waste in to aggregates to be used in new engineering application provides a promising solution to both the problems. In this work the usability of demolished waste as coarse aggregates in new concrete is attempted. This experimental investigation involves evaluating the properties of the constituents of concrete including the demolished concrete wastes which shall be used as coarse aggregates in new concrete with the aim of producing high strength concrete.

II. OBJECTIVES

1). To study the utilization of demolished and construction waste as a replacement of natural aggregates.
2). To study the properties of demolished and construction waste aggregate.
3). To use of the demolished and construction waste aggregate in the new concrete as the recycled concrete aggregate reduces the environmental pollution as well as providing an economic value for the waste material.
4). To compare the compressive strength of normal concrete with recycled aggregate concrete by varying

percentage coarse aggregate with recycled aggregate.

III. METHODOLOGY



IV. MATERIALS

The materials used in concrete are subjected to various tests to ascertain their properties and to determine their usability in concrete. Concrete is an artificial material, which is made up of cement, fine aggregates, coarse aggregate and water. In this project additionally I have add an artificial admixture (super plasticizer) to improve some of the properties of concrete. The materials used are cement, M-sand, coarse aggregate, recycled aggregate and artificial admixture. In order to confirm the use of demolished waste as coarse aggregates in concrete in newly constructed project, the mechanical properties for the recycle aggregate were determined, including specific gravity, water absorption, abrasion resistance, Aggregate Crushing Value and Aggregate Impact Value. The materials used are cement, M-sand, coarse aggregate, recycled aggregate and artificial admixture. In order to confirm the use of demolished waste as coarse aggregates in concrete in newly constructed project, the mechanical properties for the recycle aggregate were determined, including specific gravity, water absorption, and abrasion resistance.

- Cement
- Fine aggregate
- Coarse aggregate
- Recycled aggregate
- Water

In this study, control mix was designed as per IS 10262:1986 to achieve a target compressive strength of 38.25 MPa. The casted cubes are test for 7, 14, 28 days Compressive strength

Cement: Ordinary Portland Cement of 53 Grade of brand name Ultra Tech Company, available in the local market was used for the investigation. Care has been taken to see that the procurement was made from single batching in air tight containers to prevent it from being effected by atmospheric conditions. The cement thus procured was tested for physical requirements in accordance with IS: 169-1989 and for chemical requirement in accordance IS: 4032-1988. The physical properties of the cement are listed in Table – 1

TABLE1: PROPERTIES OF CEMENT

SL.NO	Properties	Test results	IS:4013-1963
1.	Standard consistency	31%	24%-34%
2.	Initial setting time	39MIN	Minimum of 30min
3.	Specific gravity	3.15	3 -4
4.	Fineness	8 %	10%

Fine aggregate: M Sand is a industrial granular material which is mainly composed of finely divided rocky material and mineral particles. Hence, it is used as fine aggregate in concrete. The aggregate was tested for its physical requirements such as gradation, fineness modulus, specific gravity, moisture content, bulk density, bulking, Water absorption in accordance with IS:2386-1963.

TABLE 2: PROPERTIES OF FINE AGGREGATE

Sl. No	Properties	Test Result	I.S Recommendation
1	M Sand zone	Zone-III	IS 383 Table - 3
2	Specific gravity	2.663	IS 2386 -1963
3	Fineness modulus	2.45	IS 2386 - 1963

Coarse Aggregate: Crushed aggregates of 20mm and down size produced from local crushing plants were used. The aggregate exclusively passing through 20mm sieve size and retained on 6.3 mm sieve is selected. The aggregates were tested for their physical requirements such as gradation, fineness modulus, specific gravity and bulk density, moisture content in accordance with IS:2386-1963. The individual aggregates were mixed to induce the required combined grading. The particular specific gravity and water absorption Moisture content of the mixture are given in table.

TABLE 3: PROPERTIES OF COARSE AGGREGATE

Sl.No	Properties	Test Results	I.S Recommendation
1	Nominal size used	20mm and down	----------
2	Specific gravity	2.657	IS 2386 - 1963
3	Moisture content	0.1%	IS 2386 - 1963
4	Water absorption	0.15%	IS 2386 - 1963

Recycled Coarse Aggregate : Demolished concrete waste of coarse aggregate getting from local crushing plant Crushed aggregates of 20mm and down size produced from plant were used. The aggregate exclusively passing through 20mm sieve size and retained on 6.3 mm sieve is selected. The Demolished concrete waste of coarse aggregate is more water absorption compare to natural coarse aggregate. The demolished concrete waste of coarse aggregate were partially replaced in place of coarse aggregate by the percentages of 25% 50%, 75% and 100% individually and along with replacement of fine aggregate with Demolished concrete waste of fine aggregate also. The aggregates were tested for their physical requirements such as gradation, fineness modulus, specific gravity and bulk density, moisture content in accordance with IS: 2386 - 1963. The individual aggregates were mixed to induce the required combined grading. The particuler specific gravity and water absorption Moisture content of the mixture are given in table.

Table 4: Properties of Recycled Coarse Aggregatez

SL. No	Properties	Test Results	I.S Recommendation
1	Nominal size used	20mm and Down	----------
2	Specific gravity	2.82	IS 2386 - 1963
3	Moisture content	10.5	IS 2386 - 1963
4	Water absorption	0.15%	IS 2386 - 1963

V. MIX DESIGN

Indian Standard Recommended Method of Concrete Mix Design (IS 10262-1982) .The Bureau of Indian Standards recommended a set of procedure for design for M30 grade of concrete mix mainly based on the work done in national laboratories. The mix design procedures are covered in IS 10262-82. The method given can be applied for both medium strength and high strength concrete.

Concrete Mix Proportions

Cement = 440 kg/m3
Water = 197.6 kg/m3
Fine aggregate = 583 kg/m3

Coarse aggregate = 1182 kg/m3
Water-cement ratio = 0.45

Table 5: Mix Design for Conventional Concrete

Cement	F.A	C.A	Water
440	583	1182	197.6
1	1.32	2.68	0.45

Table 6: Mix Design for Recycled Aggregate Concrete

	Cement (Kg/m^3)	FA (Kg/m^3)	CA (Kg/m^3)	RCA (Kg/m^3)	Water (lit/m^3)
RCA 25%	440	583	1122.9	59.1	197.6
RCA 50%	440	583	1063.8	118.2	197.6
RCA 75%	440	583	1064.7	177.3	197.6
RCA 100%	440	583	945.6	236.4	197.6

Demolished concrete (recycled aggregates) is taken in the ratio of 25%, 50%, 75%, and 100%, by the weight of the coarse aggregates.

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VI. TEST ON CONCRETE

COMPRESSIVE STRENGTH TEST OF CONCRET

By this single test one judge that whether Concreting has been done properly or not. For cube test two types of specimens either cubes of 15 cm X 15 cm X 15 cm or 10cm X 10 cm x 10 cm depending upon the size of aggregate are used. For most of the works cubical moulds of size 15 cm x 15cm x 15 cm are commonly used. This concrete is poured in the mould and tempered properly so as not to have any voids. After 24 hours these moulds are removed and test specimens are put in water for curing. The top surface of this specimen should be made even and smooth. This is done by putting cement paste and spreading smoothly on whole area of specimen. These specimens are tested by compression testing machine after 7 days curing or 28 days curing. Load should be applied gradually at the rate of 140 kg/cm2 per minute till the Specimens fails. Load at the failure divided by area of specimen gives the compressive strength of concrete.

Fig 1: Compressive Strength Testing Machine

Table 7: Compressive Strength Test Results

SI NO	Usage of recycled aggregates	Average Compressive Strength (MPA)		
		7 days	14 days	28 days
1	0% of recycled aggregates	16.53	25.76	32.59
2	25% of recycled aggregates	15.65	24.32	31.47
3	50% of recycled aggregates	14.56	23.47	30.41

4	75% of recycled aggregates	13.53	22.30	29.42
5	100% of recycled aggregates	13.30	21.29	28.45

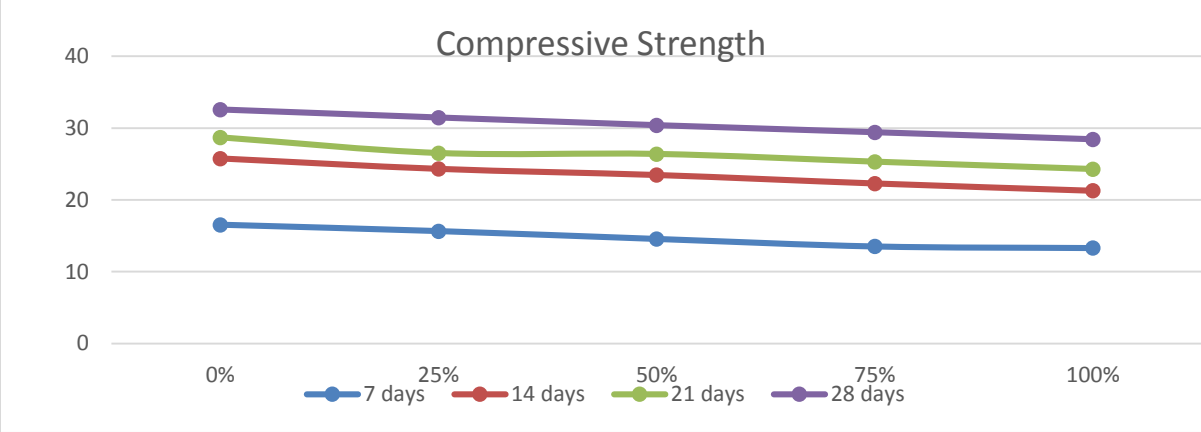

Fig 2: Compressive Strength Test Results

VII. CONCLUSION

1) The test values of compressive strength 25% & 50% of demolished concrete aggregates are near to the value of standard concrete or conventional concluded that the optimum replacement for this particular mix for high the optimum replacement for this particular mix for high strength concrete is in b/w 25% to 50% up to this replacement good compressive strength can be achieved.
2) Beyond this replacement strength reduces gradually & doesn't meet the target strength, to overcome this problem, suitable adjustment in mix design is required.
3) With the increase of 100% replacement of course aggregates the workability of decrease.
4) concrete.
5) From the above investigations, it can be

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