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RESEARCH ARTICLE

EXPERIMENTAL INVESTIGATION ON HIGH STRENGTH CONCRETE USING PARTIAL REPLACEMENTOF RECYCLING COARSE AGGREGATE

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Abstract

The primary material used in construction is concrete. Cement, fine aggregates, coarse aggregates, and water make up concrete. However, the quick exhaustion of those resources and, consequently, their rising cost are becoming attention-seeking issues. As a result, the construction industries are facing difficulties related to the simple availability of those resources. This is why a number of solutions, such as the recycling and reuse of building waste, are being used to address the issue. In this area, our initiative seeks to use concrete that has been removed. In this project, we used M40 grade concrete to replace coarse aggregates with destroyed concrete in the following ranges: 0%, 20%, 30%, 50%, The prepared concrete mix is evaluated and compared to standard concrete in terms of workability tests, compressive strength, etc. The test will be run at 7, 14, and 28 days in order to evaluate the strength characteristics.

Introduction:-

Innovative design and building methods can be used to concrete with endless possibilities. Due to its high degree of adaptability and capacity to meet a variety of requirements, it is now a highly competitive building material. In recent years, the usage of concrete has expanded to extremely hard and high-altitude environments, leading to the early disintegration of some constructions. It is not totally true that strong concrete is always durable, even though compressive strength of concrete is a good indicator of longevity to some extent. Apart from the concrete's strength, exposure circumstances are now a crucial issue to take into account when assessing durability. These days, recycling coarse aggregate is a common way to make use of the material left over after buildings are demolished. To raise the ground's level, the majority of concrete wastes were previously disposed of in low-lying areas. But when the environment is taken into account, recovered coarse aggregate encourages their reuse and reduces the cost of building. The most popular man-made building material is concrete. It is made by combining the necessary amounts of cement, water, and fine and coarse aggregate. Although the tensile strength of the concrete is quite low, it has a high compressive strength. When tensile stresses occur, steel bars are added to the concrete to strengthen it. This composite material is known as reinforced cement concrete. Plain cement concrete is the phrase for concrete that isn't reinforced. Concreting is the process of pouring concrete. Concrete's strength, longevity, and other properties are determined by the mix percentage, compaction technique, and additional measures taken during placement, compaction, and curing. The building sector is currently experiencing anxiety due to the lack of sand and gravel and their expensive prices. Deforestation and the extraction of natural aggregates over time

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Literature Review: -

T.Manikandan et al (2015) investigated the replacement of recycled coarse aggregate by M30 grade concrete with coarse aggregate. It is observed that the replacement was done up to 100% with coarse aggregate. The mix of 50% gives high strength of concrete at 90 days. By 50% replacement of RCA, the compressive strength attained is 0.4% less than that of normal concrete, but it reaches near the target strength of 33.85N/mm2 and the split tensile strength attained is 0.3% less than that of normal concrete, but it reaches the target strength of 3.42 N/mm2. The flexural tensile strength of concrete made using recycled aggregates will be lower than the same concrete made with new aggregates. From that they concluded, comparing the compressive strength & split tensile strength the most appropriate % of replacement is 50. So, we recommend 50% replacement of coarse aggregate by RCA.

D.V. Prasada Rao et al (2014) investigate the compressive strength of concrete by replacing the coarse aggregate with recycled coarse aggregate at concrete grades of M20, M25, M30 for 3, 7, 28 & 90 days. Recycled coarse aggregates are replaced by 100% for the coarse aggregate to compare the strength between conventional and recycled concrete. OPC 43 grade of cement is used. It is observed that the compressive strength of recycled concrete was has nearby strength to the conventional concrete for all concrete grades at 3, 7, 28, 90 days. From that they concluded replacingRCA at 100% to the concrete is provide required strength to the concrete.

Thomas et al. (2013) 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. RA concrete 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 CO2 and chlorides which reduces their penetration rates. SCM are used to improve strength and durability of RA concrete.

Fathei Ramadan salehlamein et al (2012) Examined the flexural strength of concrete using recycled coarse aggregate. In this test recycled coarse aggregates are taken at different sizes of 10mm and 20mm. Recycled coarse aggregates are replaced at 0%, 30%, 50% 65% for 28 days. OPC 53 grade of cement is used. It is observed that the flexural strength by using 20mm size of recycled coarse aggregate is provide more strength as compare to the using 10mm size of recycled coarse aggregate at 50% of replacing the RCA. The flexural strength of concrete using recycled coarse aggregate at 65% is reduced. It is concluded that the using 20mm size of recycled coarse aggregate is provide more strength at 50% replacement. From above study, provision of 20mm size of recycled coarse aggregate at 50% replacing is provide good flexural strength.

Olorunsogo and Padayachee et al (2011) Investigated the durability of concrete made with different percentages of recycled concrete coarse aggregates (0%, 50%, and 100%). They showed that durability quality of recycled concrete is reduced with increases in the quantities of recycled aggregate, and the quality improved with the age of curing. They concluded that this phenomenon is due to cracks and fissures created within the recycled aggregate during processing, which make the aggregate susceptible to ease of permeation, diffusion and absorption of fluid.

Ajdukiewicz and Kliszczewicz et al (2010) Examined the mechanical properties of high performance and high strength concretes made with recycled aggregates. In their work, they considered recycled aggregates produced from concrete with compressive strength 40-70 MPa. They concluded that the water content should be modified in the recycled concrete mix design to obtain the same workability. The results indicated that the compressive strength dropped by about 10% when using recycled aggregates, while the bond stress at failure dropped by 8-20%, depending on the type of fine aggregate used in the concrete.

Frondistou- Yannas et al (2008) evaluated and compared the mechanical properties of conventional concrete and concrete containing pieces of concrete from demolition waste in the place of natural coarse aggregate [4]. He found out that recycled concrete best matches the mechanical behaviour of conventional concrete when the recycled concrete is enriched in gravel at the expense of mortar. Therecycled aggregate concrete has a compressive strength of at least 76%

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Material And Its Properties:-

Materials that go for making concrete for this study were tested before casting the specimens.

1. Cement
2. Fine aggregate
3. Coarse aggregate

4. Recycled coarse aggregateCEMENT

Cement is a widely used building material that is essential to construction projects. With its cohesive and adhesive qualities, properties, which provide a binding medium for the discreet ingredients. It is obtained by burning together, in a definite proportion, a mixture of naturally occurring argillaceous and calcareous material to a partial fusion at high temperature. The product obtained by burning, cooled and ground to therequired fineness is known as cement. We are using Ordinary Portland cement of 53 grade.

- Fineness- 4.5%
- Consistency - 32%
- Initial setting time - 50 minutes
- Final setting time - 430 minutes
- Specific gravity - 3.15

Fine Aggregates

Aggregates are generally imparted greater volume stability and durability to concrete. The aggregate is used primarily for purpose of providing bulk to the concrete. The most cement paste to hold the coarse aggregate in suspension. Fine aggregate most of which passes through a 4.75 mm IS sieve and contains only so much fine material as its permitted by the specification.

Properties

1. Fineness modulus- 3.415 (Zone II)
2. Specific gravity - 2.65
3. Moisture Content - 1% COARSE AGGREGATE

Coarse aggregate most of which are retained on the 4.75mm IS sieve and contain only so much of coarse material as is permitted by the specification are termed coarse aggregate. Crushed gravel or stone obtained by the crushing of gravel or gravel or hard stone. Uncrushed gravel or stone resulting from the natural disintegration of rock. Partially crushed gravel or stone obtained as product of the building of the two types.The graded coarse aggregate is described by its nominal size i.e. 40mm, 20mm, 16mm and 12.5mm. The grading of coarse aggregates should be as per specifications of IS 383- 1970. H.

Properties

1. Fineness modulus - 7.1
2. Specific gravity - 2.78
3. Water absorption - 1.5% RECYCLED COARSE

Aggregate

Recycled coarse aggregates are the materials which obtained while demolish the concrete buildings. From the demolished material the coarse aggregate is separately taken for the project and that coarse aggregate has some bonding agent on it. We can't use that coarse aggregate with bonding agent because it has more water absorption property. So, the recycled coarse aggregate is treated with NAOH at 2N for 24hrs.

Sieve Analysis

The sample is brought to an air-dry condition before weighing and sieving. This may be achieved either by drying at room temperature or heating at a temperature of 10000C to11000C. Table 4.1 shows the sieve analysis of recycled coarse aggregate.

Materials	Fineness modulus
Natural coarse aggregate	7.14
Recycled coarse aggregate	7.92

Concrete Mix Design Stipulations For Proportioning

1) Grade designation: M40
2) Type of cement: OPC 53 Grade: 20mm
3) Maximum nominal size of aggregate: 360kg/m3
4) Minimum Cement content: 0.40
5) Maximum w/c ratio
6) Workability: 75 mm (slump)
7) Exposure condition: Severe
8) Method of concrete placing: Normal pouring
9) 9. Degree of Supervision: Good
10) Type of aggregate: Crushed angular aggregate

General

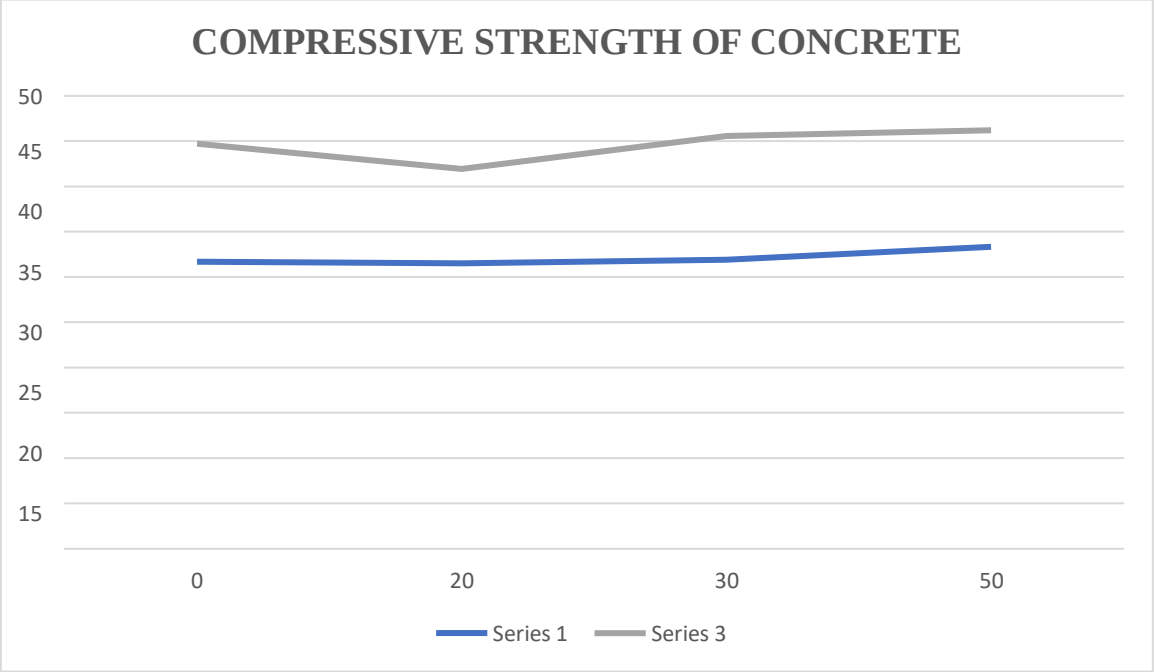
The casting of concrete is done so that the strength of concrete can be measured. After arriving mix ratio, the exact quantities of materials for the mix is were weighed and kept ready before mixing is started. The specimens of cubes and cylinders were casted and tested. Size of 150 mm x 150 mm x 150 mm standard cubes for compressive strength and 150 mm diameter and 300 mm height standard cylinders for split tensile strength. Weigh batching is used in this project work.

Preparation of Mould Cube moulds of standard size 150mm×150mm×150mm are used, which is made up of cast iron and the inside faces are machined plane. All the faces of moulds are assembled by using nuts and bolts and are clamped to the base plate. It is to be noted that, all the internal angle of the mould must be 90. The faces must be coated with mould oil to prevent leakage during filling. The inside of the mould must also be preventing the concrete from sticking to it

Mixing of concrete may be done by hand or by machine. Mixing should be done thoroughly so as to have a uniform distribution of ingredients which can be judged by uniform colour and consistency of concrete. The mass is then turned to obtain a workable mass and placed in the required area within 30 minutes. Hand mixing can be used for small quantity of concrete due to non-availability of machine or where noise of machine is to be avoided. In general, a quantity of 10 % extra-cement is used to compensate the possible inadequacy

S.NO	Re- aggregate %	Strength at 7 daysKN	Strength at 28 daysKN	Strength at 7 days N/mm^2	Strength at 7 days N/mm^2
1	0	713.5	945	31.67	44.72
2	20	742.6	960	31.50	41.94
3	30	776.5	971	31.94	45.58
4	50	800	1025	33.33	46.2

Tests For Replacement Of RCA



Conclusion:-

Use of Recycled Coarse Aggregate is environmentally helpful to reduce the effects of waste material which produced from buildings. Replacing the building materials are more helpful to reduce lack of space in construction site. The compression and Tensile strength is evaluated by replacing RCA for coarse aggregate is compared with the conventional concrete as per IS codes. By replacing RCA is provide high compressive strength at 25% replacement of RCA. The strength obtained at 50% replacement is 47 N/mm2 and the strength is gradually reduced from the above study replacing RCA for Coarse Aggregate at 25% with the addition of is economical and increase both compressive and flexural strength of concrete.

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