International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 04 Issue: 03 | Mar -2017 www.irjet.net p-ISSN: 2395-0072

EXPERIMENTAL INVESTIGATION ON PERFORMANCE OF RECYCLED CONCRETE AGGREGATE AS COARSE AGGREGATE

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Abstract - *In most of the construction industry and in urban areas, many concrete structures like buildings, bridges and roads, water tanks are razed after a period of time into their service life for purpose of replacement and also due to natural disasters, blasting of buildings, demolition of unused structures, etc. As a result large amount of demolished concrete is generated as waste. Most of the demolished waste is disposed off by dumping it as land fill. It will affect the soil properties and also increase transportation cost. It is becoming increasingly difficult to obtain good quality aggregate at reasonable prize. The increase in cost is mainly due to the cost transportation cost and few quarries. Considering the present situation the best solution would be to reuse the demolished concrete. Our project deals with an experimental investigation on the effective of replacement of natural aggregates by recycled aggregates in different percentages like (5%, 15%, 25%, 35%, 45%, 55%, 65%, 75%, 85% and 95%) on the strength characteristics of concrete.*

Key Words: ***Demolition, Recycling, Disasters, Strength.***

1. INTRODUCTION

The aim of designing a structure is to fulfill its intended purpose during its intended life time adequate serviceability in terms of stiffness, durability and economy. Safety implies that the like hood of partial or total collapse of the structure is acceptably low not only under the normal expected loads but also under abnormal but portable over loads such as due to earthquake or extreme wind. Collapse may occur due to various possibilities such as exceeding the load bearing capacity, overturning, sliding, buckling, fatigue fracture, etc. Serviceability implies satisfactory performance of the structure under service loads, without discomfort to the user due to excessive deflection, cracking, vibration, etc. other considerations under the preview of Serviceability are durability, impermeability, acoustic and thermal insulation etc. Conservation of natural resources and preservation of environment is the essence of any development. Nature has a way of clearing off some of mess by process of biodegradation but not certain products have come up which are non-biodegradable. One way of reducing such wastes is the process of recycling and this is a solution in many areas. Rapid growth in population and urbanization are pushing the growth in construction, especially in the developing countries and old buildings are being demolished to be replaced with new ones. One of the problems arising from continuous technological and industrial development is the disposal of waste materials. Following this process in discriminately leads to two basic problems on the one had there is an urgent need to fruitfully construction debris, which is often simply thrown away have used has been filling materials, without considering the environment need of the problems on the other hand, the industry is facing with the non-availability of good quality aggregates with reasonable distances and deforestation from the thoughtless mining for aggregates from quarries. Recycling of the construction wastes is considering as the need of the hour. Research in different countries has suggested the possibility of reusing the hard inert materials in the construction wastes .Broken concrete and bricks mostly from buildings can be used to give recycled aggregate concrete and similarly broken pavement can be used to build reclaimed asphalt pavement. In our project we are using recycled aggregates to find the strength characteristics of concrete.

2. MATERIALS

A brief specification of the materials used in the specimen and their properties are explained.

2.1. CEMENT

Ordinary Portland cement of 43 grades in one lot was procured and stored in air tight container. The cement used was fresh i.e. used within three months of manufacture. It should satisfy the requirement of IS12262. The properties of cement are determined as per IS4031:1968 & results are tabulated

Table -1: Properties of cement

PROPERTIES	VALUES
Fineness	10%
Initial setting time	28min
Final setting time	2-3hours
Specific gravity	3.10

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2.2. FINE AGGREGATE

A fine aggregate obtained from the river is used for experimental purpose. The less amount of clay and silt (<3% by weight). The hire from silt, clay, salt and organic material and it was clean and dry. It is of size passing through 1.19 micron sieve.

Table -2: Properties of Fine aggregate

S No	Property	Values
1.	Specific gravity	2.58
2.	Fineness modulus	2.69

2.3. COARSE AGGREGATE

The coarse aggregate is strongest and porous component of concrete. Presence of coarse aggregate reduces the drying shrinkage and other dimensional changes occurring on account of movement of moisture. The coarse aggregate used passes in 19 mm and retained in 11.4mm sieve. It is well graded (should of different particle size and maximum dry packing density and minimum voids) and cubical in shape

Table -3: Properties of Coarse aggregate

Coarse aggregate	Values
Size	20mm
Bulk density	1674kg/m^3
Fineness modules	6.17
Specific gravity	2.58
Water absorption	0.55%

2.4. RECYCLED COARSE AGGREGATE:

Recycled concrete aggregate is comprised of crushed concrete or stone that can be graded to meet the specification for both aggregates base as well as sub base. Specifying recycled materials creates a market for material that would otherwise be land filled and in most instance, is a more economical alternative to using virgin material

Table -4: Properties of recycled coarse aggregate

Recycled coarse aggregate	Values
Specific gravity	3.25
Impact value in %	22.0

2.5. WATER

Ordinary drinking water available in the construction laboratory was used for casting all specimens of this investigation. Water helps in dispersing the cement even, so that every particle of the aggregate is coated with it and brought into ultimate contact with the ingredients. The quality of water was found to satisfy the requirement if IS456-2000.

2. MIX DESIGN

Grade of concrete selected is M30 (1:1.02:2.26) and water content adopted is 0.38. The mix proportion was designed in accordance with IS (456-2000) for good degree of quality control and moderate exposure condition. The controlled mixes were prepared by using natural sand as fine aggregate and for comparison 100 percent crusher sand was used in companion mixes.

3. CASTING AND CURING

The mould specification, preparation of mould the method of casting and curing are discussed in following.

S.No	Specimen	Size (mm)
1	Cube	150mmx150mmx150mm
2	Beam	100mmx100mmx500mm
3	Cylinder	150mmdia. & 300mm height

4. RESULT AND DISCUSSIONS

Testing of concrete plays an important role in controlling and confirming the quality of cement concrete. Cube, beam and cylinder are tested for its strength characteristics.

4.1. RESULTS FOR COMPRESSION STRENGTH

It has been observed that the concrete produced from (0%, 5%, 15%, 25%, 35%, 45%, 55%, 65%, 75%, 85%, and 95%) replacement of natural coarse aggregate by recycled concrete aggregate, shows maximum compressive strength as compared to other replacement. The optimum strength of concrete is obtained in 35% replacement

Fig -1: Testing of cube

Fig -2: Testing of cylinder

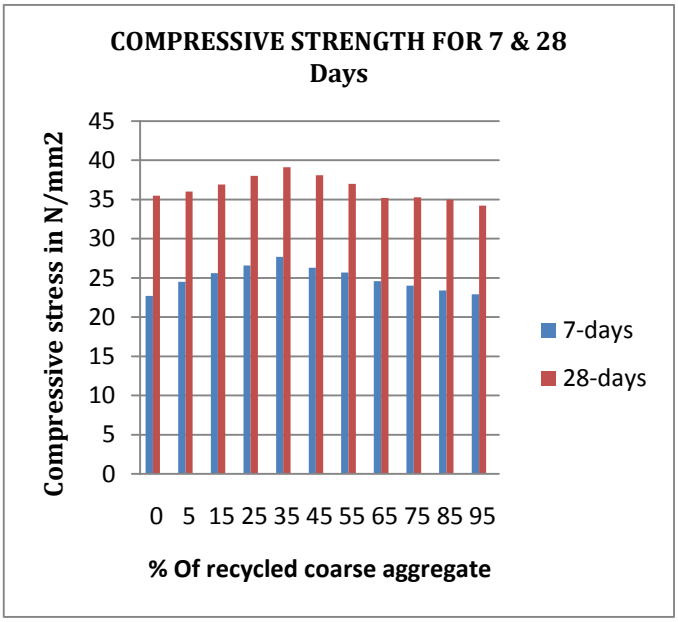

Chart -1: Compressive strength test

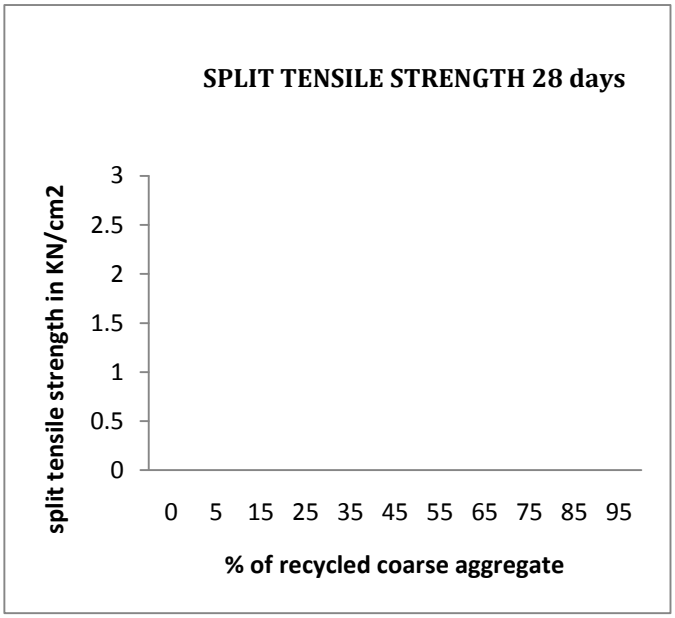

Chart -2: Split tensile strength test

4.2. RESULTS FOR SPLIT TENSILE STRENGTH

The test is carried out by placing cylinder specimen of dimension 150mm diameter and 300mm length, horizontally between the loading surface of compression testing machine and the load is applied until failure of the cylinder along the vertical diameter. The failure load of the specimen is noted. The optimum strength of concrete is obtained in 35% replacement

4.2. RESULTS FOR FLEXURE STRENGTH

The test is carried out to find the flexural strength of the prism of dimension 100 x 100 x 500 mm.The prism is then placed in the machine in such manner that the load is applied to the uppermost surface as cast in the mould. Two points loading adopted on an effective span of 400 mm while testing the prism. The load is applied until the failure of the prism. The optimum strength of concrete is obtained in 35% replacement

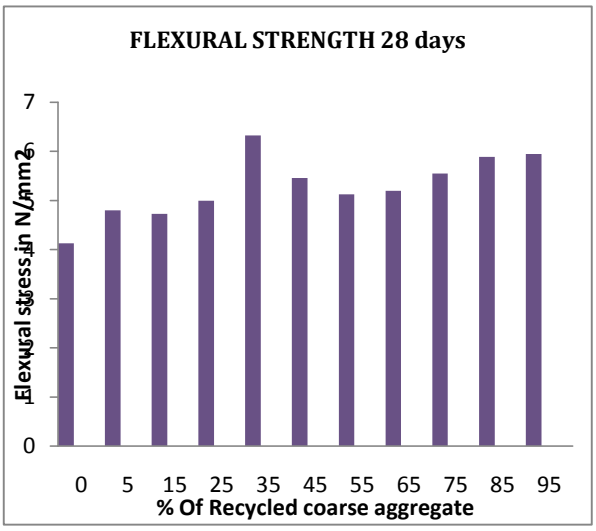

Chart -3: Flexural strength test

4. CONCLUSIONS

Based on this experimental investigation the behavior of recycled concrete aggregate and concrete was concluded as, it can be seen that recycled concrete aggregate as natural coarse aggregate has no detrimental effect on the strength and performance of concrete when designed correctly.An experimental study was carried out to investigate the properties of concrete with recycle aggregates. The recycled concrete aggregate used in this investigation is of free cost since it is the waste obtained from the quarries. It can be concluded that 35% replacement of natural aggregates by recycled concrete aggregates gives the maximum compressive strength, tensile strength, flexural strength.

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