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 CONCRETE WITH REPLACEMENT OF COARSE AGGREGATE BY DEMOLISHED BUILDING WASTE WITH STEEL FIBER (LATHE WASTE)

S.SAKTHIVEL[1], G. ARUN KUMAR[2], S. ATHUL[3], S. DEEPANJALI[4] AND V. KAVIYA[5]

Department of civil engineering, The kavery engineering college, Mecheri, Tamilnadu, India

Anna University, Chennai, Tamil Nadu, India

ABSTRACT:

There is a large amount of demolished waste are generated every year in India and other developing countries. But very small amount of waste are recycled and reused. So, it have a serious problem to create environmental pollution and also required large amount of space. So, our project deals about reusing of Demolished Concrete Aggregate (DCA) & introduction of Steel Fiber (SF) from the lath wastages are replacing as coarse aggregate in concrete of different percentages 40, 50, 60 DCA& 1% of steel fiber (lathe waste) to minimize the generation of demolished building wastes. The replacement of Demolished Concrete Aggregate(DCA)& Steel fiber(lathe waste) in special concrete of 7, 14, 28 days curing & The various tests to be conducted on concrete such as compressive strength, split tensile strength and flexural strength. The tests values are computed and compared with the conventional concrete.

KEYWORDS: Demolished Concrete Aggregate (DCA), steel fiber (SF), Lathe waste, coarse aggregate.

1.INTRODUCTION

Due to rapid development of Industries and infrastructure in urban areas the waste generation also increase every year in India. At present, demolition material are dumped on land are treated as waste, which means they cannot be utilized any purpose. A ministry of urban development constructed a first plant that recycles construction waste situated in New Delhi but it is not sufficient to overcome a problem of generating demolished waste. The disposal of Construction & Demolished(C&D) waste are 5000 tons per day according in Hindu and also 23.75 million tons waste is generated annually in India in the year of 2007. It leads to serious problem to pollute environment large and also occupy large amount of space .In concrete industry at present globally consumes 8 to12 billion tons of natural aggregate annually. Due to continuous use of natural sources like stone and sand is another major problem to change climatic condition and degrading the Earth and also met with demand in future.

By the reuse of demolished concrete waste in the form of recycled aggregate concrete is viewed as an attempt to conserve the natural resource and preserving the environment ecologically balance. The recycled aggregate concrete are replacement with coarse aggregate when exceed the limit it have some disadvantages from its characteristics, property and behavior. Some drawbacks of exceeding replacement of recycled aggregate concrete will be improved by adding steel fiber collected from lathe waste. The strength behavior of concrete compressive strength, split tensile strength and flexural strength of special concrete these results are compared to conventional concrete.

2. MATERIAL PROPERTIES:

MATERIAL USED

2.1 Cement

2.2 Replacement of Demolished Concrete Aggregate

(40%, 50%, 60%)

2.3 coarse aggregate

2.4 Fine aggregate

2.5 Steel fiber (1%) lathe waste

2.6 Water

2.1 CEMENT

Locally available Ordinary Portland Cement (OPC) of 53grade has been used and physical properties are mentioned in table below.

TABLE 1 PHYSICAL PROPERTIES OF CEMENT

SL.NO	PHYSICAL PROPERTIES OF CEMENT OPC 53GRADE	RESULT
1.	Specific gravity	3.15
2.	Standard consistency	33.67
3.	Finess test	1.70
4.	Initial setting time	27min 8sec
5.	Final setting time	8Hours 10min

2.2 DEMOLISHED CONCRETE AGGREGATE (DCA)

The recycled concrete can be defined as crushed concrete composed of aggregate fragments coated with cement paste (or) cement mortar. In demolished aggregate the water absorption ranges are high and the laboratory result shows pozzalanic property, decreased bulk density, decrease sp. Gravity, increased abrasion loss are compared to the normal aggregate. As per IS2386 part (IV), the impact and crushing strength value for concrete wearing should not exceed 30% & other than wearing surface 45%. The crushing and impact values of recycled aggregate satisfy BIS limit & possible for application.

2.3 COARSE AGGREGATE

Locally available crushed stone aggregate are used as a coarse aggregate which have the size of 20mm used for the project. The properties of coarse aggregate are tabulated below (TABLE 2) compared to demolished concrete aggregate.

TABLE2 PHYSICAL PROPERTIES OF DEMOLISHED CONCRETE AGGREGATE AND NORMAL AGGREGATE

SL.NO	PHYSICAL PROPERTIES	DEMOLISHED CONCRETE AGGREGATE	NORMAL COARSE AGGREGATE
1.	Specific gravity	2.68	2.70
2.	Impact value	24.26	13.23
3.	Water absorption	3.52	1.00
4.	Bulk density	1.39	0.72
5.	Crushing test	20.83	17.42
6.	Abrasion test	14.6	13.4
7.	Size	20mm	20mm

2.4 FINE AGGREATE

Sand was collected from nearby river Zone-III is used as a fine aggregate is passed through the sieve of 4.75mm. IS: 383(1970) is followed for fine aggregate. The various properties of sand are tabulated in table3

TABLE 3 PHYSICAL PROPERTIES OF FINE AGGREGATE

SL.NO	DESCRIPTION	VALUE
1	Specific gravity	2.30
2.	Bulk density	0.79
3.	Finess test	6.03

2.5 STEEL FIBRE

Steel fiber are collected from lathe wastages and add 1% to the concrete for this project.

SL.NO	MATERIALS	SPECIFICATTION
1.	Appearance	Irregular
2.	size	2.5mm Gauge

2.6 WATER:

Water cement ratio (W/C) of 0.45 was used in the preparing of concrete and for this purpose portable water used for mixing and curing purpose.

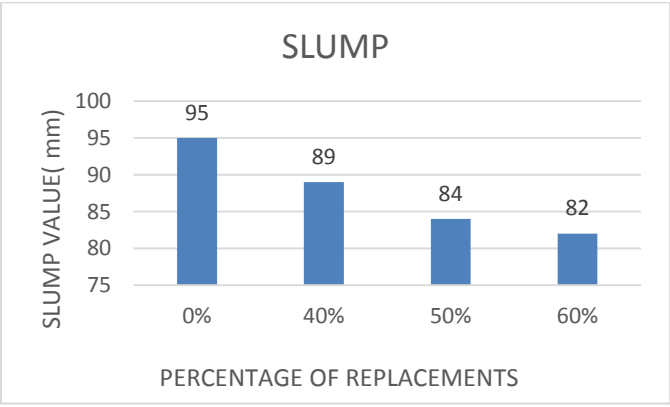
3. EXPERIMENTAL METHODOLOGY:

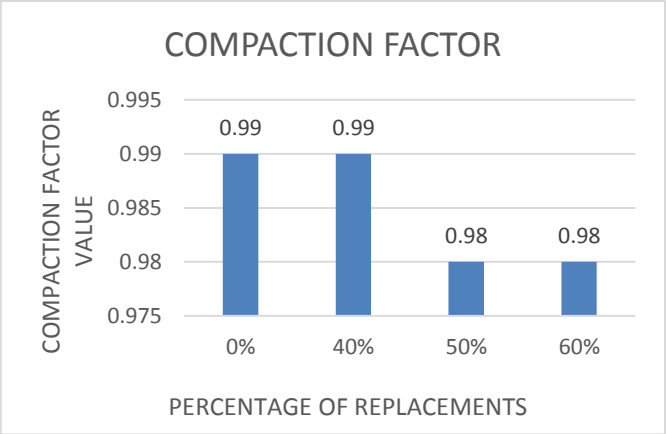
CONCRETE:

The concrete mix design was done in accordance IS: 10262(1982). In this project M_{25} grade are used the mix ratio is 1:1.1:2.8. By using this proportion value the volume of cement, fine aggregate and coarse aggregate are estimated. The Ordinary Portland Cement (OPC-53GRADE), Good stone aggregate and natural sand of Zone-III was used as coarse aggregate and fine aggregate. For this study cubes (150×150×150mm), cylinder (150mm dia&300mm height) and beam (100×100×500mm) were casted by replacement of coarse aggregate by Demolished Concrete Aggregate (DCA) 40%, 50%, 60% by the weight of coarse aggregate and also 1% of steel fiber from lathe waste to increasing the strength then further test are conducted such as workability then it will be casted.

4. TESTING OF FRESH CONCRETE:

To determine the workability of concrete by using slump cone& compaction factor test by using to determine consistency of concrete and also the water cement ratio values to be will be find out for different proportions both the slump cone and compaction factor values of a conventional concrete and replacement of Demolished Concrete Aggregate (DCA) of different percentages (40%, 50%, 60%DCA& 1% steel fiber) are plotted in graph.





5. CURING OF CONCRETE:

Casting of concrete after the completion of 24 hours mould will be removed then cured by using portable water. The specimen is fully immersed in portable water for specific age of 7, 14, 28 days. After the completion of curing it will be tested.

6. TESTING ON HARDERNED CONCRETE

1. Compressive strength test

2. Split tensile strength test

3. Flexural strength test

RESULT AND DISCUSSION

1. THE COMPRESSIVE STRENGTH

The compressive strength is determined by dividing the maximum of failure load of the specimen during the test by the cross sectional area of the specimen. The normal concrete and the percentage of replacements in special concrete are crushed at different days (7, 14, 28 days) are show in table& graph in detail.

$$\text{Compressive strength} = \frac{P}{A} \ (\text{N/mm}^2)$$

Where,

P - Load (N)

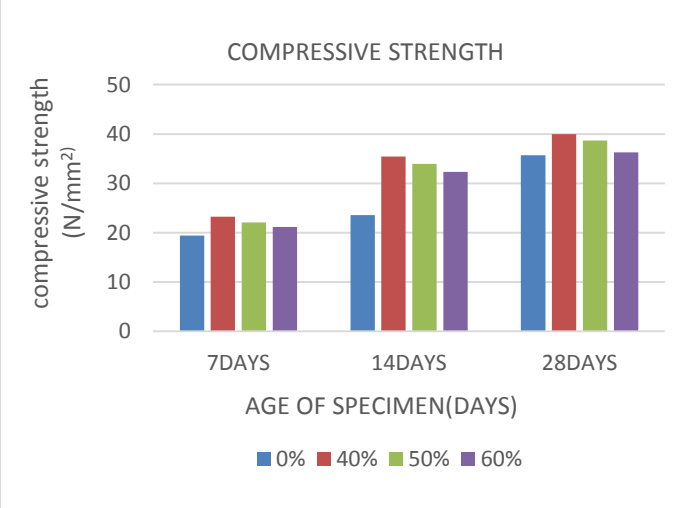
A - Area (mm^2)

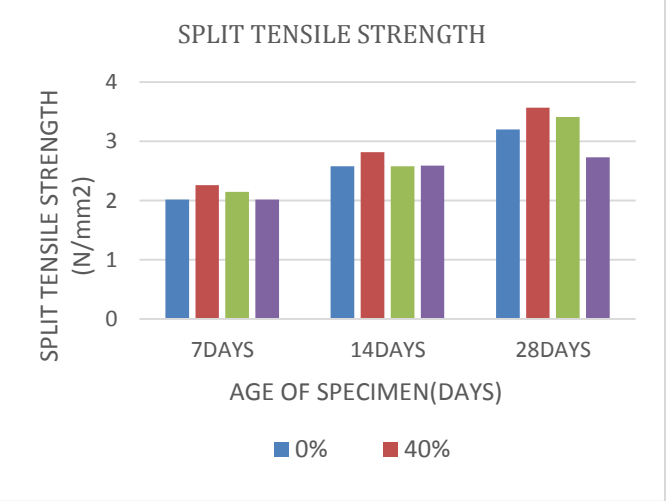
Table I. Compressive Strength of concrete

SL. NO	MIX	AVG.COMPRESSIVE STRENGTH ($\frac{N}{mm^2}$)		
		7DAYS	14DAYS	28DAYS
1	0%	19.40	23.59	35.70
2	40%DCA&1%SF	23.25	35.40	39.99
3	50%DCA&1%SF	22.06	33.92	38.66
4	60%DCA&1%SF	21.18	32.29	36.29

Table II. Split tensile strength

SL. NO	MIX	AVG.SPLIT TENSILE STRENGTH ($\frac{N}{mm^2}$)		
		7DAYS	14DAYS	28DAYS
1	0%	2.02	2.58	3.20
2	40%DCA&1%SF	2.26	2.82	3.57
3	50%DCA&1%SF	2.15	2.58	3.41
4	60%DCA&1%SF	2.02	2.59	2.73





2. SPLIT TENSILE STRENGTH

A measure of the ability of material to resist a force that tends to pull it apart. It is expressed as the minimum tensile stress (Force per unit area) needed to split the material apart.

$$\text{Split tensile strength} = \frac{2P}{\pi dl} \ (\text{N/mm}^2)$$

Where,

P - Load (N)

D - Diameter of specimen (mm)

L - Length of the specimen (mm)

3. FLEXURAL STRENGTH ON BEAM

The flexural strength is stress at failure in bending. Flexural strength, also known as modulus of rupture, or bend strength, or transverse rupture is a material property, defined as the stress in a material just before it yields flexure test.

The modulus of rupture is determined by testing standard test specimens of size 100 X 100 X 500 mm.

$$\text{Flexural Strength} = \frac{3Pa}{bd^2} \ (\text{N/mm}^2)$$

Where,

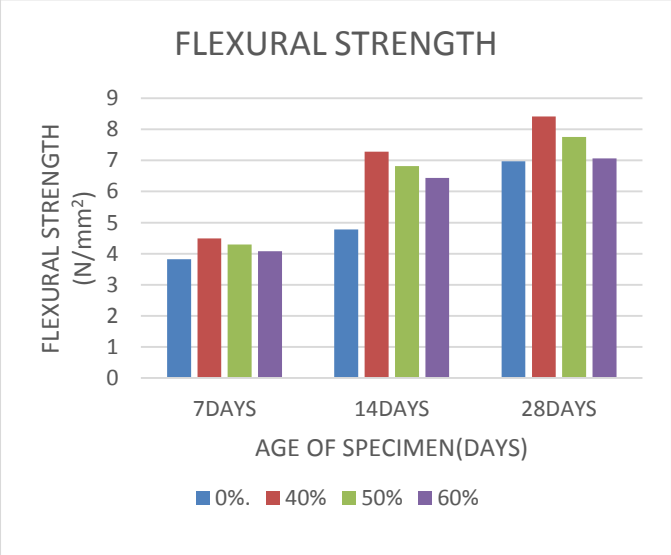
P - Load (N)

a - Diameter of specimen (mm)

b - Breath of the specimen (mm)

d - Depth of the specimen (mm

SL. NO	MIX	AVG. FLEXURAL STRENGTH ($\frac{N}{mm^2}$)		
		7DAYS	14DAYS	28DAYS
1	0%	3.82	4.78	6.97
2	40%DCA&1%SF	4.49	7.28	8.41
3	50%DCA&1%SF	4.29	6.82	7.75
4	60%DCA&1%SF	4.08	6.44	7.07



RECOMMENDATION:

Based on the result of the test, it is recommended that 60% DCA& 1% SF (lathe waste) is optimum for replacement coarse aggregate it as an economical for use in concrete works.

7. CONCLUSION

The following conclusion can be drawn from the results obtained from the experimental investigations.

The specimen cast with 40% DCA&1%SF replacement by coarse aggregate gives better compressive strength of 1.27% increased, Split tensile strength of 1.11% increased and Flexural strength of 1.29% increased. When to compare to conventional concrete.

The specimen cast with 50%DCA&1%SF replacement by coarse aggregate gives better compressive strength of 1.22% increased, Split tensile strength of 1.04% increased and Flexural strength of 1.22% increased .When to compare to conventional concrete.

The Replacement of Demolished Aggregate Concrete (DCA) 60%& Steel Fibre (SF) 1% it also gives the better result in compression strength (1.15%), split tensile strength (0.95%) & flexural strength (1.13%) when compare to conventional concrete.

Comparison of three different percentages of replacements, the strength will not reduce when compare to conventional concrete. So, the replacement of 60%DCA&1%SF in concrete gives more Economical and provides better performance.

8. REFERENCE:

. 1. Mohd Monishl, Vikas Srivastava1, V.C. Agarwal1, P.K. Mehta2 and Rakesh Kumar2 (2013) "Demolished waste as coarse aggregate in concrete" ISSN: 2278-5213
Feb-2013

2. Vaishali.G. Ghorpade1 "effect of recycled coarse aggregate on workability and shear strength of fibre reinforced high strength concrete" ISSN: 2319-8753
Vol. 2, Issue 8, August 2013

3. Tammi Sai Krishna "An Experimental Investigation on Flexural Behavior of Recycle Aggregate Fiber Reinforcement Concrete" e-ISSN: 2395 -0056 Volume: 02 Issue: 04 | July-2015

4. Suman Preet Singh 1, Rajwinder Singh Bansal2 "Strength evaluation of steel fibre reinforced concrete with recycled aggregates" e-ISSN: 2320-8163 Volume 4, Issue 1 (January-February, 2016)

5. Abhishek Mandloi1 Dr. K. K. Pathak2 Utilization of Waste Steel Scrap for Increase in Strength of Concrete-Waste Management *ISSN (online): 2321-0613* Vol. 3, Issue 09, 2015

6. Aiyewalehinmi E.O1 and Adeoye T.E2"Recycling Of Concrete Waste Material From Construction Demolition waste" Volume 2 ~ Issue 10 (2016) pp10-19ISSN(Onli ne) : 2321-8193 April, 2016;

7. Prakash Somani1,Brahmtosh Dubey2, Lavkesh Yadav3, Jitendra Kumar4, Abhishek kumar5 ,
Mahipal Singh6 "Use of demolished concrete waste in partialreplacement of coarse aggregate in concrete" *(SSRG-IJCE) – volume 3 Issue 5 – May 2016*
8. Jitender Sharma1, Sandeep Singla2 "Study of Recycled Concrete Aggregates" *(IJETT) – Volume 13 Number 3 – Jul 2014*
9. Mirjana Malešev 1, Vlastimir Radonjanin 1 and Snežana Marinković2,"Recycled Concreteas Aggregate for StructuralConcreteProduction"ISSN2071-1050 *March2010*