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Effect on Workability and Flexural Strength by Replacement of Natural Course Aggregate with Waste Course Aggregate

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Abstract:-The aim of sustainable development is to reduce the environmental impact of a constructed facility over its lifetime. The research has been executed in order to utilize waste coarse aggregate from demolished concrete, which is conserve our natural resources of virgin aggregates and also reduce the cost of construction. This paper introduces an experimental investigation on the effect of properties of concrete such as workability and Strength tests using waste Coarse Aggregate (WCA) by replacing natural coarse aggregate (NCA). The results of this experimental study is aimed at examining the properties and strength of waste coarse aggregate concrete made from 5%, 10%, 15% & 20% replacement ratios of WCA from NCA. The properties and consequences of waste coarse aggregate concrete is found and compared to that of Reference concrete (RC) and reported in this paper. Thus from the results of workability and Flexural strength it can be concluded that for percentage replacements of NCA by WCA up to 20% there is a reduction in workability and strength of concrete was marginal. Hence the results with 20% use of waste coarse aggregates give workable, strong and green concrete as comparable to the Reference concrete.

Keywords- Waste coarse aggregate (WCA), Natural coarse aggregate (NCA), Reference concrete (RC), Workability, Flexural strength.

I. INTRODUCTION

In the world of construction, concrete like different materials is playing an essential role in construction development. Concrete is a composite material which is a mixture of cement, fine aggregate, coarse aggregate, water and some times admixtures are also used to improve its quality and property. Concrete is such an expensive material however now a day's demolished concrete is only being used as a landfill material instead of recycling the concrete as a waste coarse aggregate (WCA) to use for the development reason.

II. EXPERIMENTAL INVESTIGATION

In the present work control concrete mix of M-25 grade was designed in accordance with ISI0262-2009. Four series of mixtures were prepared by replacing natural aggregate with 5%, 10%, 15% and 20% waste coarse aggregates. The mixes are designates as Reference, WCA 5%, WCA10%, WCA15% and WCA20% respectively. The experimental Programme consisted of testing the properties of fresh concrete and strength properties of hardened concrete according to relevant IS code of practical.

1. Test on Materials

- Water absorption test
- Slump test
- Flexural strength test

1.1 Water absorption test

To determine the water absorption of aggregate first of all we take the sample of aggregates (WCA & NCA). Now sample is immersed in clean water for about 24 hours and dried to surface dry condition. The sample is divided into two equal parts and weigh, this weight of surface dry sample is recorded as B. One sample is placed in an oven and dried to a constant weight and noted as A.

Table 1: Water absorption of aggregates

Material	**Weight of sample (gm)**	**Surface dry sample weight (B)in gm**	**Oven dry sample weight (A) in gm**	**% of water absorption** $\frac{B-A}{B} X100$
Natural Coarse aggregate	1500	750	748	0.26
Waste coarse aggregate	1500	750	725	3.33

1.2 Slump test

The slump tests were carried out on fresh concrete mixes. While casting specimens, slump test was carried out to determine the workability of fresh concrete mixes as per IS 6461-1973.The slump value for different concrete mixes is given in table 2.

Table 2: Slump value of different percentage of Waste coarse aggregate (WCA)

Particulars	**Slump (mm)**
0% WCA (Reference concrete)	30
5%WCA	27
10%WCA	26
15%WCA	26
20%WCA	25

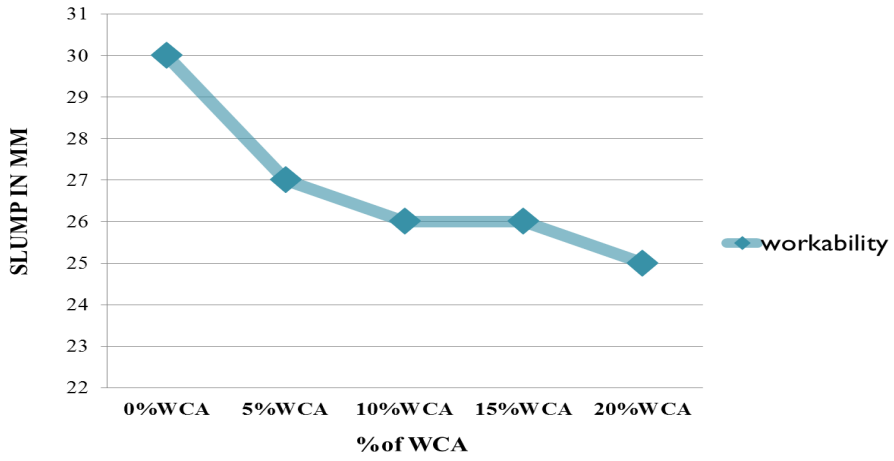

Fig. 1: Workability of various percentage of WCA concrete

1.3 Flexural strength test

The rectangular beam of size 150x150x700mm for each mixes was cast for the determination of flexural strength. To study the strength development of WCA concrete is comparison to Reference concrete, flexural strength tests were conducted at the age of 28 days. The test results are reported in the table 3 for different Replacement of WCA concrete respectively.

Table 3: Flexural strength of concrete at 28 days in tones

Mixes	Reference concrete	WCA5%	WCA10%	WCA15%	WCA20%
Flexural strength at 28 days	2.65	2.56	2.49	2.46	2.40

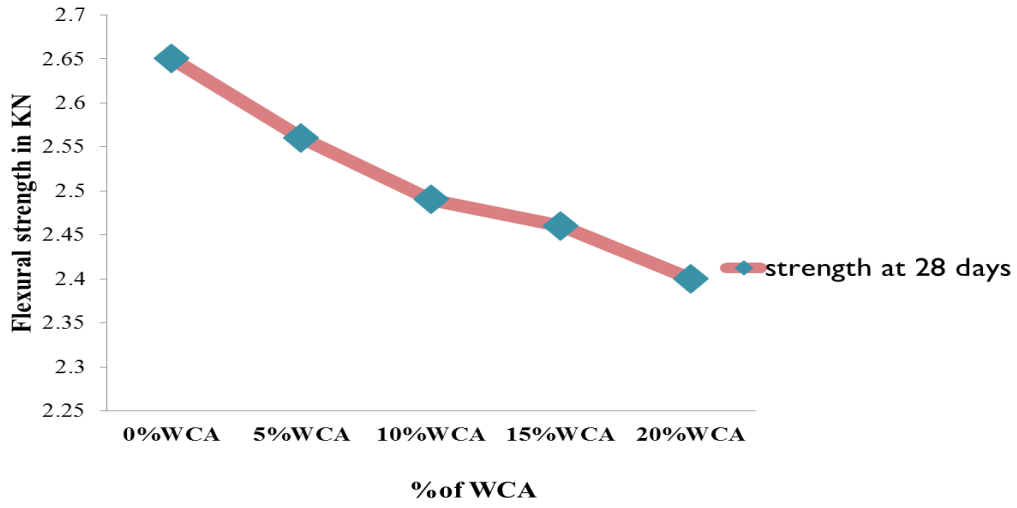

Fig. 2: Represents the variation of flexural strength with percentage replacement of WCA for M25 grade concrete

III. CONCLUSION

- Replacement of natural coarse aggregates by WCA (Waste coarse aggregates) up to 20%, the effects are marginal.
- The water absorption of WCA is higher than the natural Coarse aggregates. The range may vary based on the type of aggregates in this case it is 2.5% higher. This is also because of the attached mortar present on the aggregate surface.
- The slump value for WCA concrete up to 20% replacement shows a decrease of about 5%.
- Replacement of natural coarse aggregate by WCA up to 20% is possible, without much compromising the strength and workability.
- The variation in flexural strength of WCA concrete and natural coarse aggregate concrete was marginal. A reduction of 5 to 18 % was found in the 28 days flexural strength of WCA concrete.

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