Assessment of Aggregate Potential from a Dismantled Multi Storey Building - A Case Study of Vasant Vihar Area (Pocket A)

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ABSTRACT: The Vasant Vihar area is known as bungalow type of structure with low high building. This type of building is quiet popular in the Vasant Vihar area however recently due to high density population and multiplication of families few of the bungalows have been converted into G+4 storey building.

Since, the old buildings have got good quality of cement n concrete with steel bars therefore the dismantled building have generated lot of coarse aggregate n the disposal of these aggregates were difficult for the area because it was creating lots of dust. Owing to the situation of air pollution specially dust it was recommended that the dismantled building materials must be used as coarse aggregate material. Since, the bungalow structure was converted to the G+4 storey building therefore the required amount of coarse aggregate was accommodated within the required manufacturing of concrete.

Huge quantities of construction and demolition wastes are generated every year in developing countries like India. The disposal of this waste is a very serious problem because it requires huge space for its disposal and very little demolished waste is recycled or reused. This study is a part of comprehensive program wherein experimental investigations have been carried out to assess the effect of partial replacement of coarse aggregate by demolished waste on workability and compressive strength of recycled concrete for the study at 7-day and 28-day. The compressive strength thus, observed was compared with strength of conventional concrete. Test results showed that the compressive strength of recycled concrete up to 30% coarse aggregate replacement (C. A. R.) by demolished waste at the end of 28-day has been found to be comparable to the conventional concrete.

Keywords: Demolished wastes, workability, compressive strength, recycled concrete, coarse aggregate.

INTRODUCTION

India is the fastest growing economy in Asia and infrastructure serves as a pillar for this enormous growth in economy. But due to the rapid development mainly in the metro cities the rate of dismantling has also increased three folds. Thus, huge amount of demolition wastes is generated every year in the developing country like India. But the disposal of this dismantled waste is an extremely serious problem to the environment.

We know that the design life of a residential building is generally 50 years. Inhabitation of the structure after its design life is over is very dangerous to its occupants and also for the surrounding buildings. Thus the demolition become essential to prevent the future accidents due to collapse of any part of the building and loss of life of the inhabitants. It can also cause damage to the neighbouring properties. The accumulated dismantled material is hard to dispose off and pollutes the environment.

So, the reusing of the dismantled material become the only sustainable approve towards disposing off the dismantled material. After analysing the dismantled waste collected from the Vasant Vihar area of New Delhi it was found that large proportion the waste was concrete rubbles. It has been reported by several researchers (Hansen, 1992; Mehta and Monteiro, 1993; Collins, 1994; Sherwood, 1995) that the crushed concrete rubble can be used as a substitute for coarse aggregate in concrete. Some construction projects have been successfully completed using the recycled aggregates (Desmyster and Vyncke, 2000). Hendricks and Pieterson (1998) prepared concrete in which up to 20% natural aggregate was replaced with recycled aggregate and noticed a little effect on the properties of resulting concrete though the concrete strength decreases slightly when recycled aggregate was used.

MATERIALS AND METHODS

Demolished waste: Demolished waste was collected from Vasant Vihar, Pocket A, New Delhi. Demolished waste on being tested in Concrete Technology lab of School of Engineering & Technology of IFTM University, Moradabad. Demolished waste found to be pozzolanic in nature was used to partially replace coarse aggregate in the mix.

Cement: Ordinary Portland cement of Birla (43 grade) brand was used. The physical properties of OPC are shown in Table 1. The cement was tested for its physical property and it satisfies the requirement of IS: 8112-1989.

Concrete: The concrete mix design was done in accordance with IS:10262 (1982). Maximum size of coarse aggregate was 12.5 mm and a sieve analysis conforming to IS:383-1970 was carried out for both the fine and coarse aggregate.

Fine aggregate: Fine aggregate is obtained from locally available river sand, which is passed through 4.75 mm sieve. The fineness modulus of fine aggregate was 2.74 and specific gravity was 2.63.

Coarse aggregate: Coarse aggregate was obtained from locally available crushed stone aggregate about 12 mm maximum has been used in the experiment. Specific gravity of the coarse aggregate was 2.64 and the fineness modulus of coarse aggregate was 6.22.

Water: Potable water is used for mixing and curing. On addition of higher percentage of demolished waste, the requirement of water increases for the same workability. Thus, a constant slump has been the criteria for water requirement.

This study is a part of sustainable construction technique that can be employed to use the waste produced during the dismantle of the structure into a course aggregate. In this experimental investigations cheaper substitute i.e., demolished waste was used and investigation was done to assess the effect of replacement of regular material with dismantled waste. Compressive strength of this recycled concrete were observed and was compared with the natural aggregate concrete. To carry out the investigation cube size of 150mm x 150mm x 150mm was casted and coarse aggregates were replaced by demolished waste in fixed proportion of 10%, 20%, and 30% respectively. These specimens were tested after 7-day and 28-day to identify cube strength.

Table 1. Properties of cement

Properties	Required as per IS:8112-1989	Observed Values
Normal Consistency	-	28%
Initial setting time	30 Min	110 Min
Final setting time	600 Min	320 Min
3-day compressive strength	23 N/mm^2	23.42 N/mm^2
7-day compressive strength	33 N/mm^2	34.21 N/mm^2
28-day compressive strength	43 N/mm^2	43.79 N/mm^2

Table 2. Slump and average compressive strength of concrete

Types of concrete	Compressive Strength (N/mm^2)		Slump Test (mm)
	7-Day	28-Day	
0% replacement of Demolished waste	12.3	35.2	30
10% replacement of Demolished waste	11.6	32.1	22
20% replacement of Demolished waste	10.2	30.7	26
30% replacement of Demolished waste	10.0	30.1	25

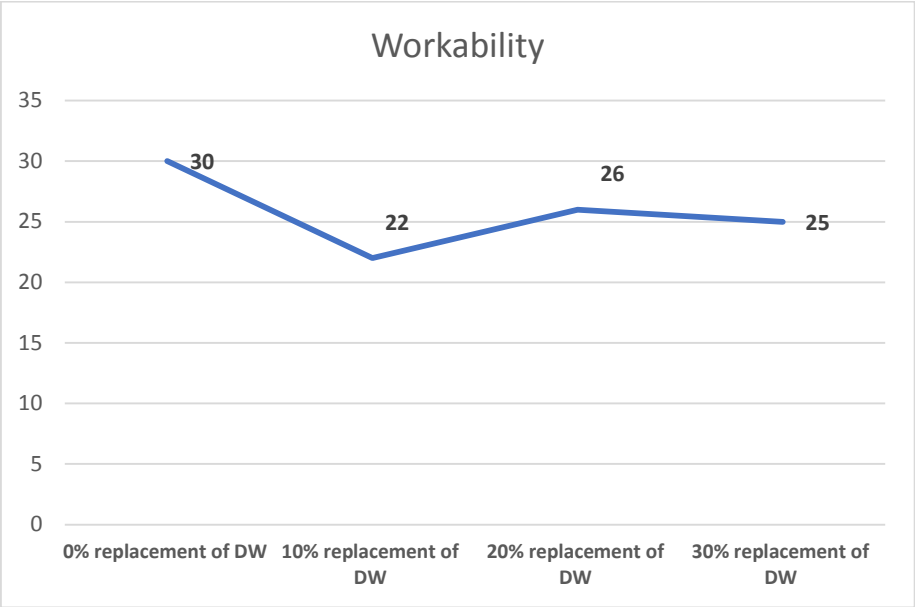

Fig. 1. Workability of various percentage of concrete mix

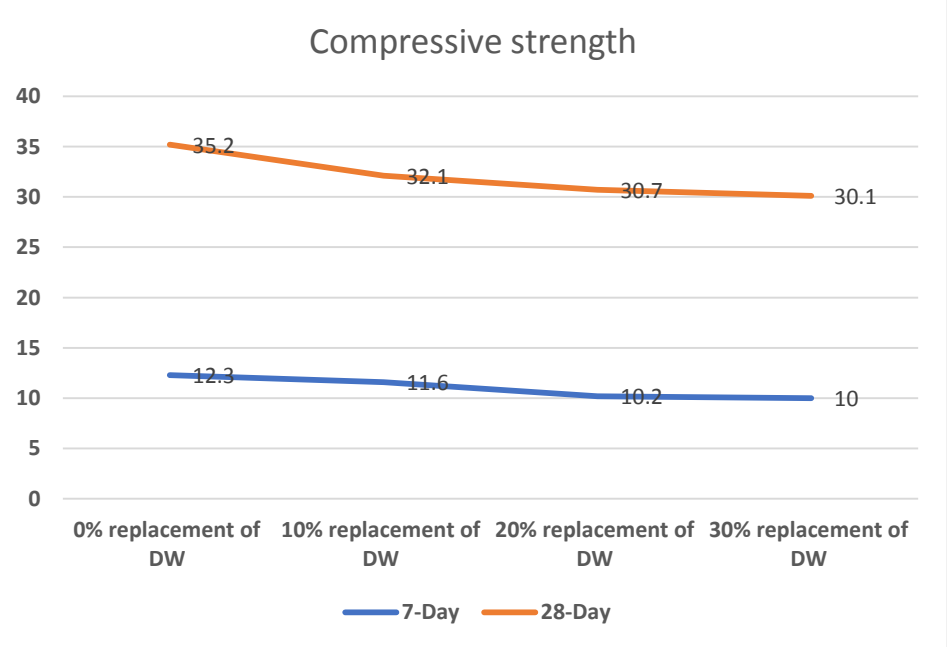

Fig. 2. Compressive strength of various percentage of concrete mix

RESULTS AND DISCUSSION

The observations noted in regards to workability and compressive strength summarized in Table 2, Figure 1 and 2. Three cubes with 0%, 10%, 20%, and 30% demolished waste as coarse aggregate replacement were casted and tested after 7-day and 28-day and the result was compared with the natural aggregate conventional mix. For determining the fresh concrete property like workability, slump test was carried out on the different samples as per IS: 6461-1973. Table 2 shows the variations of slump for recycled concrete mixes.

The specimens were then casted in cubes to determine the 7-day and 28-day compressive strength and these observations are presented in graphical format in Figure 2. Specimen upto 30% of coarse aggregate was replaced by demolished waste which gave strength closer to the strength of plain concrete cubes.

CONCLUSION

The following conclusions were noted from the experimental study

1. Only upto 30% replacement of coarse aggregate with recycled aggregate concrete was possible beyond this the workability and compressive strength were not comparable to conventional concrete.

2. Water required to make the design mix for the same workability saw a increasing trend when the percentage of demolished waste increases.

3. Up to 30% of coarse aggregate replaced by demolished waste gave strength closer to the strength of plain concrete cubes.

4. Recycled aggregate concrete may be an sustainable alternative to the conventional concrete.

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