

COMPARATIVE STRENGTH STUDIES OF RECYCLED AGGREGATE CONCRETE AND FRESH CONCRETE

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ABSTRACT

The waste generated during the construction and demolition activities include sand, gravel, concrete, bricks, metal, plastic, glass etc. This construction and demolition waste is mainly disposed in landfills. Recycling and reuse of this waste will result in preservation of natural resources, effective utilization of growing waste stream, saving landfill space. This paper discusses the utilization of recycled aggregates as coarse aggregates in the preparation of concrete. In the present study, fresh concrete and recycled aggregate concrete (RAC) cubes are prepared and tested for compressive strength at the end of 7th, 14th and 28th days curing. The results are compared for both the types of concrete.

KEYWORDS

Construction and Demolition, Recycling and Reuse, Recycled Aggregates, Compressive Strength

1. INTRODUCTION

Global construction industry is growing in high rate. The construction industry requires the continuous supply of raw materials of different types. Hence large material inventories are required to cater the demand.

Natural resources like sand and aggregate are used as raw material in the construction industry. These resources are depleting being non-renewable, so they should be used carefully. Natural aggregates are used for the ongoing construction projects at the same time they are used for repair work. Indian construction industry is one of the largest construction industries in the world. The construction-demolition is the continuous process and hence generates bulk amount of construction and demolition (C&D) waste. The management of C&D waste is becoming a serious concern because of their bulk quantity, transportation and disposal problem, shortage of dumping sites, environmental problem etc. Large amount of waste is generated from construction and demolition work. Part of this waste can be reused for the construction of new structures after some processing. This idea is not much popular in developing countries like India.

Hence the objective of the present work was to identify the opportunities, constraints and means to convert the C & D waste into a reusable construction material.

The focus of this study was to reduce the burden on landfills by focusing on the reuse of C & D waste.

2.MATERIALS

Recycled aggregate:This study focused on the use of recycled aggregates obtained after demolition process. The recycled aggregates used for casting concrete cubes were obtained from a construction site in Punjabi Bagh, New Delhi.

Cement and sand: Cement of grade 43 and sand has been used in this study.

3. EXPERIMENTAL PROGRAM

3.1 CONCRETE MIX PREPARATION

The concrete mix was prepared as per IS 10262 using binder-sand-aggregate ratio as 1:2:4. Two types of concrete mix were prepared. Fresh aggregates were used to prepare first set and recycled aggregates were used for second.

Hence a water cement ratio of 0.6 is being used in the present work.

3.2 CUBE CASTING

For compressive strength of concrete, cube of size 150x150x150 mm were casted for fresh aggregate concrete (FAC) and recycled aggregate concrete (RAC). Three cubes for each curing period were prepared with FAC and RAC respectively. Cement, sand and aggregates were dry mixed together in required proportion. Then appropriate amount of water was added to prepare the homogeneous concrete mix. This mixture was filled in cube mould in three equal layers.

3.3 METHOD OF CURING

The cubes were demoulded after 24 hours. The curing of these cubes was done by keeping them in water of ambient temperature. The water was changed after every 7 days. The curing was continued till the respective cubes were tested after 7, 14 and 28 days for strength of concrete in compression.

3.4 COMPRESSIVE STRENGTH TEST

For each concrete mix three identical cubes were tested. Compression testing machine was used for testing these cubes as shown in Fig. 3.



Figure 1: Cube under compression machine

4. RESULTS AND DISCUSSION

The compressive strength for 7, 14 and 28 days curing for FAC and RAC is shown in figure 4 and 5 respectively. It can be observed from the fig. 4 and 5 that the strength increases continuously with curing period. The maximum strength achieved at 28 days curing was 14.6 N/mm² and 13.4 N/mm² for FAC and RAC respectively. The comparison of the strength achieved for FAC and RAC is shown in fig. 6 and the strength reduction for RAC as compared to FAC is tabulated in table 2. It is observed from here that the reduction in strength decreases with curing period. The reason for this reduction may be the slow pozzolanic reaction that takes place and hardening of concrete with time. The strength reduction at 7, 14 and 28 days curing period was 15, 11 and 9% respectively.

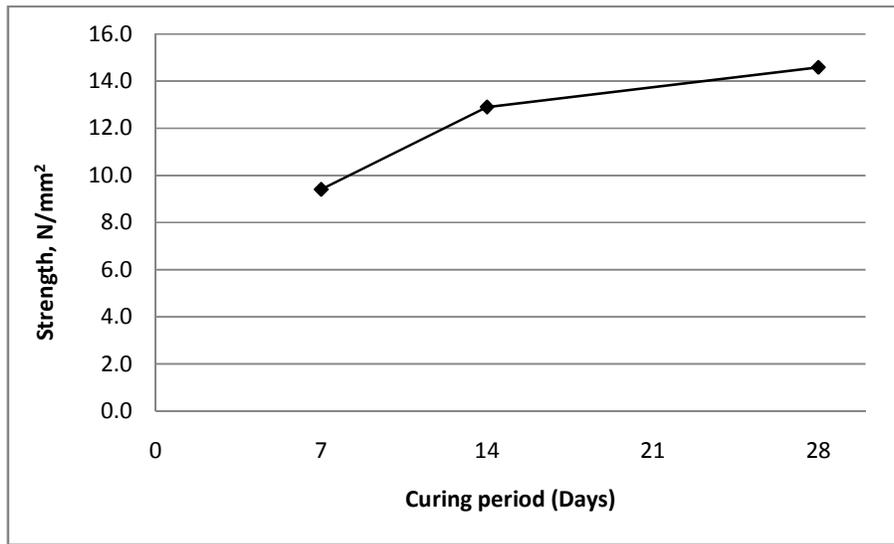


Figure 2: Compressive strength of fresh aggregate concrete

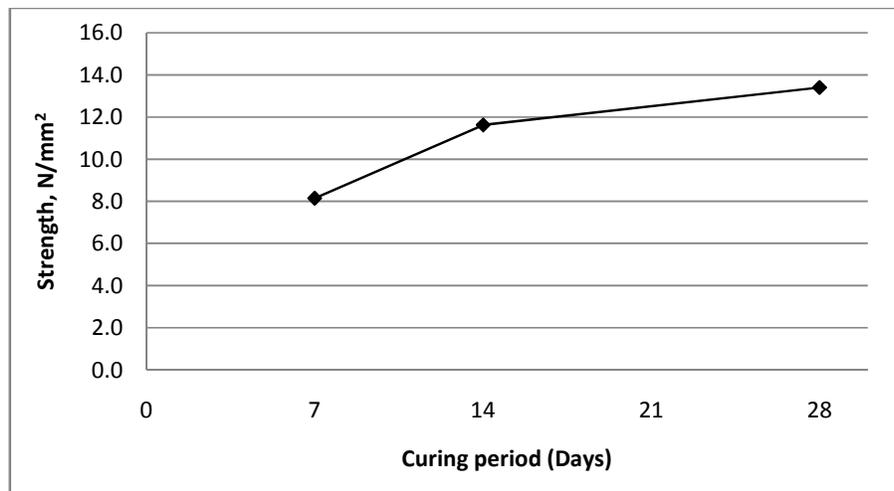


Figure 3: Compressive strength of recycled aggregate concrete

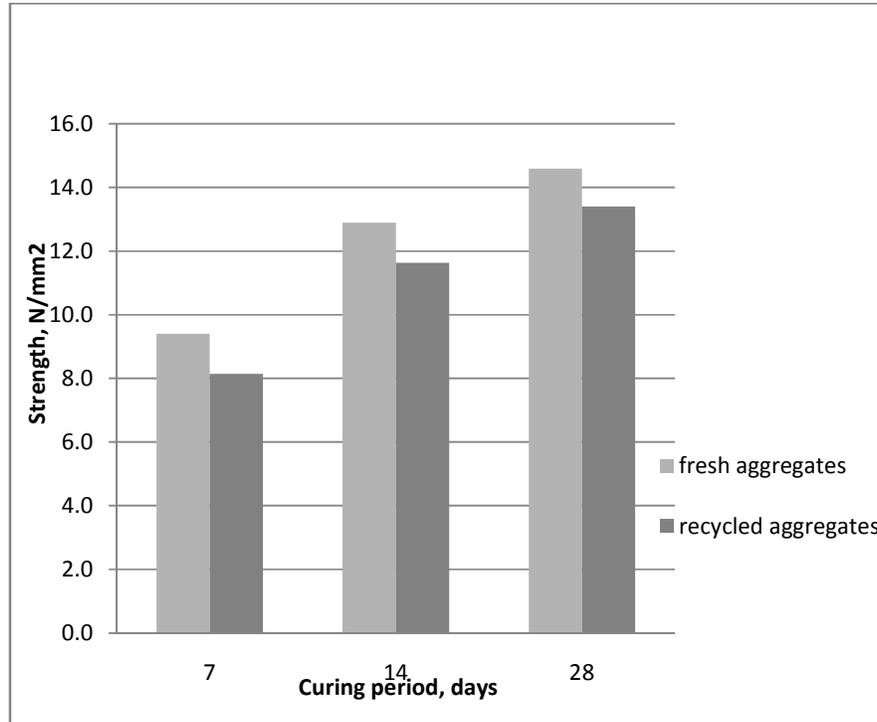


Figure 4: Comparative strength of fresh and recycled aggregate concrete

Curing period	Percent reduction
7	15
14	11
28	9

Table 1: Percent reduction in strength for RAC as compared FAC

5.CONCLUSION

The compressive strength achieved at 28 days for FA and RA was 14.6 and 13.4 N/mm² respectively. Hence a 9% reduction of strength was observed at 100% replacement of FA by the RA. The study shows that fresh aggregates can be replaced by the recycled aggregates. Recycled aggregate concrete can minimize the waste disposal problem and can reduce the cost of concrete. Further the studies may be conducted for the use of recycled aggregates in concrete considering different water-cement ratios.

More parameters like ratio of replacement of natural aggregate with recycled aggregate, moisture condition of recycled aggregate etc can be considered for checking the strength of concrete in compression.

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