

Effect of Strength Properties of Recycled Aggregate Concrete

Shylaja N

*Assistant Professor, School of Civil Engineering,
REVA University, rukmini Knowledge Park,
Kattigenahalli, yelahanka, Bengaluru, Karnataka, India*

Nanjunda K N

*Assistant Professor, School of Civil Engineering,
REVA University, rukmini Knowledge Park,
Kattigenahalli, yelahanka, Bengaluru, Karnataka, India*

M Sreenivasulu Reddy

*Assistant Professor, School of Civil Engineering,
REVA University, rukmini Knowledge Park,
Kattigenahalli, yelahanka, Bengaluru, Karnataka, India*

Anusha P Gowda

*Assistant Professor, School of Civil Engineering,
REVA University, rukmini Knowledge Park,
Kattigenahalli, yelahanka, Bengaluru, Karnataka, India*

Abstract

The outline of this research article is to check the usage of recycled aggregate concrete in civil engineering structures. Recycled aggregates utilized in the present work was generated from concrete cubes collected from different sites, which are crushed in a crusher to a fine size ranging from 4.75 mm to 10mm. Three different concrete mixes were produced and tested for compressive strength and water absorption. From the results, it is seen that there is no much enhancement in compressive strength as recycled aggregates percentage increased. But it is observed that water absorption increased as recycled aggregates percentage increased. Thus based on the performance benefits, these aggregates must balance against increase on the environment impact. Hence recycled concrete aggregate may be suggested in pavements and bridges in transportation infrastructure.

Keywords: compressive strength recycled aggregate, recycled aggregate concrete etc.

Introduction

With the recent development in civil engineering field, it is reportedly that approximately 200 million tons of concrete waste was generated in china in a year [1]. Waste concrete recycling has become a very good approach in the worldwide due to the disposing of demolition and construction waste. Also, global construction activities are growing in persistently to find defended resources for replacing the natural materials in concrete production. In the last ten years, many researchers investigated systematically the usage of recycled aggregate derived from demolition wastes and construction wastes to produce concrete products [2]. Recycled aggregates are mainly consists of coarse natural

aggregate and old cement mortar. Generally it is seen a lot of difference in physical properties such as high void ratio, low bulk density, high water absorption, high porosity, low bulk density etc., between recycled aggregate concrete and ordinary aggregate concrete due to several commendable reasons such as rough surface, angular grain and adhere of motor to aggregate [3]. Many researchers have been carried out their experimentation on mechanical characteristics of recycled coarse aggregates concrete. Also, many research investigators have expressing criticism to the possibility of usage of recycled aggregates to make structural concrete [4-5]. Some research scholars showed that compressive strength decreases with the recycled aggregate concrete with certain range of content, however with the increase of aggregate, the modulus of elasticity of the concrete decreases around 20%, which is proven by many researchers, however the particle size was not considered on the mechanical behavior of recycled aggregate concrete.

[6-9]. Surya M et al [10] showed that water absorption of recycled aggregate concrete is increased with increase in percentage of recycled aggregates but have passably higher resistivity as compared with natural aggregate concrete. The higher resistivity of recycled aggregate concrete shows a beneath permeability to chloride stipulate lower possibility of reinforcement corrosion.

Experimental investigation

The recycled aggregates in the research were generated by crushing waste concrete collected from three different sites as shown in Fig.1 and crushed at the crushing unit, where it is segregated into three to four types of aggregates and M sand. In the present work we used only two types of aggregates

whose size ranging from 4.75 mm to 10mm. Three concrete mixes were produced with different proportions as 1:1.5:3, 1:2:4 and 1:4:6. The calculated quantity of the materials is dry mixed for 3 to 5 min and dumped in an inclined bucket conveyor and transported to the mixing machine. The block making machine force the concrete down words into the mould block size of 400 x 200 x200. Concrete blocks are wrapped up in a rack and curing is done for 28 days. Succeeding the curing period, mechanical characteristics of the hardened concrete was evaluated.



Figure 1: Crushed waste concrete



Figure 2: Concrete blocks curing

Results and Discussion

Compressive Strength

Figure.3 to 5 shows the variation of compressive strength between normal concrete blocks and recycled concrete blocks at different sites. From Figure 3 and 4 it is clear that the compressive strength increases with increase in load in both the cases. However the maximum average compressive strength of 2.15 N/mm² and 3.45 N/mm² at proportion of 1:1.5:3 and 1:2:4 respectively was obtained as compared with and recycled concrete blocks. However at site 3, for proportion 1:4:6, the results were very promising as shown in Figure 5. As compared with the other two sites, the recycled concrete blocks have the higher strength than the normal solid concrete blocks at an average compressive strength of 5.32 N/mm² and observed a 26% increase in compressive strength as compared with normal concrete blocks.

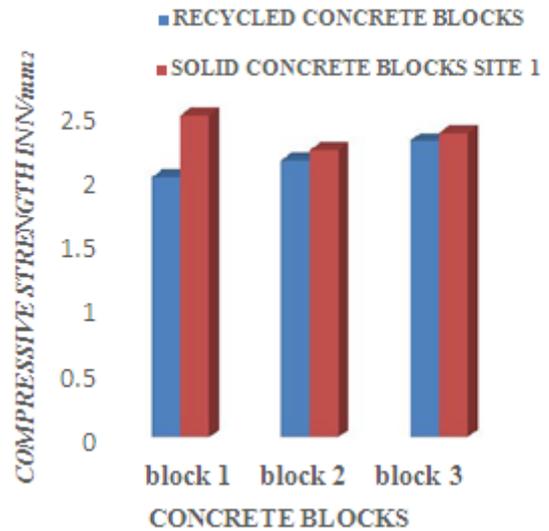


Figure 3

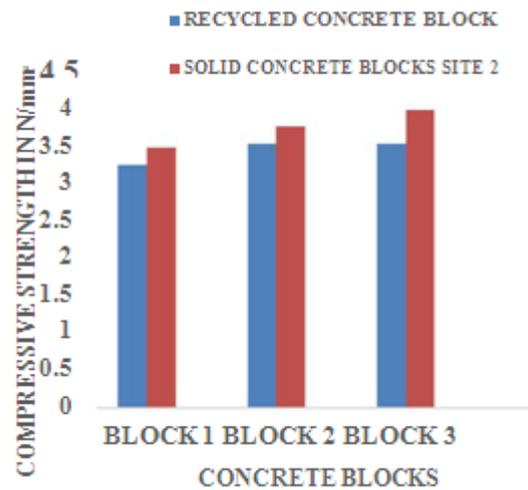


Figure 4

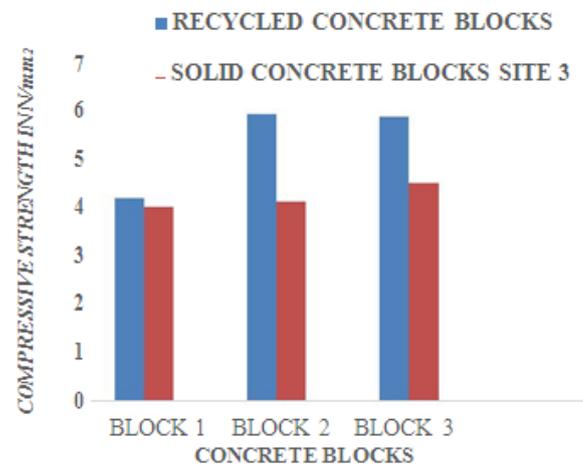


Figure 5

Figure 3, 4 and 5: Compression strength between recycled concrete blocks and normal concrete blocks at different sites.

Water Absorption Test

The outcome of water absorption test conducted for different mixes is shown in Figure 6. From the Figure 6 it is seen that as the quantity of recycled aggregate increases, the water absorption also increases. Also it is discern that, the water absorption value of recycled concrete blocks was 2.68% which is larger than the normal concrete blocks. This may be ascribing to higher water absorption of recycled concrete aggregates as compared with natural aggregates.

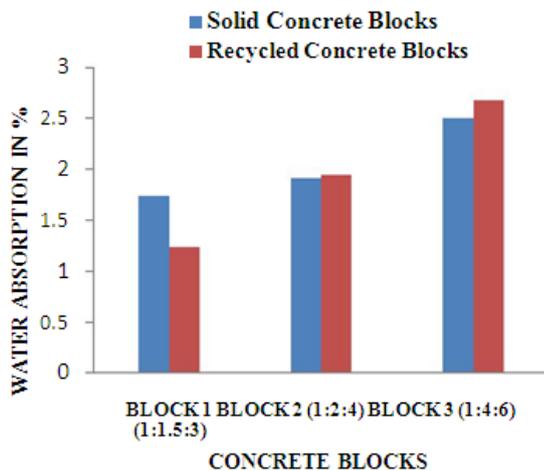


Figure 6: Water absorption between solid concrete blocks and recycled concrete blocks.

Conclusion

This paper investigated the influence of aggregate size on the strength performance of recycled aggregate concrete and the following conclusions can be drawn.

- The recycled aggregates used satisfies the codal requirements in respect to physical and strength properties, however their values are lower than the natural aggregates.
- The compression strength of the recycled aggregates concrete increases with increase in load similar to natural aggregate concrete; however its strength in a particular case was 5.32 N/mm² which is higher than normal solid concrete blocks.
- The water absorption of recycled aggregates concrete increases by 2.6% as compared to natural aggregate concrete.
- Finally, it is concluded that, the recycled aggregates concrete properties are fulfilled the expectations for usage in concrete.

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