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Experimental Investigation on Concrete with Different Waste Stone as a Aggregate

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Abstract

Advancements in technology get better not only human comforts but also harm the environment. Use of waste stone as a aggregate in construction industry has become popular and safe now. At present construction industry is in need of finding cost effective material to enhance the strength of concrete. The effect of natural aggregate concrete (NAC), granite stone concrete (GSC), recycled aggregate concrete (RAC) and shabath stone concrete (SSC) were investigated. Experimental investigation was done using M20 mix and tests were carried out as per recommended procedures by relevant codes. The compressive strength and flexural strength of concrete has been studied in this research.

Keywords: Natural and Recycled aggregate, Shabath and Granite stone, compressive strength.

As a construction material, concrete is not considered to be environment friendly due to its unpleasant effects on the environment. However, it remains to be a most commonly used construction material. This creature the current situation, the concrete industry has to conform to sustainable development, predicting the future of concrete and developing essential strategies concerning this issue. For instance, better durability and more efficient use of concrete should be aimed at. Indeed, today, aggregates make up nearly 50 to 80% of concrete volume. Put differently, if the concrete industry fails to utilize substitute aggregates in the future, around 8 to 12 billion tones of natural aggregates will be addicted as of year 2010 (Tu et al., 2006). Veera reddy et.al., (2010) investigated the replacement of coarse aggregate by ceramic scrap and concluded that excess of 20% replacement of coarse aggregate by ceramic scrap leads to reduction of strength compared to the conventional concrete. T. Sekar et.al., (2011) Studied the compressive strength of concrete cube made with ceramic insulator and glass insulator were found to be 16% and 26.34% lesser than that of the conventional concrete. G. Murali et.al., (2012) investigated the natural aggregate had been replaced with the waste shabath stone and found that 30% replacement of coarse aggregate by shabath stone had attained a good strength. The use of recycled aggregate generally increases the drying shrinkage and decreases the compressive strength and modulus of elasticity of concrete compared to natural aggregate concrete [5-6].

Cement

The Portland Pozzolana Cement conforming was used for the preparation of test specimens. The properties of cement as shown in table 1.

Table 1: Properties of Cement

Property	Specific Gravity	Fineness	Initial Setting Time	Final setting Time	Compressive Strength
Value	3.00	97.80	1hr 04min	9hr 23min	54.18 N/mm2

Fine Aggregate

Clean River sand is used as fine aggregate. The specific gravity and fineness modulus were found to be 2.65 and 2.54 respectively. The properties are tested as per IS 383:1970 [7].

Coarse Aggregate

Four different coarse aggregate were used for this investigation viz, natural aggregate, shabath stone, recycled aggregate and granite stone respectively as shown in fig 1. Its properties are tested as per IS 383:1970 [7] and are given in the table.2.

Fig1 Broken granite, Shabath stone and Recycled aggregate.

Table 2: Properties of Coarse Aggregate

S.No	Type of aggregate	Impact value %	Crushing value %	Water absorption %
1.	NAC	7.2	22	0.55
2.	RAC	18	35	0.95
3.	SSC	17	31	0.84
4.	GSC	14	27	0.76

MIX PROPORTIONS

The concrete mix is designed as per IS 10262 – 2009 [8] and IS 456-2000 [9] for the normal concrete. The grade of concrete which we adopted was M20 with the water cement ratio of 0.45.

TEST SPECIMENS

Cubes of size 150mm X150mm X150 mm and prisms of size100mmX100mmX500 mm were prepared using the standard moulds. The samples are casted using the four different aggregate. The samples are demoulded after 24 hours from casting and kept in a water tank for 28 days curing. A total of 24 specimens are casted for testing the properties such as compressive strength, and flexural strength. The details of the specimen and their notations are given below in table.3.

Table: 3. List of Specimens

S.No	Type of aggregate	Cube (no's)	Prism (no's)
1.	NA	3	3
2.	RA	3	3
3.	SS	3	3
4.	GS	3	3

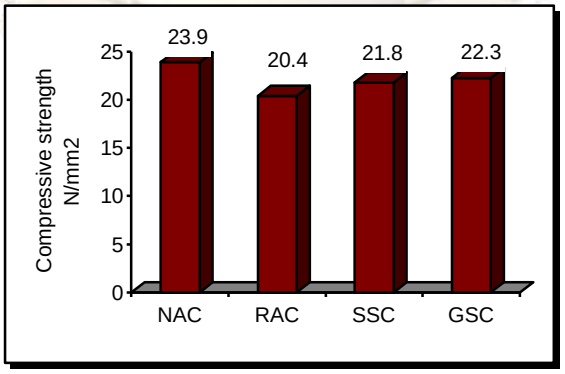

Fig. 2 Compressive strength Vs Various aggregate concrete

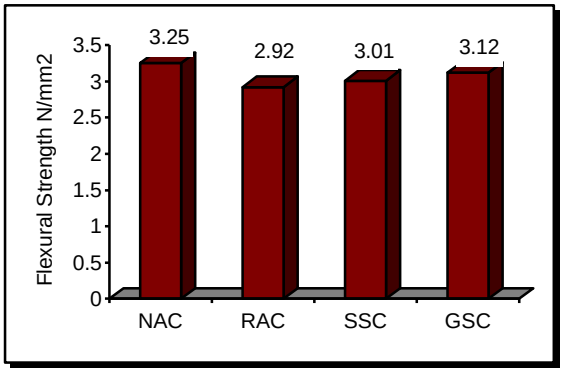

Fig.3 Flexural Strength Vs Various aggregate concrete

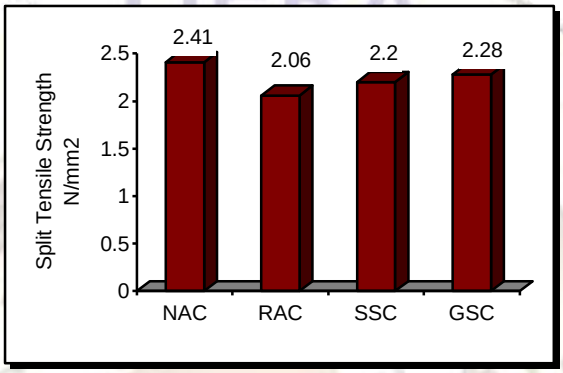

Fig.4 Split Tensile Strength Vs Various aggregate concrete

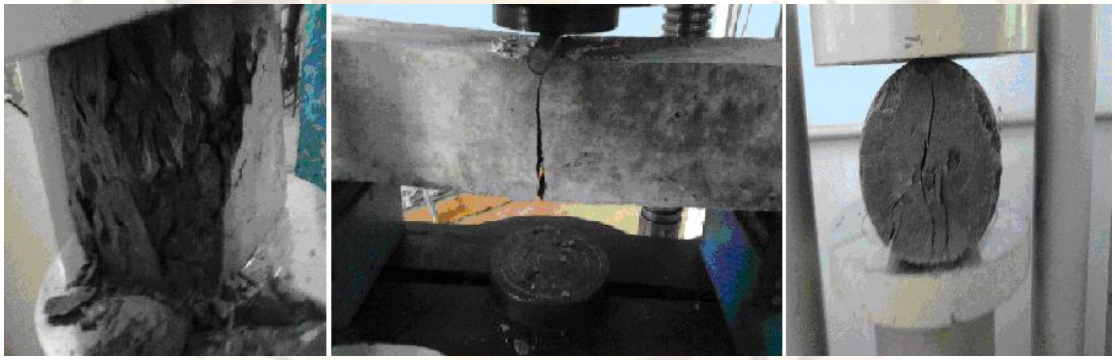

Fig 4. Failure pattern of cube and prism

RESULTS AND DISCUSSIONS:

It can be observed from the Fig.2 the compressive strength of NAC is found to be 23.9N/mm^2. Moreover the compressive strength of RAC, SSC and GSC were decreased by 14.64%, 8.78% and 6.69% respectively than that of the NAC. Similarly the Flexure strength of NAC is found to be 3.25N/mm^2. The Flexure strength of RAC, SSC and GSC was decreased by 10.15%, 7.38% and 4% than that of the NAC, are depicted in fig 3. The fig 4 shows that the Split Tensile Strength of RAC, SSC and GSC were decreased by 14.52%, 8.71% and 5.39% than that of the NAC. Above 3 cases, the strength of Recycled Aggregate Concrete was found to be lower than that of the other aggregates mentioned above.

CONCLUSION:

Based on the results obtained from the experiments, the following conclusions are drawn:
The test result shows that the Compressive, Split Tensile and Flexure Strength of RAC were found to be lower than RAC, SSC and GSC. The Strength of GSC showed better performance than NAC and

SSC. Moreover the GSC gives similar strength that of the NAC. Hence waste Granite stone can be used as a coarse aggregate in construction industry depend upon the waste granite stone availability. Shabath Stone can be used as a aggregate in concrete for unimportant construction works.

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