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EXPERIMENTAL STUDY ON STRENGTH CHARACTERSTICS OF CONCRETE WITH PARTIAL REPLACEMENT OF CEMENT WITH GRANITE SLURRY AND PARTIAL REPLACEMENT OF AGGREGATE WITH QUARTZ STONE

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ABSTRACT: In the environmental, the waste material is available on the resources with an important consumption and growing need for aggregates, The granite production and high volume of quartz stone material is generated as a amount of waste material, Almost 65% of this waste material gets wasted on the processing and polishing stages which have a serious impact on the environment. And the granite slurry is also an production waste. So it has become these wastes particularly in the manufacture of concrete products for construction purposes. The objective of these study to possibility of using quartz stone material as a substitute rather than natural aggregates along with waste granite slurry powder as substitute of cement. This experimental study was carried out an two series of concrete mixes, gravel substitution mixture and mixture of cement and gravel substitution. The concrete foundations were produced with constant water/cement ratio. The results obtains that the strength characteristics of concrete specimens produced using quartz stone mixing up with the granite slurry powder and cement replacement with the granite slurry powder were found to conform with concrete production standards and substitution of natural aggregates by waste quartz stone and granite slurry up to 20% and 10% respectively along with submission of cement by granite waste slurry powder up to 10% of any formulation for concrete. The results obtained show that the strength characteristics of concrete specimens produced using quartz stone, Quartz stone aggregate along with granite waste slurry powder were found to conform with concrete production standards and substitution of natural aggregates by quartz stone aggregates up to 20% along with submission of cement by granite waste slurry powder up to 10% of any formulation is beneficial for concrete.

KEYWORDS: Granite slurry powder, quartz waste aggregate, Ordinary Portland Cement, compressive strength

INTRODUCTION

Concrete is an artificial material in which the aggregates both fine and coarse are bonded together by the cement when mixed with water. The concrete has become so popular and indispensable because of its inherent in concrete brought a revolution in applications of concrete. Concrete has unlimited opportunities for innovative applications, design and construction techniques. Its great versatility and relative economy in filling wide range of needs has made it .very competitive building material. Recycling of industrial wastes has actually environmental, economical and technical benefits. These benefits can be seen from two different angles, one from the point of the waste producer and the other from the user part. For the producer, the benefits of recycling industrial wastes are economical and environmental for the user additional technical benefits may be attained from recycling. For the producer, the environmental benefit can be attained as far as the waste is recycled. It is independent of where it is recycled. But the economical benefit is determined on the demand for the waste by different user. Sustainability in Concrete Production can be achieved by innovations in substitutions of materials used

In my project I had used the waste materials like granite slurry powder, quartz stone aggregate obtained from Industries. Use of these waste materials is not very usual though it has no behavioral problem and there has been little research work done on the waste. Granite waste slurry powder is a solid waste material generated from the granite processing, and can be used as a partial replacement of cement while preparing concrete. Quartz stone is a metamorphic rock resulting from the transformation of a pure limestone. The purity of the quartz stone is responsible for its colour and appearance; Quartz stone is used for construction and decoration has a noble appearance, and is consequently in great demand. The concrete industry is constantly looking for supplementary material with the objective of reducing the solid waste disposal problem. The waste is dumped in nearby pits and vacant spaces. This leads to serious environmental pollution an occupation of vast area of land. So it poses a severe threat on the environment, eco-system and the health of the people. This huge unattended mass of quartz stone is too high and is used in concrete as partial replacement of natural coarse aggregate in construction industry.

II. EXPERIMENTAL PROGRAM

MATERIAL USED AND THEIR PROPERTIES

Cement: Ordinary Portland cement of 53 grades is available in local market is used in the investigation. The cement used for all tests is from the same batch. The cement used has been tested for various properties as per IS: 4031-1988 and found to be conforming to various specifications of IS: 12269-1987.

Coarse Aggregate: Crushed angular granite from local quarry is used as coarse aggregate. The cleaned coarse aggregate is chosen and tested for various properties such as specific gravity, fineness modulus, bulk modulus etc. The physical characteristics are tested in accordance with IS: 2386 – 1963. The aggregates are free from alkali contents.

Fine Aggregate: The locally available river sand is used as fine aggregate in the present investigation. The cleaned fine aggregate is chosen and tested for various properties such as specific gravity, fineness modulus, bulk modulus etc. in accordance with IS: 2386-1963. The fine aggregate belongs to zone-II. It is free from harm full ingredients.

Water: Water used for mixing and curing is fresh potable water, conforming to IS: 3025-1964 part 22, part 23 and IS: 456-2000.Sometimes an image may contain text embedded on to it. Detecting and recognizing these characters can be very important, and removing these is important in the context of removing indirect advertisements, and for aesthetic reasons.

Granite Slurry Powder: Granite Slurry powder was collected from the deposits of granite factories during processing. It was sieved by IS-90 micron sieve before mixing in concrete.

Quartz stone aggregate: The quartz stone was generated during the cutting process. The Quartz stone are crushed into pieces manually. The aggregates passing through IS sieve 20mm and retained on 12.5mm were taken

MIX PROPORTION: Based on the ingredient properties of concrete, M_{25} concrete mix design as per IS 10262-2009 was prepared and its proportion was 0.5: 1: 1.64: 2.55 (W: C: FA: CA) by weight.

PROCEDURE: This experimental study was carried out on two series of concrete mixtures: Cement substitution mixture and mixture of cement and gravel substitution. 6 Standard cubes of 150mm x 150mm x150mm are cast and are cured in water for each mixture. In the first series GS1, GS2, GS3, GS4, and GS5 mixes are prepared with partial replacement of cement as 5%, 10%, 15%, 20% & 25% respectively. In the second series M1, M2, M3, M4, M5, and M6 mixes are prepared with aggregate is replaced by 10%, 15%, 20%, 25%, 30% and 35% respectively along with

10% replacement of cement with granite slurry powder obtained from first series, which is taken as optimum for second series. In GS1, GS2, GS3, GS4, and GS5 mixes cement is replaced by Granite slurry powder where as in M1, M2, M3, M4, M5, and M6 mixes aggregate is replaced by quartz stone aggregate along with cement replacement. In aggregate replacement equal amount of quartz stone aggregate were taken. After curing of these specimens, these are tested for compressive strength.

III. EXPERIMENTAL RESULT

Table 1: Compressive strength of cubes 7 days and 28 days with only cement replacement

Table2: compressive strength of cubes 7 days and 28 days with cement replacement by granite slurry powder along with aggregate replacement by quartz stone .

Table1

Mix type	% of replacement of granite slurry powder	Compressive strength(N/mm^2)	
		7 days	28 days
control	0	25.674	33.82
Gs-1	5	27.87	35.78
Gs-2	10	30.325	38.459
Gs-3	15	26.415	33.052
Gs-4	20	24.37	29.48
Gs-5	25	20.756	25.08

Table2

mix	%of aggregate replacement by granite slurry powder	%of aggregate replacement by quartz stone aggregate	Compressive strength in N/mm^2	
			7 days	28 days
control	10	0	25.674	33.82
M1	10	10	25.86	34.54
M2	10	15	26.04	34.87
M3	10	20	26.311	36.08
M4	10	25	26.44	36.08
M5	10	30	24.0	31.79
M6	10	35	23.7	30.03

Fig :1 & fig2 compressive strength 7&28 days in cubes with cement replacement

Fig1:

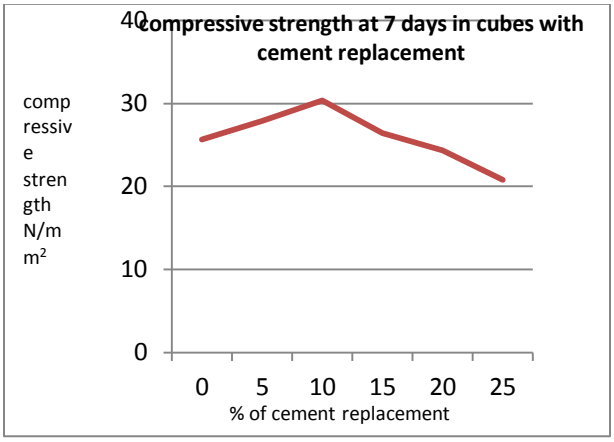


fig2:

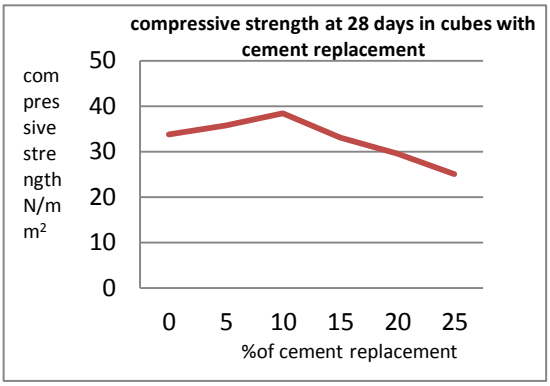


Fig5&fig6 : compressive strength in cubes 7&28 days with cement and aggregate replacement

Fig5:

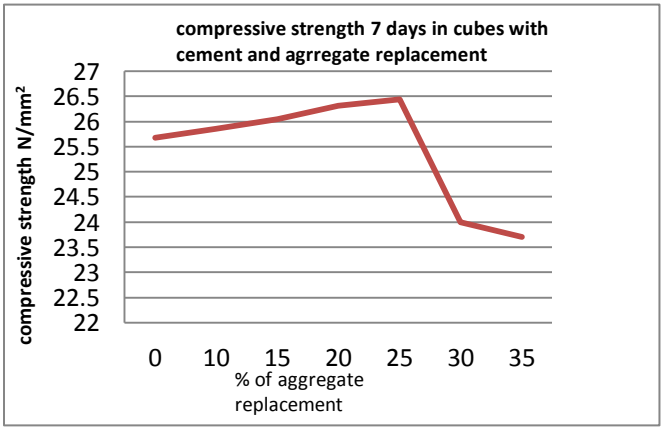
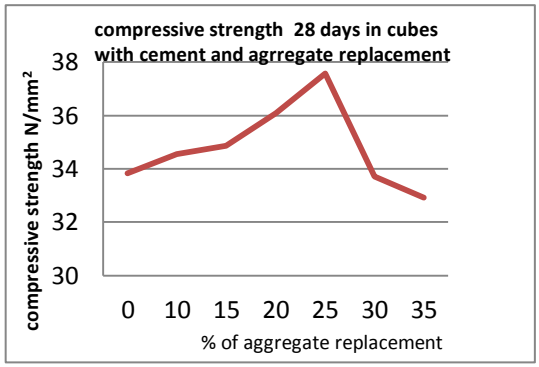


fig6:



IV. CONCLUSION

Based on the above results of the investigation conducted on recycled concrete with partial replacement of cement and aggregate up to 25% granite slurry powder and up to 35% quartz stone aggregate respectively, The following conclusions can be drawn:

1. Compressive strength of concrete is increased with the replacement of cement up to 10% granite slurry powder, and the strengths decreased with cement replacement by granite slurry powder more than 10 %. Hence 10% Cement replacement by granite slurry powder is taken as optimum.

2. Compressive strength of concrete is increased with aggregate replacement up to 25% combination of 20% quartz stone and 10% of cement replacement by granite slurry powder and the strength decreased with aggregate replacement more than 25% along with cement replacement by granite slurry powder. Hence 25% Aggregate replacement is taken as optimum in which 10% of quartz stone aggregate are taken.

3. From above results it is noticed that though there is no significant increase in strengths, The above replacements are acceptable and economical, since cost of cement is high.

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