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FLEXURAL BEHAVIOUR ON BETHAMCHERLA MARBLE STONE AGGREGATE

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ABSTRACT

In the recent year demand for concrete has increased worldwide. This has lead to development of various studies on materials. Meanwhile we ae not allowed to complete the natural resource usage in concrete. We have some waste materials which were not useful in that pattern of works. One of those material is Bethamcherla marble stone aggregates as replacement of coarse aggregate in concrete.This paper represents the study of flexural strength of concrete for different combinations. The comparison is made between conventional aggregate beams and beams made with Bethamcherla marble stone aggregates (BMSA). The beams of varying proportions are casted replacing partially and totally natural granite coarse aggregate (NGCA) with using BMSA. The beams are tested by adding GI steel fibre of volume 0%, 1% and 2% of volume of conventional beam. It is observed that there is consistent decrease of flexural strength of concrete of 0, 25, 50, 75 and 100 % of replacement of natural granite coarse aggregate (NGCA) with Bethamcherla marble stone aggregates. It was also observed that strength increased (volume) when 1% and 2% of GI steel fibers were used compared with conventional beam.

Key-Words: ***Natural Granite coarse Aggregate(NGCA), Bethamcherla marble stone aggregate(BMSA),GI steel fibers, Flexure strength, concrete.***

I. INTRODUCTION

The global use of concrete is next to water in this era. As the demand for concrete as construction material increases, the demand and scarcity has been raised to a peak.

There has been rapid increase in the waste materials and by products production due to exponential growth rate of population from last few decades the basic strategies to decrease solid waste disposal problems have been focused at the reduction of waste production and recovery of usable materials from the waste as raw materials as well as utilization of waste as raw materials whenever possible. Natural aggregate is becoming expensive due to scarcity. The world-wide consumption of natural aggregate as coarse aggregate in concrete production is very high and several developing countries have encouraged some demand in the supply of natural aggregate in order to meet the increasing needs of infrastructural development in recent years. In particular, the demand of natural aggregate is quite high in developing countries owing to rapid infrastructural growth.

In the recent years, the growth in industrial production and the consequent increase in consumption have lead to fast decline in available natural resources on the other hand, a high volume of production has generated a considerable amount of course material which have adverse impact on the environment. The Civil Engineering construction industry is to be one of the most potential consumers of mineral recourses, thus generating a great amount of solid waste as a bye product stones. Stones have perhaps the noblest material from nature used by men for his artistic expression. There are many natural stone wonders the earth offers us which we must pamper as unique treasures. India offers a variety of a natural stone viz; Granite, Sandstone, Slates, Marbles, Quartzite, Bethamcherla marble stones in multi colors, shapes and size. Bethamcherla stones are basically flaggy lime stone it is natural split table and when spitted in compact slabs and tiles, Kurnool district of Andhra Pradesh has been gifted by nature with huge deposit of Bethamcherla stone. It is excellent flooring stone have been unique geo mechanical properties required for flooring stones. When polished it gives glossy finish even as good as galaxy granite. Natural stone sector has grown from an almost manual activity to a highly industrialized business in last decades.

Waste has always been big news to business. Watching what you throw away at the end of the production is almost as important as finished product itself. More and more companies are examining ways of saving waste in their everyday activity as a route to both project and cleaner production. Quarries producing natural stone, Bethamcherla marble stone, marble slate stone etc, generate large quantity of solid waste. This waste is in the form of over lying Burdon, inter bedded burden, production waste generation during cutting, sizing, splitting at quarry floor. Besides many environmental problems especially from large generation of waste and its disposal continue to be the biggest factor that will determine the future development of Bethamcherla stone like other natural stones. In this situation, some developing countries are facing a shortage in the supply of natural aggregate. Therefore, it is necessary to replace natural aggregate in concrete by alternate materials either partially or completely without compromising the quality of concrete. Also, is it desirable to obtain cheap, environmentally friendly substitutes for coarse aggregates that are preferably by-product in recent years, there is a growing interest in the use of marble waste obtained from quarries in some countries where natural aggregate is not widely available and also marble is a prosaic but nearly indispensable construction material. This work examines the influence of marble as aggregate in partial replacement of natural aggregate on concrete properties, which include workability of fresh concrete, compressive and split tensile strengths. The concrete contains different ratios of quarry dust while maintaining a constant water/cement ratio. The results of this work confirm that the natural aggregate may be replaced totally and partially with BMSA.

AIM AND SCOPE OF THE STUDY

Main aim of the study is to know the involvement of Bethamcherla waste stone in construction works. In this study importantly, it is concentrated on some basic properties Bethamcherla waste stone, to know the suitability of the Bethamcherla waste stone in construction works by conducting some workability tests and some mechanical properties tests, in this paper we worked with flexure strength. To make explore the usage of local accessible materials to the surrounding people.

II. LITERATURE REVIEW

- MD NorAtan and Hanizam Awang (2011) studied the compressive and flexural strengths of a self-compacting concrete using raw rice husk ash. They concluded that up to 45% replacement of raw rice husk ash with three mineral additive components produce improved compressive strength and flexural strength. The addition of raw rice husk exhibits better performance in flexure as compared to its performance in compression.

- S. Aravindan& C.D. Arunkumar, conducted an experimental study on fibre reinforced concrete using industrial waste. Basic object of the experimental work is to study the strength variation in concrete on addition of different quantity of Galvanized wire and copper coated wire fibres with respect to Flexure, Split tensile, Compression, modulus of elasticity and Impact energy. The main aim of the study is to know the optimum dosage of fibres used in concrete mix by comparing the test results. From the above study, it revealed that compressive, split tensile, flexure, modulus of elasticity were increases up 72 to some percentage but impact strength almost doubled. From the study it was concluded that, 1% addition of Galvanized wire and copper coated wire was found as optimum percentage of fibres. But for Lathe scrap the addition of 2% was found as optimum percentage of fibres.

- Hebhoud conducted the experimentation flexure test on concrete. He used the marble aggregate as coarse aggregate. The results showed that use of marble aggregate up to 70% of any formulation is beneficial for the concrete.

- Joseph conducted the experimental work on the structural characteristics of concrete using lateritic sand and quarry dust as fine aggregate. The results revealed that there is a considerable increase in both flexural and tensile strengths with increase in laterite.

III. MATERIALS AND PROPERTIES

Cement: Cement is the most important material in the concrete and it act as the binding material. Ordinary Portland cement of 53 grade was used.

Aggregate: The basic objective in proportioning any concrete is to incorporate the maximum amount of aggregate and minimum amount of water into the mix, and thereby reducing the cementitous material quantity, and to reduce the consequent volume change of the concrete.

Coarse aggregate:

The fractions from 20 mm are used as coarse aggregate. The Coarse Aggregates from Crushed Basalt rock, conforming to IS: 383 is being used.

Bethamcherla Marble Aggregate:

The stone itself, specifically in the forms of overburden, screening residual, stone fragments. Stone wastes are generated as a waste during the process of cutting and polishing. It is estimated that 175 million tons of quarrying waste are produced each year, and although a portion of this waste may be utilized on-site, such as for excavation pit refill or berm construction, the disposals of these waste materials acquire large land areas and remain scattered all around, spoiling the aesthetic of the entire region. In this project we crushed BMSA into required sizes i.e., 20mm .

Fine aggregate:

The amount of fine aggregate usage is very important in concrete. This will help in filling the voids present between coarse aggregate and they mix with cementitous materials and form a paste to coat aggregate particles and that affect the compact ability of the mix. The aggregates used in this research are without impurities like clay, shale and organic matters. It is passing through 4.75mm sieve.

IV EXPERIMENTAL INVESTIGATION

The experimental program comprises casting and testing of Bethamcherla marble stone aggregate (BMSA) and Natural granite coarse aggregate (NGCA). The mix proportion details for the beams without Fibres (0%) are taken. The beams with fibre material 1% and 2% are presented in Table.Total 90 beams (For flexure 90) were casted in which 30 beams are without fibre (0%) and remaining 60 with fibre with 1% and 2% G.I steel fibre along with replacement of natural aggregate by BMSA of 0, 25, 20, 75 and 100 %.

FLEXURAL STRENGTH ON CONCRETE

Flexural testing is utilized to decide the bending properties of a material. Flexural tests are extremely sensitive to specimen. Beams are cured in a standard manner and tested.

Test on flexural strength

The load and strength results for the beams is made with natural granite coarse aggregate concrete and BMSA concrete for 28 days are presented in Table The following figureshows the Average Flexural strength with the replacement of NGCA by BMSA at 0%, 1% and 2% GI steel Fibres by volume of concrete for 28 days.

SPECIMEN DETAILS

Standard specimens beams are used to conduct the strength tests are taken according *to IS10086-1982*.

- The flexural strength characteristics are studied, by casting the beam specimens of size 150x150x600mm.

CASTING OF SPECIMENS

Before placing the concrete inside faces of the mould are coated with the machine oil for easy removal afterwards after completion of the workability tests, the concrete has been placed in the standard metallic moulds in three layers and has been compacted each time by tamping rod. Before placing the concrete inside faces of the mould are coated with the machine oil for easy removal afterwards. The concrete in the moulds has been finished smoothly.

CURING

After casting the specimen, the moulds were air dried for one day and then the specimens were removed from the moulds after 24 hours of casting of concrete specimens. Markings have been done to identify the different percentages. All the specimens were cured in curing tank(water curing).

V. TEST RESULTS

Table: Flexural strength values obtained each concrete mix with 0%, 1% and 2% GI Steel Fibres

S.NO	Nomenclature of the specimen	Average load (KN)	Average flexure strength (N/mm^2)	% difference in flexure strength
1.	NGCA-0-0	30.17	4.47	-
2.	BMSA-25-0	29.03	4.30	-3.80
3.	BMSA-50-0	24.03	3.56	-20.36
4.	BMSA-75-0	21.53	3.19	-2863
5.	BMSA-100-0	18.02	2.67	-40.27
6.	NGCA-0-1	31.11	461	+3.13
7.	BMSA-25-1	29.16	4.32	-3.35
8.	BMSA-50-1	24.82	3.73	-16.55
9.	BMSA-75-1	22.34	3.31	-25.95
10.	BMSA-100-1	19.51	2.81	-37.14
11.	NGCA-0-2	35.30	5.23	+17.00
12.	BMSA-25-2	33.21	4.92	+10.07
13.	BMSA-50-2	28.42	4.21	-5.82
14.	BMSA-75-2	25.24	3.74	-16.33
15.	BMSA-100-2	21.06	3.12	-30.20

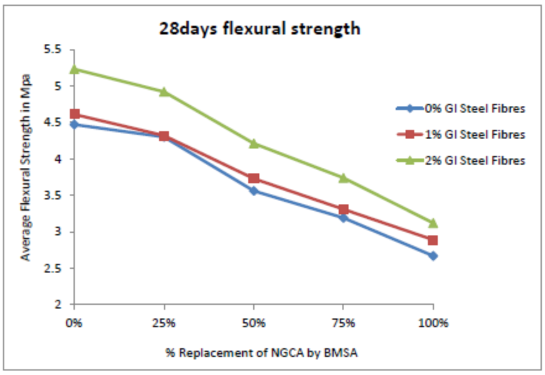

Figure: 28 days Average Flexural strength Vs % replacement of NGCA by BMSA at 0%, 1% and 2% GI steel Fibres

However, it is cautioned that the method explained here is only to indicate an approach for predicting the flexural strength for Bethamcherla marble stone aggregate concrete. More number of investigations has to be carried out to validate the regression model.

VI. CONCLUSIONS

1. It is observed that flexural strength of beams decreases gradually. For 0% replacement of BMSA we are getting flexural strength of 4.47 Mpa , after adding 1% and 2% of GI steel fibers for same mix proportion strength is around 4.61Mpa and 5.23 Mpa respectively.

2. For 25% replacement of BMSA , flexural strength of 4.30 Mpa after adding 1% and 2% of GI steel fibers for same mix proportion strength is around 4.32 Mpa and 4.92 Mpa respectively.

3. For 50% replacement of BMSA , flexural strength of 3.56 Mpa after adding 1% and 2% of GI steel fibers for same mix proportion strength is around 3.73 Mpa and 4.21 Mpa respectively.

4. For 75% replacement of BMSA , flexural strength of 3.19 Mpa after adding 1% and 2% of GI steel fibers for same mix proportion strength is around 3.31 Mpa and 3.74 Mpa respectively.

5. For 100% replacement of BMSA , flexural strength of 2.67 Mpa after adding 1% and 2% of GI steel fibers for same mix proportion strength is around 2.81 Mpa and 3.12 Mpa respectively.

From the above investigation, finally my work noticed to give the following report

The flexural strength decreases with increase in replacement with BMSA and increase with increase in G.I steel fibre content in concrete.

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