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COMPRESSION BEHAVIOUR ON BETHAMCHERLA MARBLE STONE AGGREGATE

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ABSTRACT

Concrete is the most extensively used building material in the world and has a significant impact on structural construction projects. Concrete is second only to water in terms of worldwide consumption. It's crucial to the development of our society and the future of the building sector. Since its discovery, it has been widely used in building projects because to its durability, dependability, and practicality. Concrete's name comes from the Latin word "concretes," which means "grows together," alluding to the chemical hydration process that transforms the material within from a viscoelastic condition into a hard, thick, and long-lasting product. Cement is the most widely used manufactured product on Earth, and its many forms provide a wide range of useful features. However, we are not permitted to use all of our natural resources at this time. We have some scraps that weren't necessary for that sequence of tasks. Bethamcherla marble stone aggregates is one alternative to using sand or gravel for the coarse aggregate in concrete.Compressive strength of concrete in various mixtures was investigated in this work. Bethamcherla marble stone aggregates (BMSA) are compared to the standard aggregate cube. Different sized cubes made of BMSA are cast in place of natural granite coarse aggregate (NGCA) in various quantities. The cubes are put through their paces by being filled with GI steel fiber at a volume of 0%, 1%, and 2% of that of a standard cube. Compressive strength of concrete consistently drops when using Bethamcherla marble stone aggregates to replace natural granite coarse aggregate (NGCA) at percentages of 0, 25, 50, 75, and 100%. When compared to a standard cube, the strength (volume) of materials reinforced with 1% and 2% GI steel fibers was found to be much higher.

<u>Key-Words:</u> Natural Granite coarse Aggregate(NGCA), Bethamcherla marble stone aggregate(BMSA),GI steel fibers, Compressive strength, concrete.

I. INTRODUCTION

Today, only water is used more widely than concrete across the world. Concrete's importance as a building material has led to record levels of both demand and shortage.

Population growth over the past few decades has resulted in a corresponding increase in waste materials and byproducts, so efforts to lessen the burden of solid waste disposal have largely centered on cutting down on waste generation, recycling as much as possible, and finding new uses for otherwise useless materials. As supplies decrease, the price of natural aggregate rises. Several developing nations have stimulated some demand in the supply of natural aggregate to satisfy the expanding demands of infrastructure development in recent years, adding to the already high global use of natural aggregate as coarse aggregate in concrete manufacturing. In particular, increased infrastructure development in emerging nations has resulted in a substantial increase in demand for natural aggregate.

Recent years have seen a rapid depletion of natural resources due to rising industrial production and consumption, while at the same time a large amount of production has resulted in a great deal of waste with negative effects on the environment. The civil engineering construction sector is expected to be a major user of mineral resources, leading to massive amounts of waste stones. Stones are among the highest-quality natural materials used by humans for aesthetic purposes. Coarse aggregate used in the concrete industry is typically sourced from granite rocks; however, BMSA can be an attractive alternative in situations where neither granite rocks nor a solution to the disposal of Bethamcherla marble waste are readily available.Bethamcherla marble is abundantly available, occupying about 10% of the earth's surface in different forms. The main constituent of Bethamcherla is calcium carbonate along with silica and iron as impurities .Many grades of limestone are available and their classification is done on the basis of calcium carbonate content. The marble rock is metamorphic from the lime stone. In this research work the performance of discarded flooring Bethamcherla Bethamcherla, in the Kurnool district of Andhra Pradesh, is a prime source of limestone. This comes in naturally split slab-like parts that, after being polished and processed into regular forms, would create a superbly strong flooring stone with a shine and finish on par with that of granite. Bethamcherla waste stone is a kind of waste rock that contains a natural mineral with a specific gravity between 2.6 and 2.85. Marble stones from Bethamcherla are often a basic, flaky lime stone with natural cracks. It's a high-quality flooring stone with the specific geo mechanical qualities sought for in such materials.

AIM AND SCOPE OF THE STUDY

The study's primary objective is to learn how Bethamcherla waste stone is used in building projects. In this research, we focused on compressive strength as an indicator of the appropriateness of Bethamcherla waste stone for use in building projects. Other tests for workability and mechanical qualities were also conducted. In order to investigate how the local community makes use of readily available resources.

II. LITERATURE REVIEW

EFFECTS OF REPLACING COARSE AGGREGATE WITH CRUSHED MARBLE TILE WASTE ON CONCRETE PROPERTIES

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- Compressive Strength of all Concrete Mixes containing Marble Aggregate showed higher value than the Standard Mix, The maximum value obtained by 50% replacing of Coarse Aggregate.
- A 50% replacing of coarse aggregate showed 10% increasing in compressive strength.
- Natural Aggregates can be replaced by marble aggregates in concrete mixes. More studies will be required to use this waste material as construction material in concrete mixes

WASTE MARBLE CHIPS AS CONCRETE AGGREGATE

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- On the observation of result of compressive strength test it is clearly seen that result of 28th day is decrease by 5.56% than 21st day result, the reason behind it could be the poor curing conditions of mould as compared to other mould specimen. Thus it is highly recommended to keep all the specimen under the healthy curing condition.
- Upon cost analysis result it is proved that the marble concrete proves more economical at

  rate of around 7.44% than concrete made withconventional coarse aggregate.
- As marble chips is used in concrete, it reduces use of natural aggregate which reduces mining to extract natural aggregate, which results in reduced environmental contamination.

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 cubes with fibre material 1% and 2% are presented in Table.Total
90 cubes (For comperssion 90) were casted in

which 30 cubes 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 %.

Test on Compressive strength

The cube compressive strength got yield with the replacement with BMSA aggregate concrete by 0, 25, 50, 75, and 100%. and with galvanized iron steel fibres which are added in the dosage of 0%, 1% and 2% of the volume of concrete at the time of mixing at 7 days and 28 days.

The results of cube compressive strength made with natural granite coarse aggregate concrete and concrete modified with Bethamcherla marble stone aggregate concrete for 7 and 28 days curing are presented

Test Results and discussion for 7 days

The results of compression strength made with NGCA and BMSA for seven days with 0,1,2%of G.I Steel fibres are presented in the table. From these it is observed that as a replacement of BMSA increases, the compressive strength decreases continuously.

For NGCA-0-0 the average compressive strength reported as 18.33MPa and for BMSA-25-0, BMSA-50-0, BMSA-75-0 and BMSA-100-0,

The average compressive strength are 17.79, 14.37, 13.35 and 11.81MPa respectively. Percentage decrease of average compressive strength with respect to NGCA-0-0 are 2.94, 21.60, 27.17 and

35.57 for BMSA-25-0, BMSA-50-0, BMSA-75-0 and BMSA-100-0 respectively.

For NGCA-0-1 the average compressive strength reported as 19.37MPa and for BMSA-25-1, BMSA-50-1, BMSA-75-1 and BMSA-100-1,

The average compressive strength are 18.42, 15.65, 13.95 and 12.35MPa respectively. Percentage decrease of average compressive strength with respect to NGCA-0-1 are 4.90, 19.20, 27.98 and

36.24 for BMSA-25-1, BMSA-50-1, BMSA-75-1 and BMSA-100-1 respectively.

For NGCA-0-2 the average compressive strength reported as 20.95MPa and for BMSA-25-2, BMSA-50-2, BMSA-75-2 and BMSA-100-2,

The average compressive strength are 19.91, 16.74, 15.07 and 13.22MPa respectively. Percentage decrease of average compressive strength with respect to NGCA-0-2 are 4.96, 20.09, 28.07 and

36.9 for BMSA-25-2, BMSA-50-2, BMSA-75-2 and BMSA-100-2 respectively.

Effect of G.I steel fibres for 7 days

The percentage increase in compressive strength for NGCA-0-1 and NGCA-0-2 is 5.67 and

14.29 over NGCA-0-0 mix. Similarly percentage increase for BMSA-25-1 and BMSA-25-2 mix is 3.54 and 11.92. The same trend continued for all other mixes. There is a percentage increase in flexural strength for BMSA-50-1 and BMSA-50-2 mix is 8.91 and 16.49. Percentage increase in compressive strength for BMSA-75-1 and BMSA-75-2 mix is 4.49 and 12.88. Percentage increase in compressive strength for BMSA-100-1 and BMSA-100-2 mix is 4.57 and 11.94

Test results and discussion for 28 days

The results of compression strength made with NGCA and BMSA for twenty eight days with 0,1,2% of G.I Steel fibres are presented in the table

5.3. From these it is observed that as a replacement of BMSA increases, the compressive strength decreases continuously.

For NGCA-0-0 the average compressive strength reported as 27.49 MPa and for BMSA-25- 0, BMSA-50-0, BMSA-75-0 and BMSA-100-0,

The average compressive strength are 26.68, 21.56, 20.03 and 17.71 MPa respectively. Percentage decrease of average compressive strength with respect to NGCA-0-0 are 2.95, 21.57, 27.14 and

35.58 for BMSA-25-0, BMSA-50-0, BMSA-75-0 and BMSA-100-0 respectively.

For NGCA-0-1 the average compressive strength reported as 29.05 MPa and for BMSA-25- 1, BMSA-50-1, BMSA-75-1 and BMSA-100-1,

The average compressive strength are27.63, 23.47, 20.93 and 18.53 MPa respectively. Percentage decrease of average compressive strength with respect to NGCA-0-1 are 4.89, 19.21, 27.95 and

36.21 for BMSA-25-1, BMSA-50-1, BMSA-75-1 and BMSA-100-1 respectively.

For NGCA-0-2 the average compressive strength reported as 31.42 MPa and for BMSA-25- 2, BMSA-50-2, BMSA-75-2 and BMSA-100-2,

The average compressive strength are 29.87, 25.11, 22.61 and 19.83MPa respectively. Percentage decrease of average compressive strength with respect to NGCA-0-2 are 4.93, 20.08, 28.04 and

36.89 for BMSA-25-2, BMSA-50-2, BMSA-75-2 and BMSA-100-2 respectively.

SPECIMEN DETAILS

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

- The compressive strength characteristics are studied, by casting the beam specimens of size 150x150x150mm.

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: Compressive strength values obtainedeach concrete mix with 0%, 1% and 2% GI Steel Fibres

S.No	Nomenclature of the specimen	7 days Average compressive strength in MPa	28 days Average compressive strength in MPa	% difference on the 7 days compressive strength	% difference on the 28 days compressive strength
1	NGCA-0-0	18.33	27.49	-	-
2	BMSA-25-0	17.79	26.68	-2.94	-2.95
3	BMSA-50-0	14.37	21.56	-21.60	-21.57
4	BMSA-75-0	13.35	20.03	-27.17	-27.14
5	BMSA-100-0	11.81	17.71	-35.57	-35.58
6	NGCA-0-1	19.37	29.05	+5.67	+5.67
7	BMSA-25-1	18.42	27.63	0.50	+0.51
8	BMSA-50-1	15.65	23.47	-14.62	-14.62
9	BMSA-75-1	13.95	20.93	-23.89	-23.86
10	BMSA-100-1	12.35	18.33	-0.33	-32.39
11	NGCA-0-2	20.95	31.42	+14.29	+14.30
12	BMSA-25-2	19.91	29.87	+4.29	+8.66
13	BMSA-50-2	16.74	25.11	-8.67	-8.66
14	BMSA-75-2	15.07	22.61	-3.26	-17.75

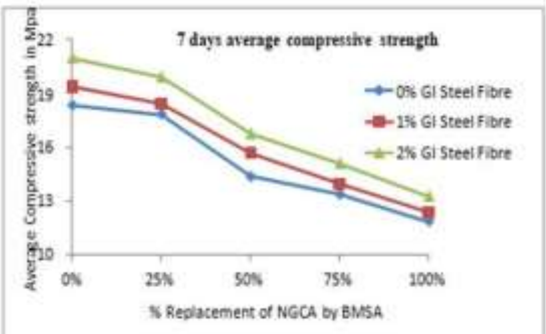

Figure: 7 days average compressive strength Vs % Replacement of NGCA by BMSA at 0%, 1%and 2% GI Steel Fibres

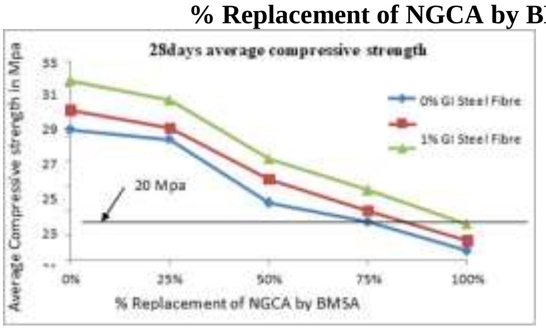

Figure: 28 days average compressive strengthVs % replacement of NGCA by BMSA at 0%,1% and 2% GI steel Fibres

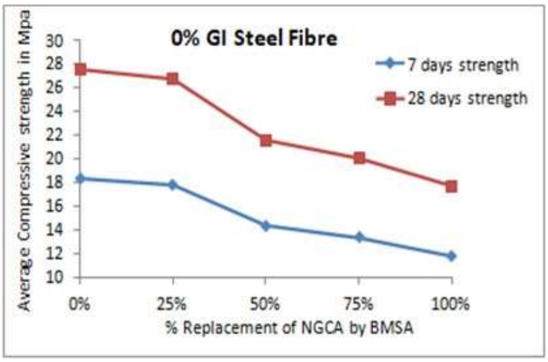

Figure: 7 and 28 days average Compressive strength Vs % replacement of NGCA by BMSAat 0% GI Steel Fibres

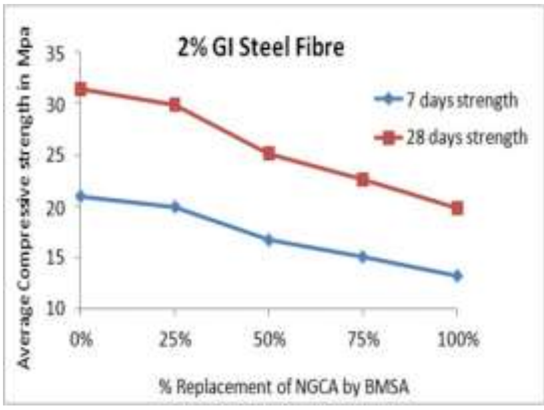

Figure: 7 and 28 days average Compressive strength Vs % replacement of NGCA by BMSAat 2% GI Steel Fibres

VI. CONCLUSIONS

The compressive strengths were decreasedwith increase of Bethamcherla marble stone aggregate in the concrete mix and increase with the increase in % addition of G.I steel fibres.

- For NGCA-0-0 the average compressive strength reported as18.33MPa, 27.49MPa for 7days and 28 days respectively
- For NGCA-0-1 the average compressive strength reported as19.37MPa, 29.05MPa for 7days and 28 days respectively
- For NGCA-0-2 the average compressive strength reported as 20.95MPa, 31.42MPa for 7days and 28 days respectively

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