Applied Laser Technology
Vol. 26, No.1,Jan (2019), pp.01–05

Aggregate behavior under compression on bethanmcherla marble

V. JYOTHISHNAIDU[1], Dr.V.RAMESH BABU [2], G.VENKATARAGHU[3], D.JAGAN[4]
[1]Assistant professor, Dept of Civil Engineering, K.S.R.M College of Engineering, KADAPA
[2,3]Assistant professor, Dept of Civil Engineering, K.S.R.M College of Engineering, KADAPA
[4]*Professor, Dept of Civil Engineering, JNTUA Ananthapuram, AndhraPradesh, AP*

ABSTRACT
Concrete is the most extensively used building material in the world and has a significant impact on structural construction projects. In terms of worldwide consumption, concrete is second only to water. It's very important for the future of the environment and the building industry as a whole. Due to its long lifespan, dependability, and adaptability, it has quickly become a staple in the building industry. The Latin word "concretes" means "grows together," which alludes to the chemical hydration process that transforms the viscoelastic constituents of concrete into the hard, thick, and long-lasting substance we know as concrete. Cement is the most widely used manufactured product on Earth, and its many forms provide a wide range of useful features. Meanwhile, we are not permitted to fully exhaust our allocation of natural resources. We now have some scrap materials that were useless in that construction scheme.Bethamcherla marble stone aggregates is one such material used to replace concrete's coarse aggregate.In this work, we describe the results of our research on the effects of various factors on the compressive strength of concrete. Cubes manufactured from standard aggregate material and BMSA (Bethamcherla marble stone aggregates) are compared. The BMSA is substituted for either some or all of the NGCA in the casting process, resulting in cubes of different proportions. The cubes are put through their paces by being filled with GI steel fiber at percentages of 0%, 1%, and 2% of the volume 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%. It was also shown that the volume of cubes reinforced with 1% and 2% GI steel fibers had more strength than those reinforced with normal cubes.

__Key-Words:__ **Natural Granite coarseAggregate(NGCA), Bethamcherla marble stone aggregate(BMSA),GI steel fibers, Compressivestrength, 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.Throughout the last few decades, the human population has increased exponentially, leading to a corresponding increase in the production of waste materials and byproducts. As a result, the primary strategies for lowering the burden of solid waste disposal have centered on cutting down on waste generation, recycling as much as possible, and repurposing materials. As supplies decrease, the price of natural aggregate rises. Natural aggregate is widely used as coarse aggregate in concrete production across the globe. In recent years, some emerging nations have pushed for an increase in the supply of natural aggregate to keep up with the rising demands of infrastructure expansion. 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.

As one of the largest potential users of mineral resources, the civil engineering construction sector also produces a substantial quantity of solid waste as a by-product. Stones are the most magnificent substance man has ever utilized to express himself creatively from nature. Although granite rocks are typically used as coarse aggregate in the concrete industry, using BMSA is a viable alternative in areas where neither granite rocks nor a solution to the disposal problem of Bethamcherla marble waste are readily available.

About ten percent of Earth's surface is comprised of various types of Bethamcherla marble, therefore it's easy to come by. Bethamcherla consists mostly of calcium carbonate with trace amounts of silica and iron.Limestone is categorized according to the amount of calcium carbonate it contains. Metamorphism transforms limestone into marble. Bethamcherla limestone, sourced from the nearby town of Bethamcherla in the Kurnool region of Andhra Pradesh, is evaluated for its performance in this study. This is a property of elements that exist in nature as split slabs.

which on polishing and processing into regular shapes that would make an excellent strength of flooring stone that has the luster and finish on par with its granite counterpart. Bethamcherla waste stone is one of the natural mineral having specific gravity ranging from 2.6 to 2.85. Bethamcherla marble stones are fundamental flaggy lime stone with natural split. It is very excellent flooring stone, which have been unique geo mechanical properties required for flooring stones.

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, toknow 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 compressive strength. To make explore the usage of local accessible materials to the surrounding people.

II. LITERATURE REVIEW

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

Tanweer Ibrahim Adham1,a, Amel Mohammed Abd Elrahman2,b , Nuha Maowia Akasha3,c , Motez Mohammed Khalifa4, Yousif Abd Elgader5, Essam Hassan Mohammed6, Ahmed Mohammed Suliman7, Modather Elnour Ahmed8

- 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

Jay P. Chotaliya, Kuldip B. Makwana, Pratik D. Tank

- 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 with conventional 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 environmentalcontamination.

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 proportioningany concrete is to incorporate the maximumamount 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 BMSAinto 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%) andremaining 60 with fibre with 1% and 2% G.I steel fibre along with replacement of natural aggregateby BMSA of 0, 25, 50, 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 hasbeen 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 obtained each 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	18.53	-0.33	-32.59
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

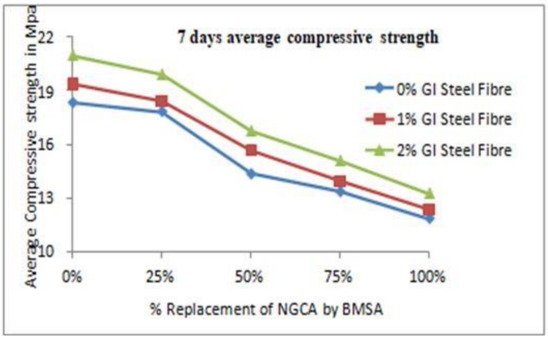

Figure: 7 days average compressive strength Vs % Replacement of NGCA by BMSA at 0%, 1% and 2% GI Steel Fibres

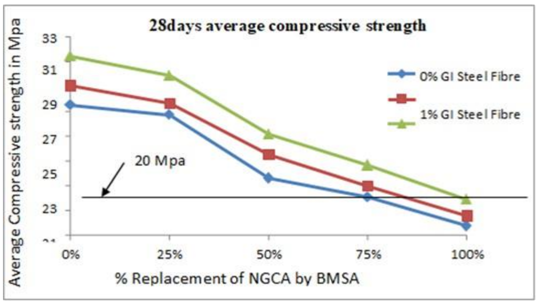

Figure: 28 days average compressive strength Vs % replacement of NGCA by BMSA at 0%, 1% and 2% GI steel Fibres

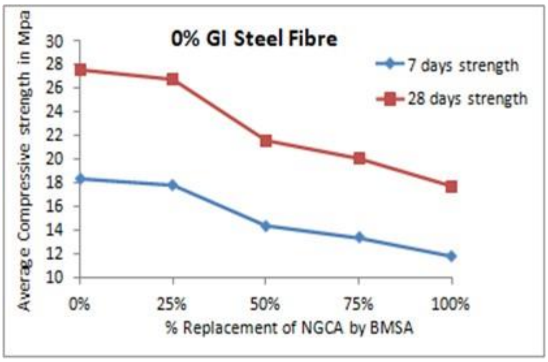

Figure: 7 and 28 days average Compressive strength Vs % replacement of NGCA by BMSA at 0% GI Steel Fibres

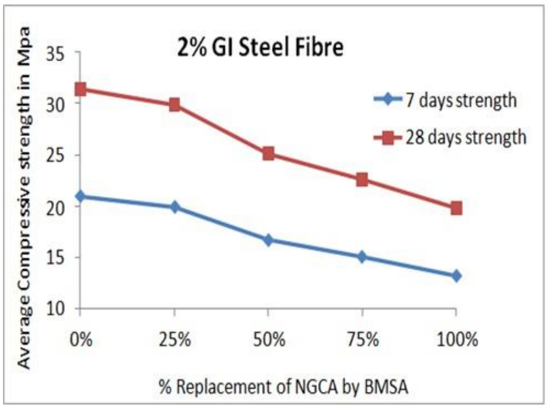

Figure: 7 and 28 days average Compressive strength Vs % replacement of NGCA by BMSA at 2% GI Steel Fibres

VI. CONCLUSIONS

The compressive strengths were decreased with 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 as 18.33MPa, 27.49MPa for 7days and 28 days respectively
- For NGCA-0-1 the average compressive strength reported as 19.37MPa, 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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