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RESEARCH ARTICLE

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EFFECTIVE UTILIZATION OF WASTE TANDUR STONE POWDER IN CONCRETE MIX TO OVERCOME WASTE DISPOSAL PROBLEMS

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ABSTRACT

India is the largest producer of raw stone material and the sector is quite developed in Andhra Pradesh, Rajasthan, Gujarat, Karnataka, etc. During the processing of stones, the raw stone block is cut as demanded into Tiles, Slabs of various thickness, polishing of these materials generate large amount of waste in form of stone chips, slurry and powder. In India amount of Stone waste quantity is millions of tons. At the place of mining dumping of waste stone is very difficult which directly affects on human health and environment, Hence reuse of this waste material is essential. Tandur stone powder is neglected as waste in several tandur stone factories, which is available in huge quantity in Tandur, India. This Tandur stone powder is having lime stone properties because tandur stone itself is a lime stone. In the present experiment we investigate characteristics strength of M20 concrete mix with replacement of 0%, 20%, 40% and 60% of cement with waste tandur stone (Shahabad) powder. Average Compressive strength at 7, 14, and 28 days on standard cubes (150mm×150mm×150mm) and average Split tensile test on standard cylinders (150mm dia. ×300mm height) at 28days is calculated. Here an approach is made to use waste tandur stone power (TSP) as replacement of cement for the comparative study with conventional concrete in terms of strength.

INTRODUCTION

India is the largest producer of raw stone materials in the world after Italy and china.

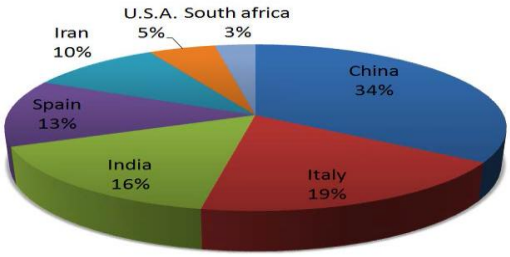

Fig No. 1.1 Country v/s stone production (%) [4]

There is continuous increment in the demand of various types of stone which leads to enormous increase in the business of stone sector industry. Today, different operations on stones, like- quarrying, sawing, cutting etc. are being processed by modern technologies which are improving the rate of production of stones as well as stone waste continuously. The stone waste is now-a-days a serious environment problem which is threat to modern civilization. As it is a non-biodegradable material, therefore poses numerous hazards. If this stone waste is dumped on land then, it can reduce

the rate of rain water percolating and deteriorate the soil fertility. Stone waste dumped in rivers, streams and seas contaminates the water and marine. Although land-filling can be an alternative to reuse stone waste but

apart from this, it can also be used to make various cement composites, as one of the best solution for disposing of stone waste, due to its economical and ecological advantages. Hence we are studying the feasibility of the lime stone viz. Tandur stone waste as a cement replacement product. This research work is carried out to replace the cement in concrete with waste TSP.

OBJECTIVE OF WORK

The main objective of this experimental investigation is to overcome the disposal problem of waste tandur stone in effective manner. To achieve this, waste TSP is used in M20 concrete mix by replacing cement in different proportions as 0%, 20%, 40%, and 60% and to check feasibility in terms of mechanical strength of TSP.

MATERIAL USED

3.1 Cement; During overall Experiment Birla Super Cement (OPC 53 Grade) has Used.

3.2 Aggregate: Sieved and dry aggregates of 10mm and 20mm are used for concrete mix. One of the most important factors for producing workable concrete is a good gradation of aggregate. Sample of well graded aggregate containing minimum voids requires minimum paste to fill up the voids in the aggregate, hence which will results in increased economy, higher strength, lower shrinkage and greater durability.

3.3 Crush sand : Stone crushed sand has used of size from 4.75 mm to 150 microns.

3.4 Admixture: An admixture has used for made required workability of concrete mix.

3.5 Tandur stone powder: Waste Tandur Stone Powder has used in mix.

MIXING & CASTING OF TEST SPECIMENS

Mix proportion of grade M_{20} designed using IS 10262-2009.

Calculate the material required for 3 cubes and 3 cylinders, for each proportion of TSP as 0%, 20%, 40% and 60% for testing at 7, 14, and 28 days (cylinders at 28 days only).

The mixing procedure was done in following manner:

- The materials required for 3 specimens of cubes were weighed as per the calculated amount.
- Dry mix the sand and cementitious materials in a pan mixer.
- Add coarse aggregate to it and mix it thoroughly to achieve cement particles on each and every coarse aggregate.
- Add the calculated quantity of water to the dry mix and mix thoroughly to get homogeneous mix.
- It had filled in clean and oiled moulds in 3 layers with 25 blows of 16mm diameter tamping rod.
- Identification Mark has marked on each specimen after initial set.
- After 24 hours concrete specimens has demould and kept for curing in a water tank.

Fig No. 4.1 Identification marks has been marked after casting

STRENGTH TESTS

5.1 Compressive strength test

- The size of the cube specimen is 150x 150 x 150 mm.
- Place the specimen centrally on the compression testing machine and load is applied continuously and uniformly on the

surface perpendicular to the direction of tamping.

- The load is increased until the specimen fails and record the maximum load carried by each specimen during the test as shown in fig.

Fig No. 5.1 Compression test

Compressive stress was calculated as follows:

Compressive strength= P / A× 1000

Where,

P = Load in kN

A = Area of cube surface = 150 x 150 mm2

5.2 Split tensile test

- The diameter of specimen to the nearest 0.2 mm by averaging the diameters of the specimen lying in the plane of pre-marked lines measured near the ends and the middle of the specimen. The length of specimen also shall be taken be nearest 0.2 mm by averaging the two lengths measured in the plane containing pre marked lines. The size of the cylinder specimen is of 150 mm diameter and 300 mm length.
- Centre one of the strips along the centre of the lower platen. Place the specimen on the strip and align it so that the lines marked on the end of the specimen are vertical and centered over the strip. The second strip is placed length wise on the cylinder centered on the lines marked on the ends of the cylinder.
- Apply the load without shock and Record the maximum load applied to specimen.
- Computation of the split tensile strength are as follows:

Split tensile strength = 2P / (3.142 × dl) × 1000

Where, P = Load in kN

d = Diameter of cylinder = 150 mm

l = Length of cylinder = 300 mm

Fig No. 5.2 Split tensile Test

EXPERIMENTAL RESULTS

6.1 compression test results

6 a) Trial:1 - Compressive strength for various proportions of TSP at 7, 14 & 28 days

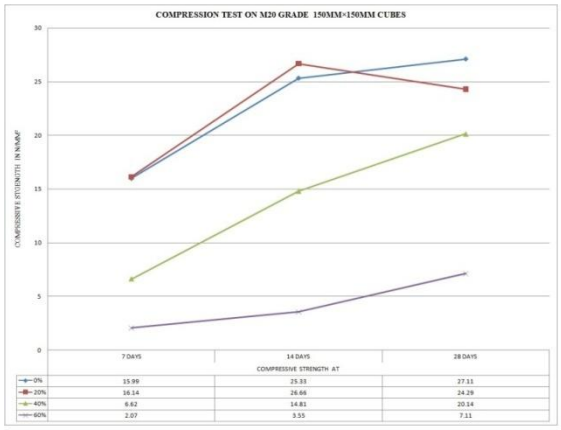

Fig.: 6.1.1 Average Compression test of M20 grade concrete cubes of size 150mm×150mm

6 b) Trial:2 - Compressive strength for various proportions of TSP at 28 days

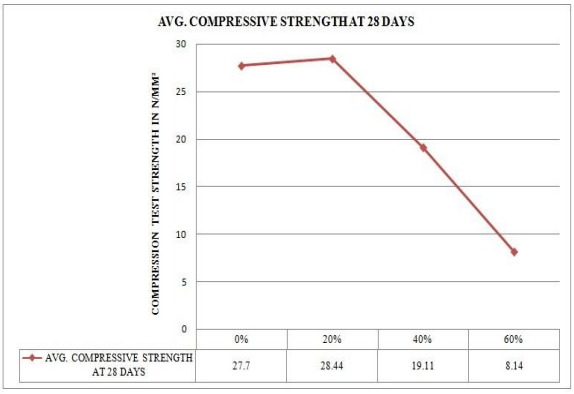

Fig.:6.1.2 Average Compression test of M20 grade concrete cubes of size 150mm×150mm

6.2 Split tensile test

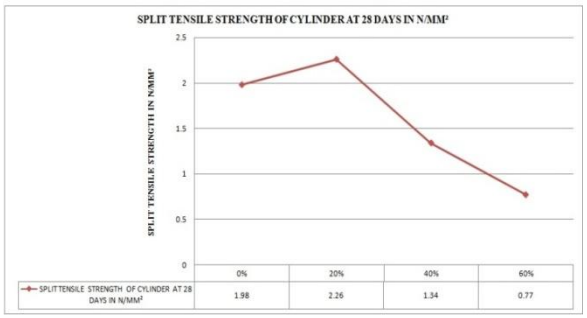

Fig.: 6.2.1 Average split tensile strength test result of M20 grade concrete cylinder (150mm×300mm size)

CONCLUSION

In trial:1, due to some mechanical and manual errors there is fluctuation in strength at 28 days for 20 % replacement of cement with TSP. For cross checking this we are planning to go for trial:2, in which we are finding the compressive strength for 0%, 20%, 40% and 60% replacement of cement with TSP at 28 days.

a) When 20% TSP was used in M20 grade concrete mix, compressive Strength has been increased to some extent as compared to 0% TSP.

b) When 40% and 60% TSP was used, cement compressive strength has been decreased linearly.

c) Similarly, when 20% TSP was used in Concrete, the split tensile strength of concrete has been increased to some extent as compared to 0% TSP.

d) After 20% Waste TSP, for the remaining percentages of TSP i.e. 40% and 60 %, Concrete Split tensile strength has been decreased linearly.

- In this research the optimum strength was found at 20% cement replaced with TSP
- Also, we can say that if we use 20% waste TSP in a concrete mix , billions of tons Tandur waste produced per annum utilized in economic manner and make concrete environmental friendly.

Future Scope

- Further research has to be carried on the reasons for decreased workability, increased compressive strength and tensile strength up to 20% TSP and decreased compressive strength and tensile strength beyond 20% TSP.
- Economical comparison of conventional concrete mix with this new designed concrete mix.
- Slump values for different proportions.
- Flexural strength results for various proportions.

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