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UTILIZATION OF STONE DUST AND STEEL FIBER AS A FINE AGGREGATE IN CONCRETE: A WASTE UTILIZATION APPROACH IN JHUNJHUNU

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ABSTRACT: As the project of the a study of mechanical properties of concrete using stone dust as a fine aggregate In the area of jhunjhunu a lot of the stone hills which are produce a higher waste as stone dust the purpose of this project is to reduce the waste by sources stone dust and there is the concrete strength after used percentage of stone dust as fine aggregate and reduce the quant it y of fine aggregate and steel fibers in the different % of the stone dust which started from the 0%, 10% and 20% it check the compressive strength. At the mixed 0%, 1.5% and 2% of steel fibers to get the higher strength

***KEYWORDS*:** Fiber Reinforced Concrete, Compressive Strength

INTRODUCTION

The word concrete comes from the Latin word "concretes" (meaning compact or condensed), the perfect passive participle of "concrescere", from "con-" (together) and "crescere (to grow). During the Roman Empire, roman concrete (or opus caementicium) was made from quicklime, pozzolana and an aggregate of pumice. Concrete is a composite construction material composed primarily of aggregate, cement and water.

FINE AGGREGATES: It is the aggregate most of which passes 4.75 mm IS sieve and contains only so much coarser as is permitted by specification. According to size the fine aggregate may be described as coarse sand, medium sand, silt and clay. IS specifications classify the fine aggregate into four types according to its grading as fine aggregate of grading Zone-1 to grading Zone-4. The four grading zones become progressively finer from grading Zone-1 to grading Zone-4. 90% to 100% of the fine aggregate passes 4.75 mm IS sieve and 0 to 15% passes 150 micron IS sieve depending upon its grading zone.

STONE DUST: Stone dust, also known as rock powders, rock minerals, rock flour, soil demineralization, and mineral fines, consists of finely crushed rock, processed by natural or mechanical means, containing minerals and trace elements widely used in organic farming practices. The igneous rocks basalt and granite often contain the highest mineral content, whereas limestone, considered inferior in this consideration, is often deficient in the majority of essential macro- compounds, trace elements, and micronutrients.

STONE DUST ABOUT: The district of jhunjhunu deriver its name from as headquarter of the jhunjhunu. the district territory of jhunjhunu as it exists now a nizamat under the erstwhile jaipur state and made up of that once used to be called the thikana of khetri, jagirs of bissau, nawalgarh, mandawa, dundlod and udaipurwati region bhomias in 1949, the princely state of jaipur who merged in the united states of greater rajasthan after the formation of the rajasthan the district to jhunjhunu was carved out of the and since then it continues to in existence however at time of merger of the jaipur state into rajasthan this district was reconstituted and the areas of the neem-ka-thana and bairath, former regions of this district was transferred to

and Jaipur district respectively several others inter tehsil, village transfers also took place. Among these transfers of some villages former churi- Ajitgarh Tehsil to jhunjhunu tehsil and to Udaipur wati Tehsil are worth mentioning as these transfer obliterate the existence of churi-ajitgarh tehsil east longitudes. It is surrounded by Churu district on the northwestern side Hissar and Mahendragarh district of Haryana state in the northeastern part and by Sikar district in the west, south and south eastern part. The total geographical area of the district is 2928 square Kms. this stands at 1.73 percent of the total area of the state from the points of area, jhunjhunu district stand at 22nd place among the existing 33 districts of the state most of the part of the district is coerce by blow sand and dunes which for part of the great that desert sand shifting and active dunes are main hazards to cultivation. Soil erosion is the result of constant deforestation and mining activity which have resulted in baring the slopes.

STEEL FIBRE REINFORCED CONCRETE: Fiber reinforced concrete represented by combination of four different phases, like cement, water, coarse aggregate, fine aggregate and a dispersion of discontinuous, steel fibre. It can also contain admixtures and pozzolans which are commonly used with the conservative concrete. All admixtures under the ASTM specifications for use in concrete are desirable for use in Steel Fibre Reinforced Concrete (SFRC).

MATERIAL AND DESIGN METHODOLOGY

MATERIALS: The properties of material used for making concrete mix are determined in laboratory as per relevant codes of practice. Different materials used in present study were cement, coarse aggregates, fine aggregates, and super-plasticizer, in addition to marble dust and steel fibres. The aim of studying of various properties of material is used to check the appearance with codal requirements and to enable an engineer to design a concrete mix for a particular strength. The description of various materials which were used in this study is given below:

PORTLAND CEMENT: Although all materials that go into concrete mix are essential, cement is very often the most important because it is usually the delicate link in the chain. The function of cement is first of all to bind the sand and stone together and second to fill up the voids in between sand and stone particles to form a compact mass. It constitutes only about 20 percent of the total volume of concrete mix; it is the active portion of binding medium and is the only scientifically controlled ingredient of concrete. Any variation in its quantity affects the compressive strength of the concrete mix. Portland cement referred as (Ordinary Portland Cement) is the most important type of cement and is a fine powder produced by grinding Portland cement clinker.

AGGREGATE: Aggregates constitute the bulk of a concrete mixture and give dimensional stability to concrete. To increase the density of resulting mix, the aggregates are frequently used in two or more sizes.

a) Coarse Aggregates: The aggregate which is retained over IS Sieve 4.75 mm is termed as coarse aggregate. The coarse aggregates may be of following types:-

i) Crushed graves or stone obtained by crushing of gravel or hard stone.

ii) Uncrushed gravel or stone resulting from the natural disintegration of rocks.

iii) Partially crushed gravel or stone obtained as product of blending of above two types.

The normal maximum size is gradually 10-20 mm; however particle sizes up to 40 mm or more have been used in Self Compacting Concrete.

b) Fine Aggregates: The aggregates most of which pass through 4.75 mm IS sieve are termed as fine aggregates. The fine aggregate may be of following types:

i) Natural sand, i.e. the fine aggregate resulting from natural disintegration of rocks.

ii) Crushed stone sand, i.e. the fine aggregate produced by crushing hard stone.

iii) Crushed gravel sand, i.e. the fine aggregate produced by crushing natural gravel.

According to size, the fine aggregate may be described as coarse, medium and fine sands.

Availability in Jhunjhunu: - The fine aggregate (send) available in village Bhagoli, Udaipurwati Jhunjhunu district.

STEEL FIBRE

Mild steel fibres having .60 mm thickness and 20 mm length i.e. aspect ratio (l/d) 33.33 which are corrugated and obtained through cutting of steel wires have been used. The fibres have been cut by fibre cutting machine to an accurate size. Three different proportions of fibres i.e. 0%, 1.5% and 2% have been used. Properties of steel fibre used are tabulated -

TABLE: PROPERTIES OF STEEL FIBRES

Average Thickness	.60 mm
Length	20 mm
Density	7850 kg/m3
Tensile Strength	8500 kg/m3
Shape	Crimped steel fibre

STEEL FIBER AVAILABILITY IN JHUNJHUNU

I am collected steel fiber in these Industries:-

- Visnu Engineering workshop, Jhunjhunu
- Visvkarma Engineering workshop, Jhunjhunu
- Sudeer Engineering workshop, Jhunjhunu
- Barguzar Engineering workshop, Jhunjhunu

TEST METHODS

COMPRESSIVE STRENGTH TEST: The acceptance criteria of quality of concrete are laid down in IS: 456-2000. The criteria are mandatory and various provisions of the code have to be complied before the quality of concrete is accepted. In all the cases, the 28-days compressive strength shall alone be the criterion for acceptance or rejection of the concrete. In order to get a relatively quicker idea of the quality of concrete, optional test for 7 days compressive strength of concrete be carried out.

Required:- Tamping rod: - about 60mm long, Compression testing machine: up to 1000ton,Moulds:-150x150x150mm,Oil:-as a garish type

Casting of cubes: The cube mould plates should be removed properly cleaned assembled and all the bolts should be fully tight. A thin layer of oil then shall be applied on all the faces of the mould. It is important that cube side faces must be parallel. After taking concrete samples and mixing them, the cubes shall be cast as soon as possible. The concrete sample shall be filled into the cube moulds in layers approximately 5 cm deep. In placing each scoopful of concrete, the scoop shall be moved around the top edge of the mould as the concrete slides from it, in order to ensure a symmetrical distribution of the concrete with in the mould. Each layer shall be compacted either by hand or by the vibration as described below.

Compaction by hand: Each layer of the concrete filled in the mould shall be compacted by not less than 25 strokes by tamping bar. The strokes shall be penetrate into the underlying layer and the bottom layer shall be roded through its depth. Where voids are left by the tamping bar the sides of the mould shall be tapped to close the voids.

Compaction by vibration: When compacting by vibration each layer shall be vibrated by means of an electric or pneumatic hammer or vibrator or by means of a suitable vibrating table until the specified condition is attained.

Curing: The casted cubes shall be stored under shed at a place free from the vibration at a temperature 220C to 330C for 24 hours covered with wet straw or gunny sacking. The cube shall be removed from the moulds at the end of 24 hours and immersed in clean water at a temperature 240C to 300C till the 7 or 28-days age of testing. The cubes shall be tested in the saturated and surface dry condition. For the true representation of actual strength of concrete in the structure, extra cubes shall be cast, stored and curded as per the identical conditions of that structure, and tested at required age.

TESTING OF COMPRESSIVE CONCRETE CUBES

The dimensions of the specimens to the nearest 0.2 mm and their weight shall be noted before testing. The bearing surfaces of the testing machine shall be wiped clean and any loose sand or other materials removed from the surface of the specimen which are to be in contact with the compression platens. The cube shall be placed in the machine in such a manner that the load shall be applied to opposite sides of the cubes as cast that is not to the top and bottom. The axis of the specimen shall be carefully aligned with the center of the thrust of the spherically seated platen. No packing shall be used between the faces of the test specimen and the steel platen of the testing machine. As the spherically seated block is brought to bear on the specimen, the movable portion shall be rotated gently by hand so that uniform seating may be obtained. The load shall be applied without shock and increased continuously at a rate of approximately 140 kg/sq. cm/min until the resistance of the specimen to the increasing load breaks down and no greater load can be sustained. The maximum load applied to the specimen shall then be recorded and the appearance of the concrete and any unusual features in the type of failure shall be noted, see fig-1and fig-2. The compressive strength of concrete shall be calculated from: - Maximum load/Cross-Sectional area of cube to be reported to the nearest 0.5N/mm 2

- The average value of set of three cubes (one sample) should have strength within the limits of ±15% of the average value. Otherwise the result of that sample will be invalid.
- The mean value of 4 samples (4 average values obtained from each sample of 3 cubes) should meet the criteria as given in table-2. For M-20 grade of concrete the mean value of these 4 samples should not be less than either 20 N/mm2.
- Any individual test result of a cube out of the above should not have value less than 21 N/mm2.

In case of doubt regarding the grade of concrete used either due to poor workmanship or based on results of cube strength test further tests should be conducted such as nondestructive test by Concrete Test Hammer, Ultrasonic Concrete Tester etc. Partial destructive test by drilling cores and testing them in compression In no case fewer than three cores be tested. The final test include the load testing on structure as under Formula

$$\text{Compressive strength} = \frac{P}{A}$$

Where, P= force in N/mm^2, A=area in mm^2

RESULT

TABLE NO.- 1 SAMPLE 1 (USE 0% STONE DUST)

S. NO.	SAMPLE NUMBER	CEMENT	SEND	STONE DUST	COARSE AGGREGATES	STEEL FIBER (%by volume)	COMPRESSIVE STRENGTH
1	S1A	1500 gram	2250 gram	Nil	4500 gram	0%	24.17 N/mm^2
2	S1B	1500 gram	2250 gram	Nil	4500 gram	1.5%	27.64 N/mm^2
3	S1C	1500 gram	2250 gram	Nil	4500 gram	2%	28.27 N/mm^2

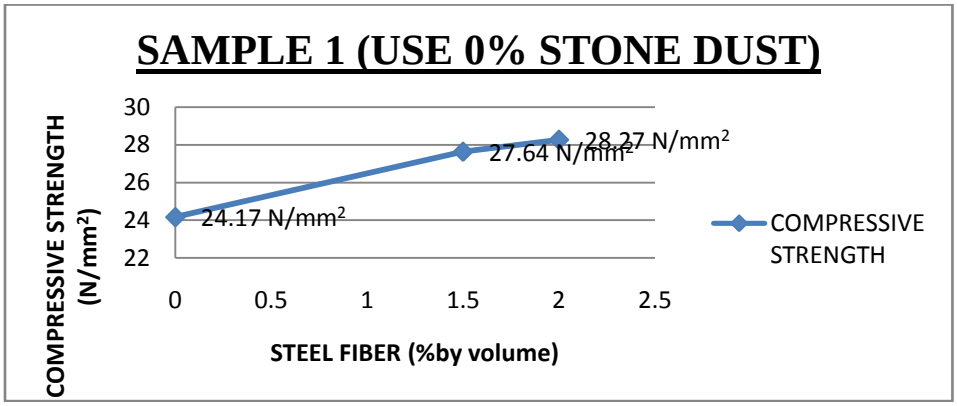

FIG: - SAMPLE 1 (USE 0% STONE DUST)

TABLE NO.- 2 SAMPLE 2 (USE 10% STONE DUST)

S. NO.	SAMPLE NUMBER	CEMENT	SEND	STONE DUST	COARSE AGGREGATES	STEEL FIBER (%by volume)	COMPRESSIVE STRENGTH
1	S2A	1500 gram	2025 gram	225 gram	4500 gram	0%	25.55 N/mm^2
2	S2B	1500 gram	2025 gram	225 gram	4500 gram	1.5%	28.58 N/mm^2
3	S2C	1500 gram	2025 gram	225 gram	4500 gram	2%	29.59 N/mm^2

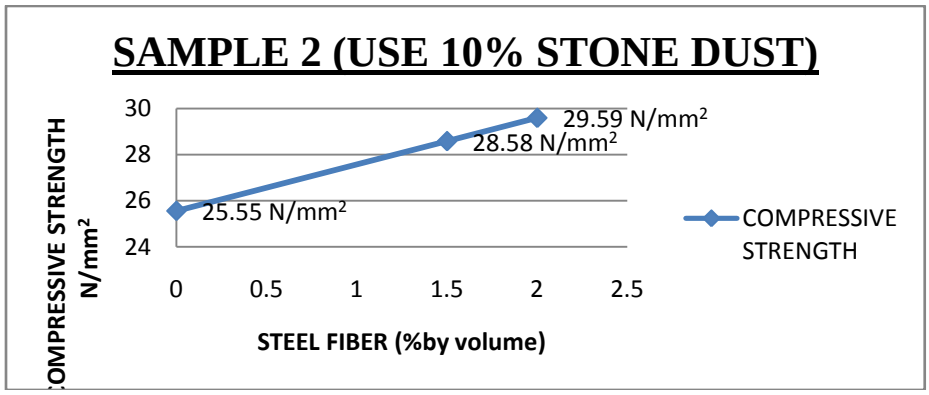

FIG: - SAMPLE 2 (USE 10% STONE DUST)

TABLE NO.- 3 SAMPLE 3 (USE 20% STONE DUST)

S. NO.	SAMPLE NUMBER	CEMENT	SEND	STONE DUST	COARSE AGGREGATES	STEEL FIBER (%by volume)	COMPRESSIVE STRENGTH
1	S3A	1500 gram	1800 gram	450 gram	4500 gram	0%	30.58 N/mm^2
2	S3B	1500 gram	1800 gram	450 gram	4500 gram	1.5%	33.29 N/mm^2
3	S3C	1500 gram	1800 gram	450 gram	4500 gram	2%	34.58 N/mm^2

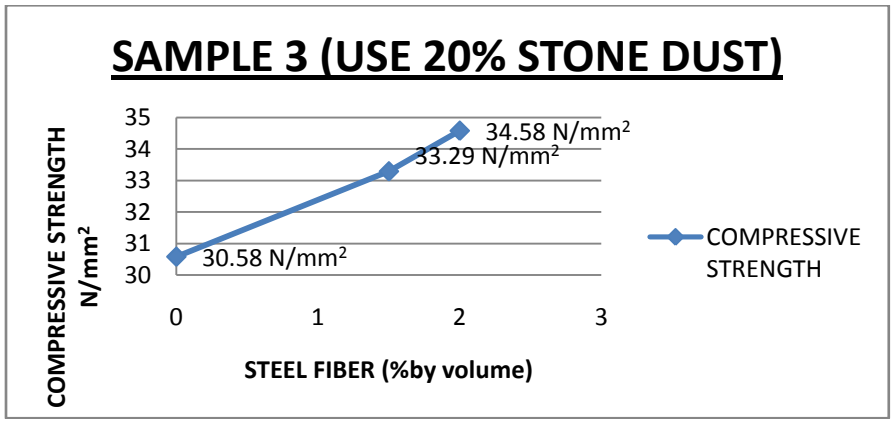

FIG:- SAMPLE 3 (USE 20% STONE DUST)

CONCLUSION

Tests on compressive strength concrete mixes with various percentages of additives indicate that 20% of addition of fine stone dust and 2% of steel fiber is optimum to produce high strength concrete without much reduction in strength. As the stone dust used is very fine, it can fill the apertures between the larger particles of fine aggregate. Hence the use of this material gives a pleasing finish to the concreted surface.

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