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Effect of Waste Glass Powder and Stone Dust on the Characteristics of Concrete

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Abstract: ***Concrete is a construction material composed of Cement, fine aggregate, coarse aggregate, and water with or without admixtures. The concrete industry is one of the heaviest consumers of natural resources due to which sustainability of concrete industry is under threat. The biggest problem facing the concrete industry is the environmental and economic concern. In this research Paper , the Ordinary Portland Cement (Grade 43) has been partially replaced by Waste Glass Powder (GLP) and in Second stage Natural sand and cement replaced by stone dust and waste glass powder accordingly in the proportion of 0%, 10%, 20%, 30%, 40% & 50%, at constant 15 % of Waste glass powder by weight of M-30 grade concrete. Concrete mixtures were produced, tested and compared in terms of Compressive Strength, Split Tensile Strength and Flexural Strength of the conventional concrete at a period of 28 days. It is observed that glass Powder and stone dust gives better results as compared to conventional concrete . It is found that strength and workability of mixes increases significantly when glass Powder and stone dust is used.***

Keywords: Cement, Concrete, Pozzolanic Material, Strength, Waste Glass Powder,Stone Dust ,Rice husk, Compressive Strength, Split Tensile Strength and Flexural Strength

I. INTRODUCTION WASTE GLASS POWDER

Glass powder is a highly fine powder made from ground glass. High precision machining equipment is necessary to prepare it, as it needs to be very uniform with an even consistency. The process involves dry or wet grinding to achieve particles of the desired size. Pigments can be added to make coloured glass powders. The glass powder is formed by crushing, milling, dry or wet grinding and sieving to achieve particles of the desired size. Glass powder particle size range is between 30 microns and 0.4 microns. Glass powder is used in a wide variety of applications so they come in a range of particle sizes and particle distributions.

Crushed glass aggregate for concrete

A. Stone Dust

Stone Dust is an ideal substitute to river sand. It is manufactured just the way nature has done for over a million years. Stone Dust is created by a rock-hit-rock crushing technique using state-of-the art plant and machinery with world class technology. Stone Dust is the environmental-friendly solution that serves as a perfect substitute for the fast depleting and excessively mined river sand, which is so essential and percolating and storing rain water in deep underground pockets

Stone Dust

II. LITERATURE REVIEW

Abdullah Anwar, the Influence of Waste Glass Powder as a Pozzolanic Material In Concrete. In this research study, the Ordinary Portland Cement (Grade 43) has been partially replaced by Waste Glass Powder (GLP) accordingly in the proportion.

Dali J.S. and Tande S.N. studied the properties of concrete containing mineral admixtures, when it is subjected to alternative wetting and drying and high temperature and resulted that the compressive strength increment is upto 25% replacement of cement by waste glass powder

K. Sundara Kumar, M. Siva Chennakesava Rao. have examines that the possibility of using glass powder as a partial replacement of cement for new concrete. The global cement industry contributes about 7% of green house gas emission into the earth's atmosphere. Waste glass is one materials when ground to a very fine powder shows pozzolanic properties which can be used as a partial replacement for cement in concrete,

III. OBJECTIVE

A. Main aim of this experimentation is to find the effect of replacement of cement by waste glass powder and sand replace by Stone dust on workability and strength characteristics of concrete.

B. Cement is replaced by glass powder at constant 12 % and natural sand are replace by stone dust in different percentages like 0%, 10%, 20%, 30% ,40% and 50 % to study the effect of Glass Powder and Stone Dust on hardened properties of concrete such as compressive, Split tensile and Flexural strength of concrete at 7, 14 and 28 days.

C. To determine the fresh property i.e. workability of M30 grade concrete by partially replacing cement with Glass Powder and Natural sand with Stone Dust.

IV. MATERIALS AND METHODOLOGY

List of Materials use in this experiment

1) Cement
2) Fine Aggregate
3) Course Aggregate
4) Waste Glass Powder
5) Stone Dust
6) Water

A. Methodology

1) Mix design (M 25 grade) as per IS 10262:2009
2) Preparation of specimens
a) Concrete Cube of size 150x150x150
b) Concrete Cylindrical columns of Dia 150mm and length 300 mm.
c) Concrete beams 0f size 150x150x700 mm.
3) Workability Test .
4) Testing of cubes for compressive strength.
5) Testing of beams for flexural strength.
6) Testing of cylindrical columns for Split tensile strength

V. EXPERIMENTAL RESULT

A. Workability Test

Slump test is the most commonly used method for measuring the consistency of concrete. It can be employed either in the laboratory or at the site. The test is popular owing to its simplicity. The apparatus for conducting slump test consists of a mould in the form of a frustum of a cone having internal dimensions as per IS 1199-1959.

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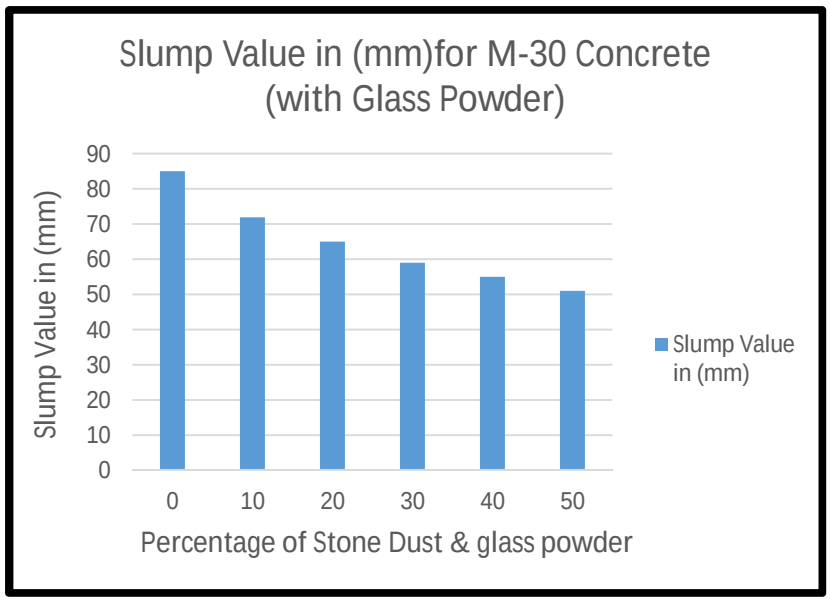
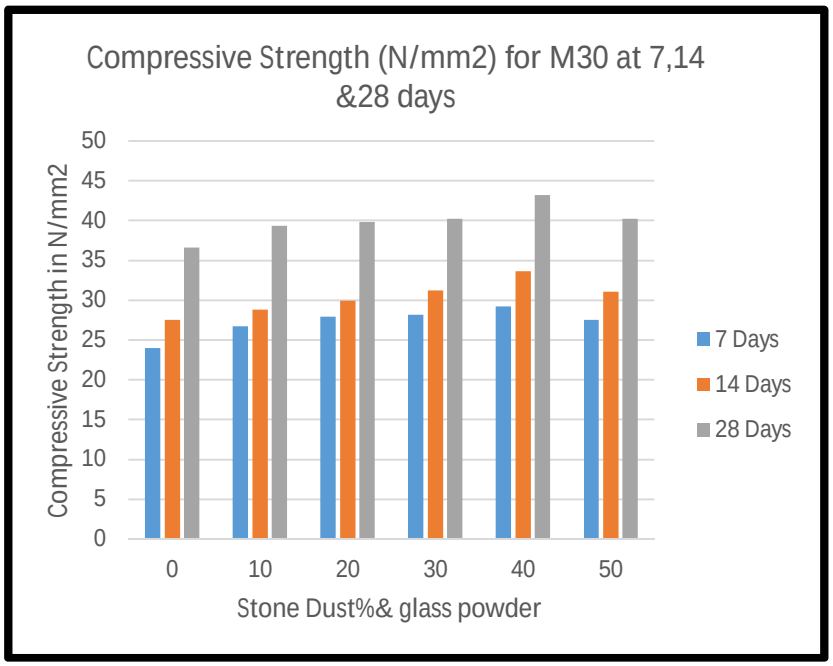


Percentage Content of Stone dust Waste Glass Powder **vs** Slump Value

1) *Discussion:* From the above graph, it was found that slump value Decreases from sample CC to R5 without glass powder, for normal concrete value of slump is 85 mm when add stone dust it value continuous decreases, when we add stone dust and waste Glass powder slump value is 85 for normal concrete and continuous decreases ,for R5 slump value is 55 mm

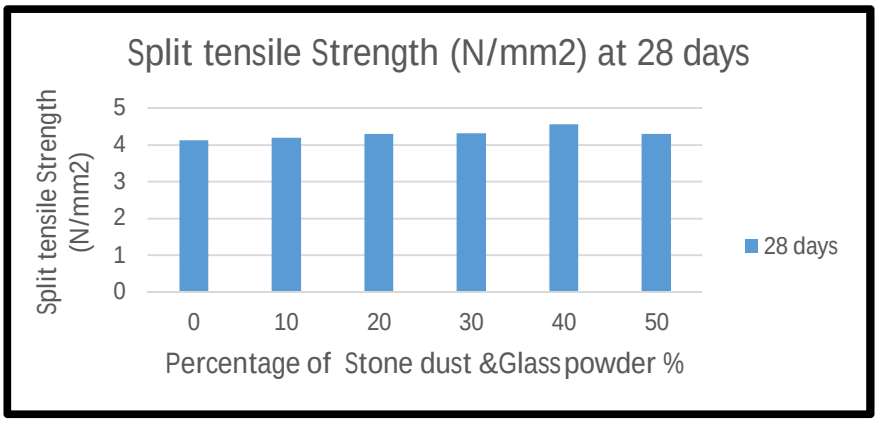
B. Compressive Strength test of M-30 Concrete



Percentage Content of Waste Glass Powder vs Compressive Strength at 7,14 & 28 days

1) *Discussion:* From the above table and graph is seen that the compressive strength in M 30 grade of concrete at 7, 14 and 28 days increases when the percentage of the stone dust increase from 0% to 50% at constant percentage of waste glass powder,. In case of case of combination of waste glass powder and stone dust value of compressive strength is increases it achieve 43.2 N/mm2.

C. Split Tensile Strength test of M-30 Concrete

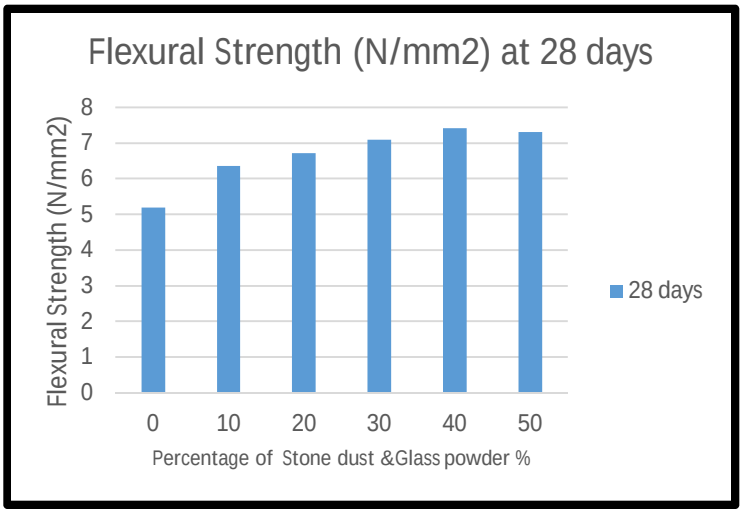


Percentage Content of Waste Glass Powder vs Split Tensile Strength

1) Discussion: From the above table and graph is seen that the Split Tensile Strength in M 30 grade of concrete at 28 days increases when the percentage of the stone dust increase from 0% to 50% at constant percentage of waste glass powder,The strength increase at 28 days is up to 4.8 %, at 40% sand replace by Stone dust and cement replace by 12% by Waste glass powder. After increase the percentage of stone dust strength decreases ,optimum percentage of stone dust is 40% & constant percentage of waste glass powder 12 % ,which give maximum value of Split Tensile Strength**.**

D. Flexure Strength test of M-30 Concrete

The result of the flexure strength with partial replacement of glass powder for 28 days are shown in the Table 5.7 for M-30 concrete and their graphical representation in the below Figure



Percentage Content of Waste Glass Powder and Stone Dust vs Flexural Strength of Concrete at 28 days

1) Discussion: From the above table and graph is seen that the Flexural Strength in M 30 grade of concrete at 28 days increases when the percentage of the stone dust increase from 0% to 50% at constant percentage of waste glass powder,The strength increase at 28 days is up to 18 %, at 40% sand replace by Stone dust and cement replace by 12% by Waste glass powder. After increase the percentage of stone dust strength decreases ,optimum percentage of stone dust is 40% & constant percentage of waste glass powder 12 % ,which give maximum value of Flexural Strength **.**

VI. CONCLUSION

A. From the experiment, it was found that slump value Decreases from sample CC to R5 without glass powder, for normal concrete value of slump is 85 mm when add stone dust and glass powder it value continuous decreases, 85 for normal concrete and continuous decreases ,for R5 slump value is 55 mm .

B. From the experiment, it was is seen that the compressive strength in M 30 grade of concrete at 7, 14 and 28 days increases when the percentage of the stone dust increase from 0% to 50% at constant percentage of waste glass powder,The strength increase at 28 days is up to 18.3 %, at 40% sand replace by Stone dust and cement replace by 12% by Waste glass powder. After increase the percentage of stone dust strength decreases ,optimum percentage of stone dust is 40% which give maximum value of compressive strength. maximum value of compressive strength is 43.2 N/mm2.In case of cement replace by glass powder the maximum value of compressive strength 39.6 N/mm2. But in case of combination of waste glass powder and stone dust value of compressive strength is increases it achieve 43.2 N/mm2.

C. From the experiment, it was is seen that the **Split Tensile Strength** in M 30 grade of concrete at 28 days increases when the percentage of the stone dust increase from 0% to 50% at constant percentage of waste glass powder,The strength increase at 28 days is up to 4.8 %, at 40% sand replace by Stone dust and cement replace by 12% by Waste glass powder. After increase the percentage of stone dust strength decreases ,optimum percentage of stone dust is 40% & constant percentage of waste glass powder 12 % ,which give maximum value of Split Tensile Strength**.**

D. From the experiment, it was found that the Flexural Strength in M 30 grade of concrete at 28 days increases when the percentage of the stone dust increase from 0% to 50% at constant percentage of waste glass powder,The strength increase at 28 days is up to 18 %, at 40% sand replace by Stone dust and cement replace by 12% by Waste glass powder. After increase the percentage of stone dust strength decreases ,optimum percentage of stone dust is 40% & constant percentage of waste glass powder 12 % ,which give maximum value of Flexural Strength

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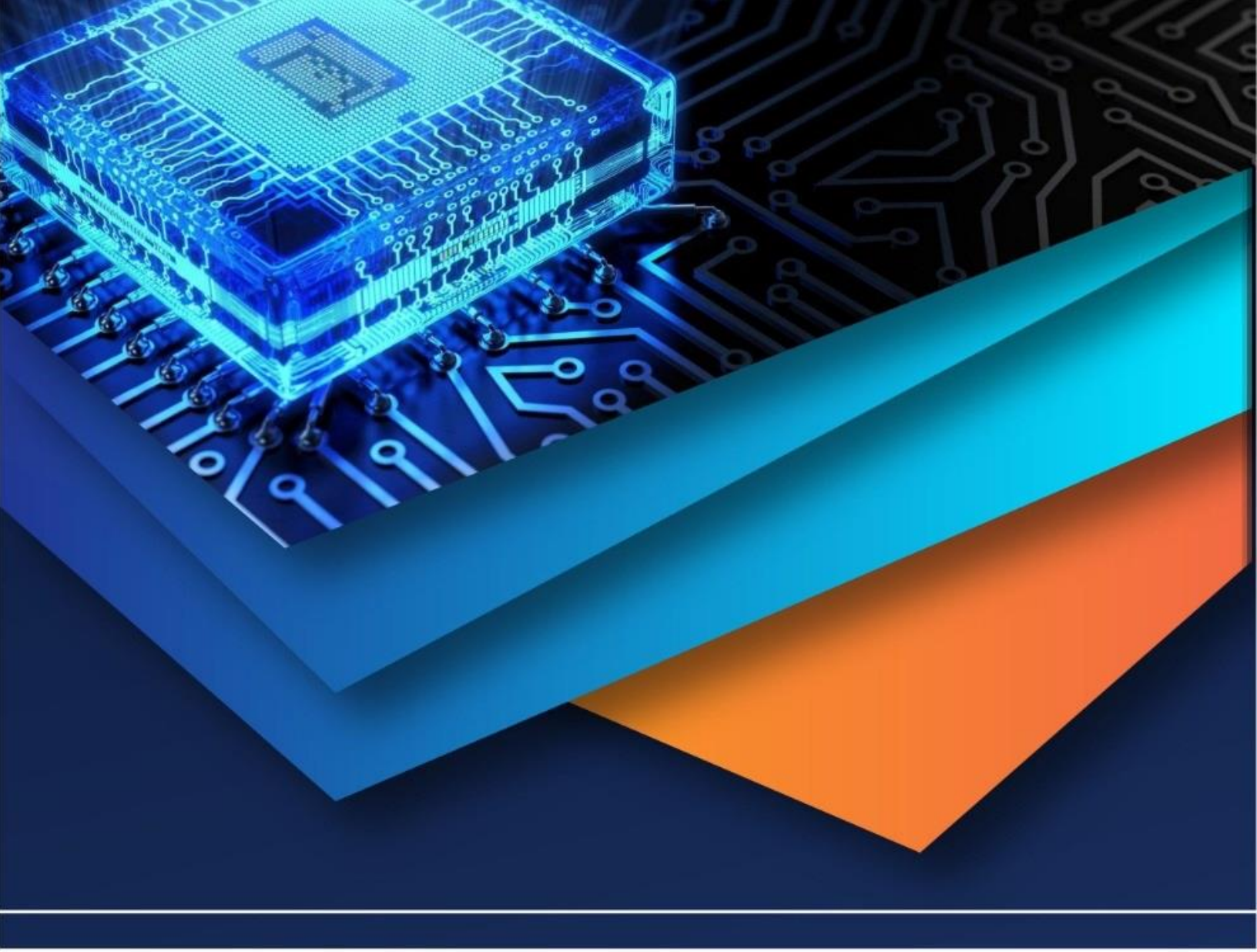

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