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Strength Study on Green Concrete

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Abstract: ***In this study, silica fume, which is finer than cement and used to substitute cement, gave concrete structures more strength and longevity. Steel fibres are utilised to improve the ductility and strength of concrete. 50% of the coarse aggregate was replaced with the 50% demolition waste aggregate. Cement with varying amounts of silica fume added (5, 10, 15, and 20%). For hardened concrete, strength tests are carried out at 7 and 28 days to assess the strength, such as compressive and split tensile. Increasing the strength parameters was made possible by the partial replacements of 10-15% of the combined use of silica fume and fly ash.***

Keywords: demolished waste aggregate, silica fume, compressive strength, split tensile strength.

I. INTRODUCTION

In the development of the concrete industry, green concrete is a groundbreaking concept that was first developed in 1998 in Denmark. Green concrete is a type of concrete that resembles ordinary concrete in many ways, but its production uses less energy and has fewer negative environmental effects. In order to increase the sustainability of the system, the idea is to use eco-friendly components in concrete. Because, for instance, waste products are used as a partial substitution for cement, charges, green concrete is frequently made and is also inexpensive to create. The size of the global construction business is expanding more quickly.

The enormous growth in construction increases demand for building supplies. The primary component of concrete is aggregate. The ongoing mining has caused issues with aggregate availability in recent years. To some extent, substitute must be found in order to solve this issue. There is a somewhat current answer, and it is referred to as "Green Concrete." It is a way of thinking about concrete that takes the environment into account from the fabrication of raw materials through mix design to structural design, building, and service life. Concrete uses inorganic waste materials like marble debris, crumbled concrete, sand stone dust as green aggregates. Additionally, by inventing or enhancing cement with low energy consumption, substituting cement with fly ash, micro silica in greater proportions, and creating new green cements and binding materials, the utilization of alternative raw materials and alternative fuels grows. Numerous industrial by-products and micro-fillers have been the subject of extensive investigation regarding their usage in concrete. Utilizing pozzolanic wastes was primarily done to increase the durability and cost-effectiveness of concrete while also enhancing its other qualities.

II. OBJECTIVES

1) To establish the ideal silica fume concentration.
2) To assess the compressive and split tensile strength of cast specimens with and without recycled aggregate at the recommended %.

III. MATERIALS

Table 1: The properties of cement are presented.

S.no	Property	Cement (53 grade)
1	Specific gravity	3.15
2	Fineness	7.81
3	Consistency	33%
4	Initial setting time	42 min
5	Final setting time	510 min

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A. *Silica Fume*

It is frequently known to as micro silica and is an ultrafine powder that is gathered as a waste product from the manufacture of silicon and ferrosilicon alloys. The particles are spherical and have an average particle diameter of 150mm. For use as pozzolanic material in high performance concrete, this application is the primary one. As an artificial pozzolanic additive, silica fume is employed. It is a substance produced when quartz and coal are reduced in an electric arc furnace to produce silicon or ferrosilicon alloy. Silica fume's chemical makeup Silicon dioxide makes up more than 90% of the compound, along with carbon, sulphur, and oxides of aluminium, iron, calcium, magnesium, sodium, and potassium.

Table 2.Physical Properties of Silica Fume:

S.No	Properties	Silica fume
1	Specific Gravity	2.24
2	Specific Surface Area	26810 m^2/kg

B. *Demolished Waste Aggregate*

Recycled concrete aggregates are concrete aggregates that contain 95% pulverised concrete. Wood, gypsum, plastics, and other contaminants are present in building and demolition debris in its natural state but must be removed before it can be used to make concrete.

C. *Concrete Mix Design*

The mix proportion for M30 grade of concrete is 1:1.86:3.44 with water cement ratio 0.45.
The mix proportion for M30 grade of concrete is 1:1.86:3.44 with water cement ratio 0.45.

IV. EXPERIMENTAL INVESTIGATIONS

A. *Compressive Strength Results*

The compressive strength conducted in compression testing machine for the cast and cured specimens and the results are furnished in Table 3.

Table 3: Compressive strength of concrete Percentage of silica fume + 50%demolished waste aggregate

S.No	Mix indication	Compressive strength results,N/mm^2		
		28 days	56 days	90 days
1	M1(0% SF+50%DA)	38.50	41.93	44.96
2	M2(5% silica fume +50% DA)	42.14	45.91	49.25
3	M3(10% silica fume+50% DA)	44.61	48.59	52.08
4	M4(15% silica fume+50% DA)	46.00	50.10	53.81
5	M4(15% silica fume+50% DA)	41.72	45.41	48.72

B. Split Tensile Strength Result

The split tensile strength conducted for the cast and cured specimens and the results are furnished in Table 4.

Table 4: split tensile strength of concrete Percentage of silica fume + 50%demolished waste aggregate

S.No	Mix indication	Split tensile strength results,N/mm^2		
		28 days	56 days	90 days
1	M1(0% SF+50%DA)	3.46	3.75	4.04
2	M2(5% silica fume +50% DA)	3.80	4.16	4.43
3	M3(10% silica fume+50% DA)	4.02	4.37	4.71
4	M4(15% silica fume+50% DA)	4.14	4.49	4.83
5	M4(15% silica fume+50% DA)	3.76	4.07	4.37

V. CONCLUSIONS

A. At combination of 0% SF+50%DA the compressive strength results for 28,56 and 90 days is 38.50 , 41.93 and 44.96 N/mm^2.

B. At combination of 0% SF+50%DA the split tensile strength results for 28,56 and 90 days is 3.46 , 3.75 and 4.04 N/mm^2.

C. At combination of 15% silica fume+50% DA the compressive strength results for 28,56 and 90 days is 46.00 , 50.10 and 53.81 N/mm^2.

D. At combination of 15% silica fume+50% DA the split tensile strength results for 28,56 and 90 days is 4.14 , 4.49 and 4.83 N/mm^2.

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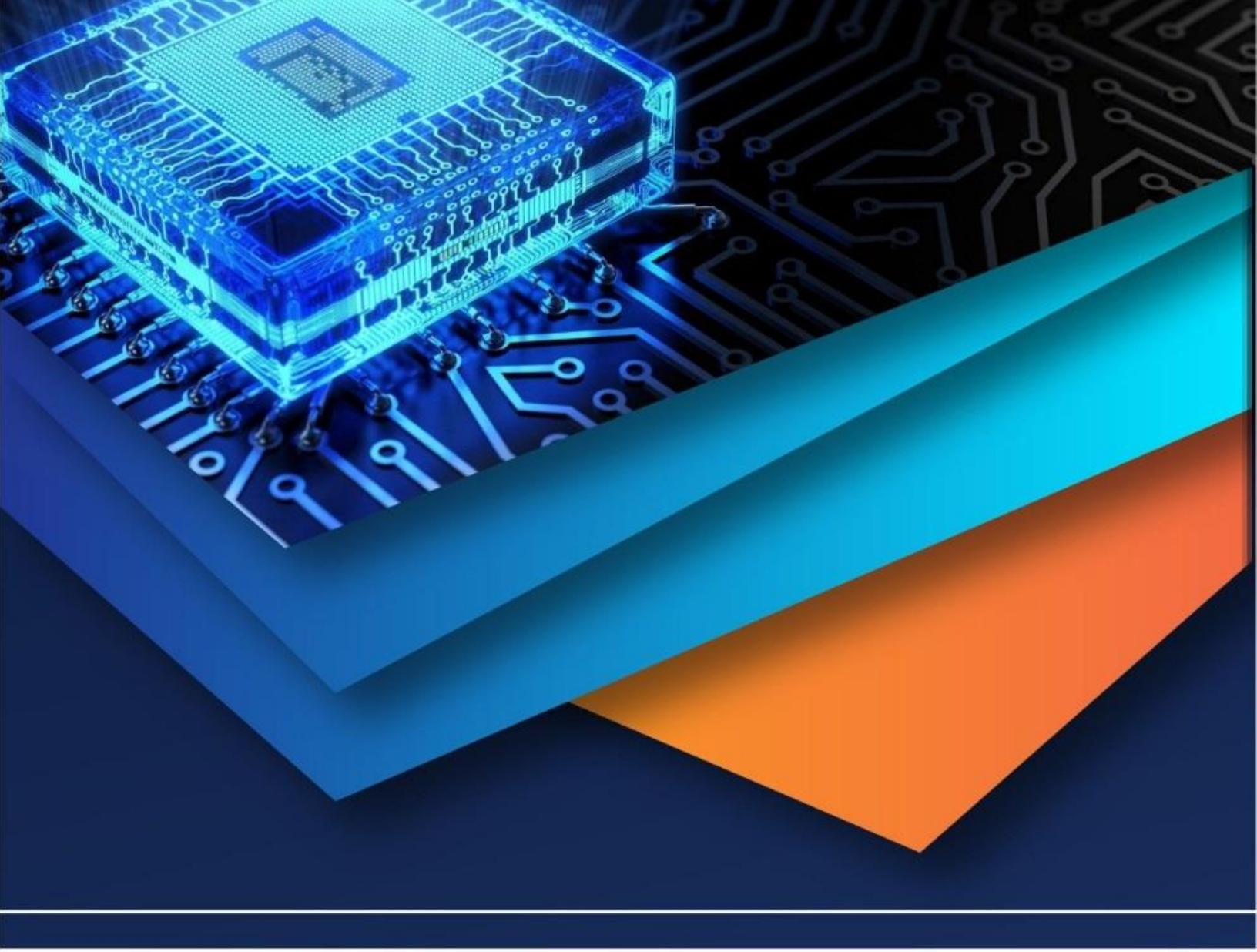
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