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Experimental Investigation of Ordinary Portland Cement Concrete with Silica Fume & Glass Powder as Partial Replacement for Cement and Fine Aggregates

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Abstract: Concrete is a composite materials and pourable mix of cement, fine aggregate and coarse aggregate that hardens into a super strong building materials. The environmental and economic concern is the biggest challenge concrete industry is facing. In this paper, the issues of environmental and economic concern are addressed by the use of silica fume powder and waste glass powder as partial replacement of cement and fine aggregates in concrete. cement were replaced by silica fume powder as 5%, 10%, 15% and Fine aggregates were replaced by waste glass powder as 10%, 20%, and 30% by weight for M-40 mix. The concrete specimens were tested for compressive strength and flexural strength at 7days and 28 days of age and the results obtained were compared with those of normal concrete.

I. INTRODUCTION

Concrete is most vital material in modern engineering construction. It has like easy mould ability, high compressive strength and long durability. Concrete is made using the basic ingredients such as cement, fine aggregate, coarse aggregate and water. The source of cement and natural fine aggregate increasing day by day the construction activities increased in all developed countries. the use of silica fume as a pozzolonic material increased in properties of fresh and hardened concrete and the silica fume replaced by cement. The most of the construction places used in glass for ornamental works and multipurpose placing of building .so the large amount of wastage of glass produced in industry and construction places. it is necessary to study about these constituent materials and material properties ,test of materials and replacing the suitable for constitute materials like silica fume and glass powder use in concrete .the constitute material are partially replaced by 5,10,15,20% etc… the using conventional concrete and moderate materials involve the enhancement characteristics such as placed and compaction without segregation and long term mechanical properties, early age of concrete life and without affect of environment .The test to be conducted for compressive strength and flexural strength in concrete.

II. LITERATURE REVIEW

K.AparnaSrivastav (et.al) had investigate issues of economic and environmental concern are addressed by the use of waste glass as partial replacement of fine aggregates in concrete. Fine aggregates were replaced by waste glass powder as 5%, 10%, 15% and 20% by weight for M-25 mix. The concrete specimens were tested for consistency, compaction factor and compressive strength at 28 days of age and the results obtained were compared with those of normal concrete. The results concluded the permissibility of using waste glass powder as partial replacement of fine aggregates up to 20% by weight for particle size of range 0-1.18mm. We estimate increase in slump value, compaction factor and compressive strength.

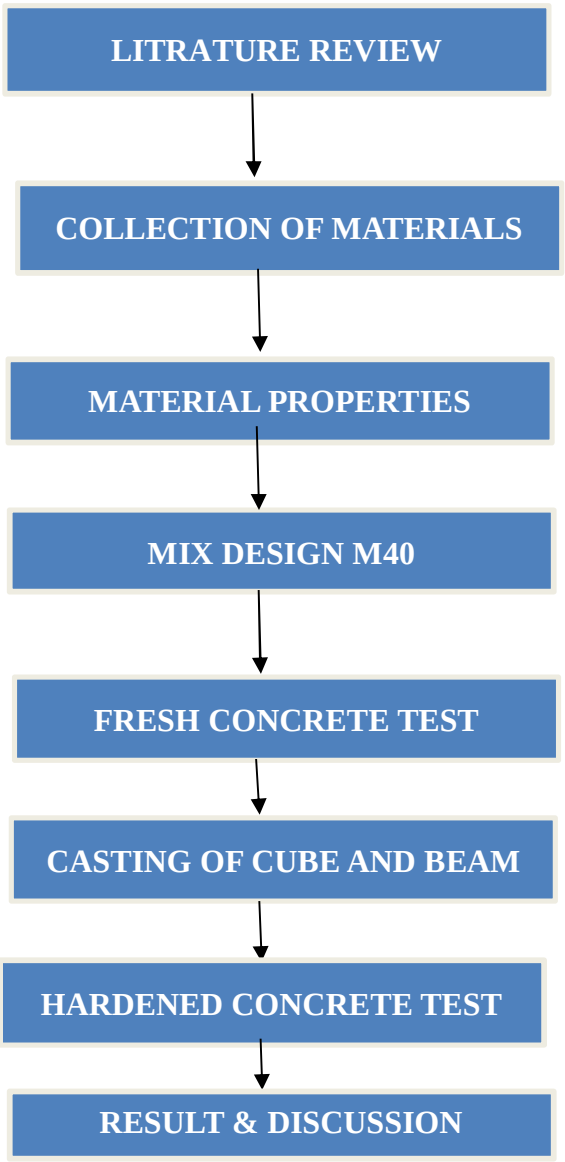
Ram Kumar (et.al) had investigate of the partial replacement of silica fume and its effects on concrete properties has been studies by adopting M-35 concrete mix in this dissertation. The main parameter investigated in this study M-35 concrete mix with partial replacement by silica fume with varying 0, 5, 9, 12 and 15% by weight of cement the paper presents a detailed experimental study on compressive strength, flexural strength and split tensile strength for 7 days and 28 days respectively. The results of experimental investigation indicate that the use of silica fume in concrete has increased the strength and durability at all age when compared to normal concrete. Hence the use of Silica Fume leads to reduction in cement quantity for construction purpose and its use should be

promoted for better performance as well as for environmental sustainability.

M. Adaway(et.al) had investigate of this project aimed to determine the level of glass replacement resulting in optimal compressive strength. Three concrete samples were tested at 7 and 28 days, for glass replacement proportions of 15, 20, 25, 30 and 40%. Compressive strength was found to increase up to a level of 30%, at which point the strength developed was 9% and 6% higher than the control after 7 and 28 days respectively. This demonstrates that concrete containing up to 30% fine glass aggregate exhibits higher compressive strength development than traditional concrete.

M. Iqbal Malik, (et.al) had investigate of this paper, the issues of environmental and economic concern are addressed by the use of waste glass as partial replacement of fine aggregates in concrete. Fine aggregates were replaced by waste glass powder as 10%, 20%, 30% and 40% by weight for M-25 mix. The concrete specimens were tested for compressive strength, splitting tensile strength, durability (water absorption) and density at 28 days of age and the results obtained were compared with those of normal concrete. The results concluded the permissibility of using waste glass powder as partial replacement of fine aggregates up to 30% by weight for particle size of range 0-1.18mm.

III. METHODOLOGY



A. Materials To Be Used

1) Cement
2) Coarse aggregate
3) Fine aggregate
4) Silica fume
5) Glass powder
6) Super plasticizer

B. Material Testing

1) Cement

S.No	Properties	Test values
1.	Specific gravity	3.05
2.	Standard consistency	35%
3.	Initial setting time	33 min
4.	Final setting time	135 min
5.	fineness	3%

2) Physical Properties of Silica Fume

PROPERTY	VALUE
Particle size (typical)	1 micron m
Bulk density	750–850 kg/m3
As-produced	130–430 kg/m3
Slurry	1,320–1,440 kg/m3
Densified	480–720 kg/m3
Specific gravity	2.22
Surface area (BET)	13,000–30,000 m2 /kg

3) Fine Aggregate: It is the passed by 4.75mm IS sieve and normally used fine aggregate in natural river sand , the sand is the aggregate resulting from the natural disintegration of rocks and which is deposited by streams and geological agencies. According to size of the fine aggregate may be described as coarse sand , medium sand and fine sand. IS specification classify in fine aggregate of grading zone 1 to grading zone 4.

S.No	Properties	Test values
1.	Specific gravity	2.5
2.	Fineness modulus	2.57
3.	Water absorption	2%

4) *Coarse Aggregate:* Locally available coarse aggregates having the maximum size of 20mm is used in the present work. Testing of coarse aggregates is done as per IS: 383-1970.The 20mm aggregates are sieved through 20 mm sieve. They were then washed to remove dust and dirt and were dried to surface dry condition.

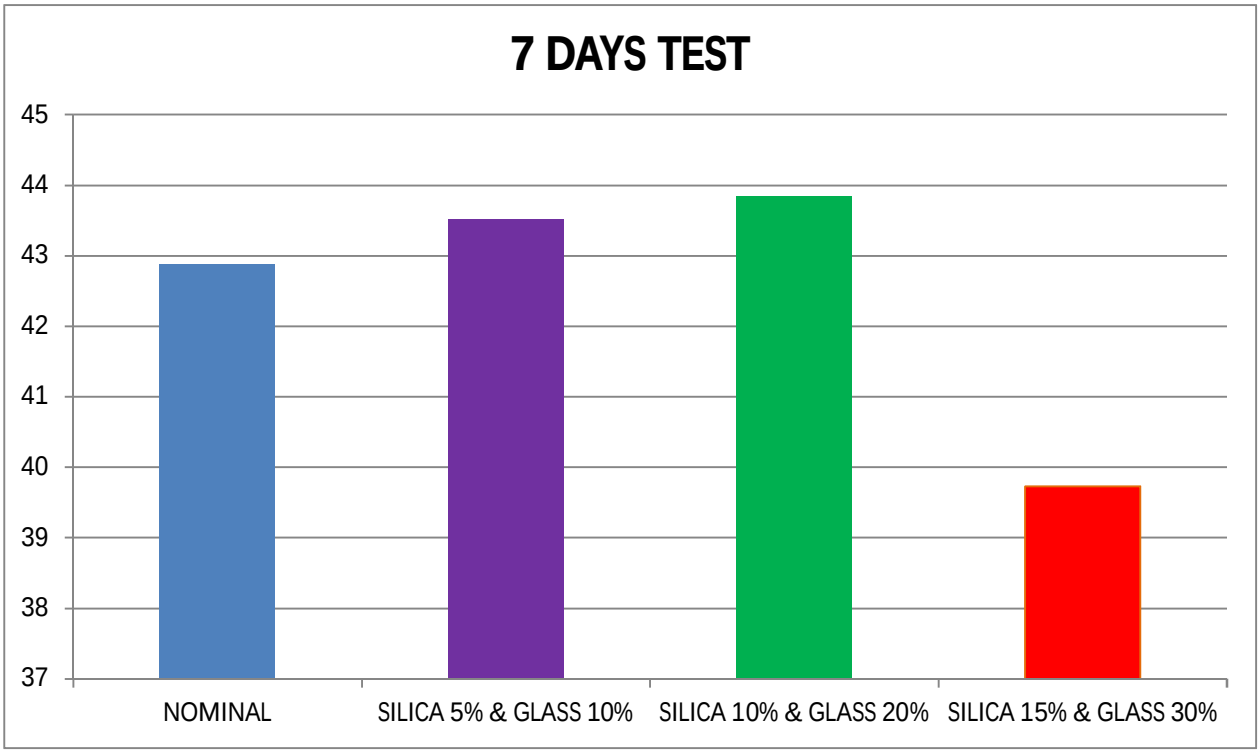
S. No.	Characteristics	Value
1.	Type	Crushed
2.	Maximum size	20mm
3.	Specific gravity	2.60
4.	Water absorption	1.5%
5.	Fineness modulus	7.2

5) *Mix Design M40*

Cement	Fine aggregate	Coarse aggregate	Water
535 kg/m^3	487.23 kg/m^3	1028.80 kg/m^3	214 lit/ m^3

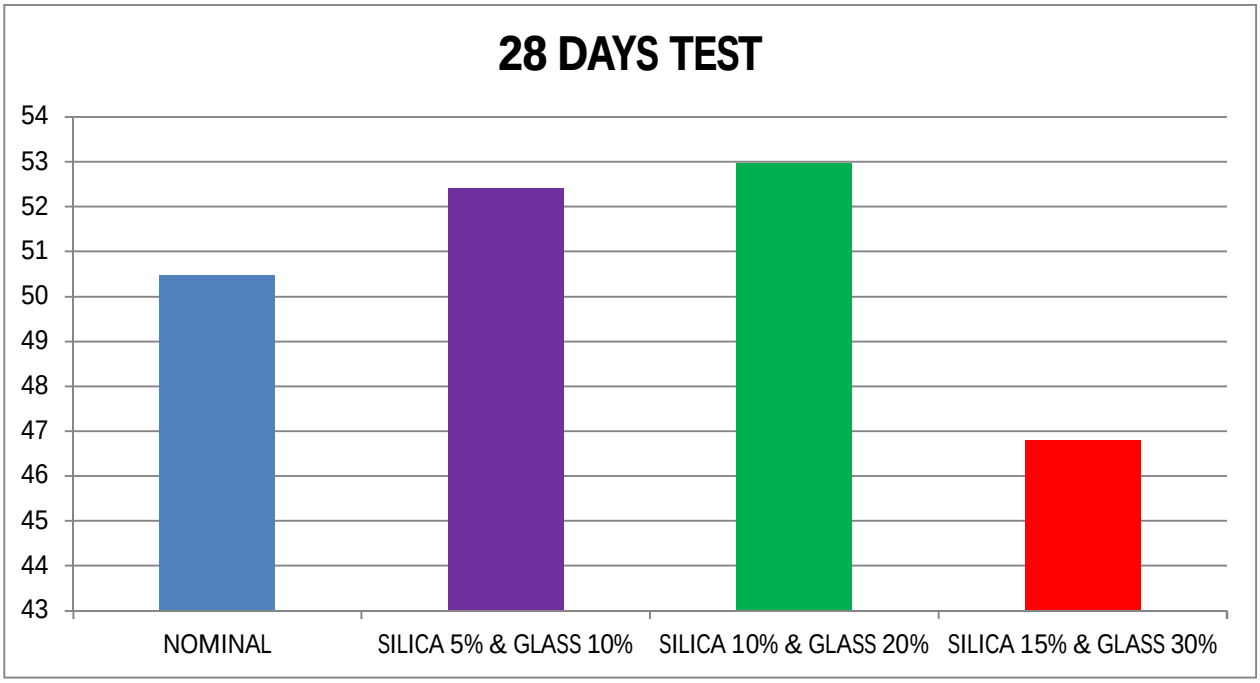
IV. RESULT ANALYSIS

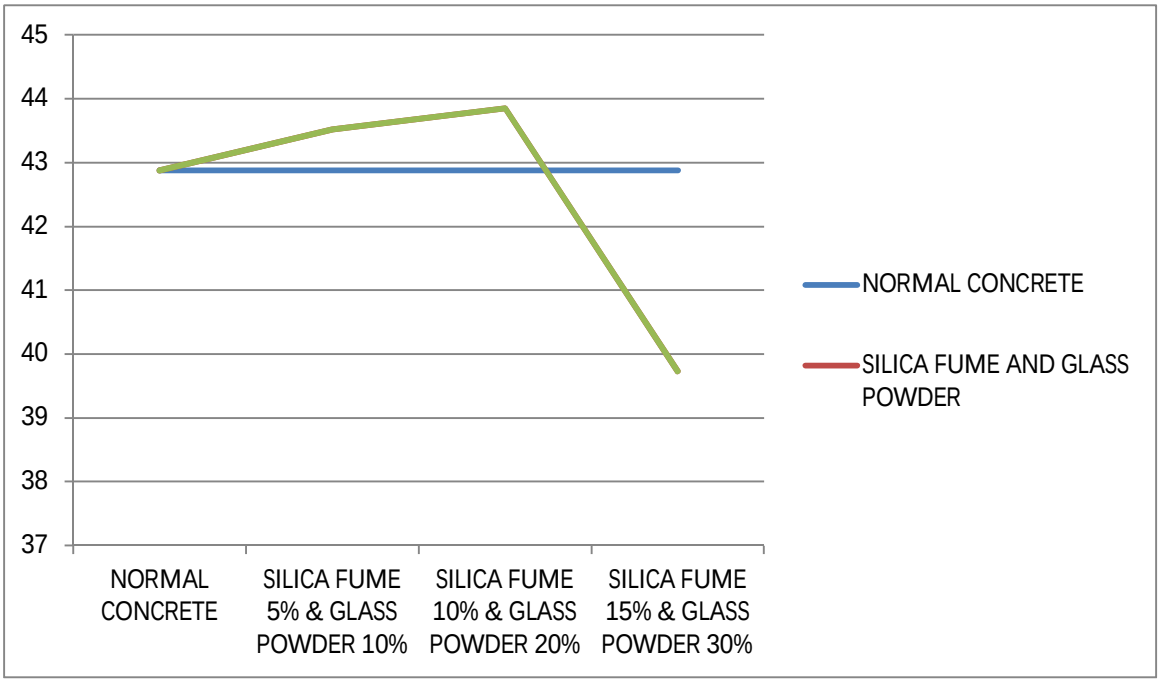
S.NO	TYPE OF AGGREAGRE		COMPRESSIVE STRENGTH AT 7 DAYS (N/mm²)
	SILICA FUME	GLASS POWDER	
1	0	0	42.88
2	5	10	43.52
3	10	20	43.85
4	15	30	39.73



Compressive test values for 28 days

S.NO	TYPE OF AGGREAGRE		COMPRESSIVE STRENGTH AT 28DAYS (N/mm²)
	SILICA FUME	GLASS POWDER	
1	0	0	50.475
2	5	10	52.41
3	10	20	52.96
4	15	30	46.80





V. CONCLUSION

10% replacement of cement by silica fume powder and 20% replacement of fine aggregate by glass powder optimum increase in compressive strength at 7 and 28 days

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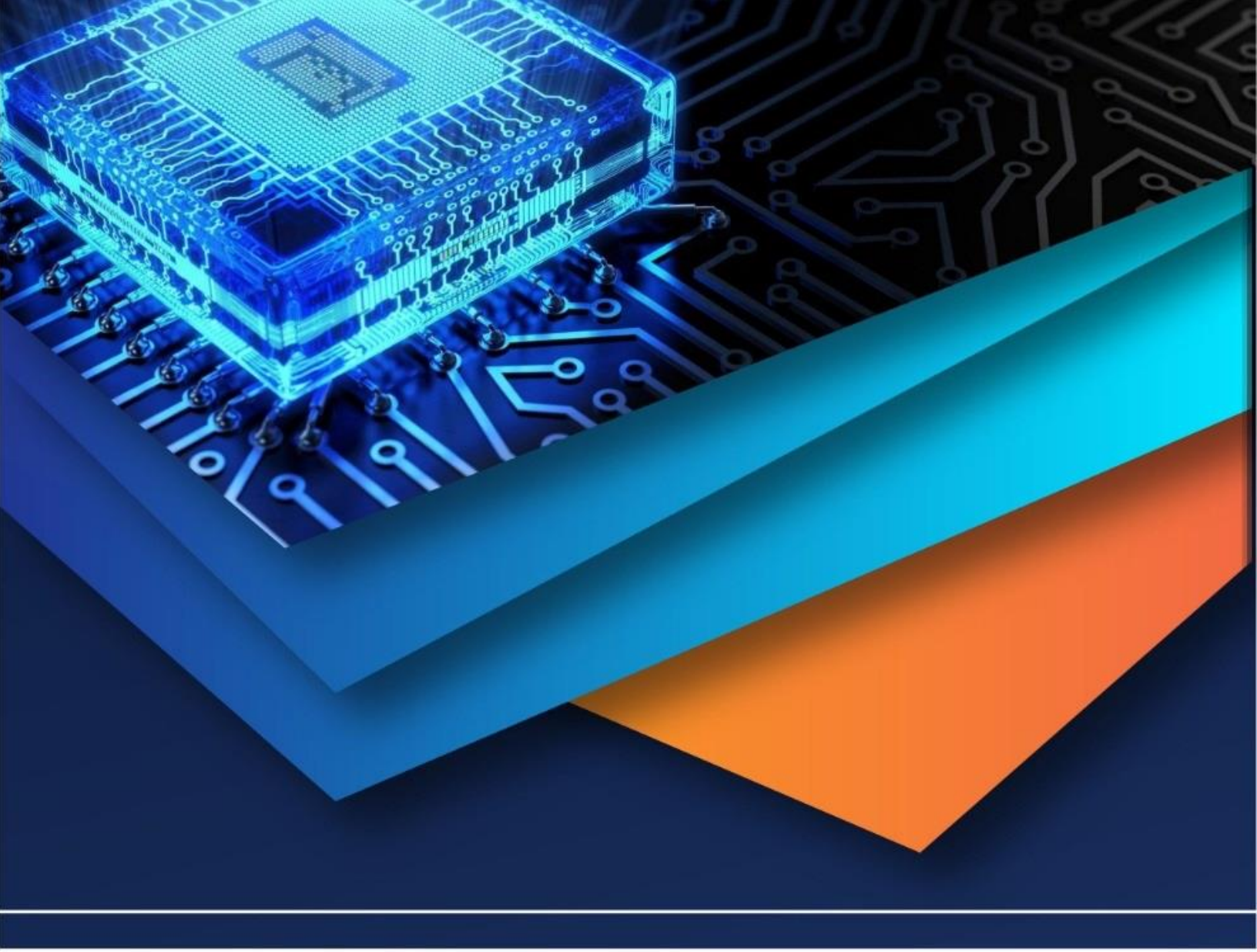

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