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The Investigation on Tensile Strength of Concrete By Addition And Replacement Of GGBS And Flyash

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ABSTRACT

This study is to work out the effect of mineral admixture GGBS and Fly ash in concrete of grade M-35 when it is added in & replaced for the fresh state and hardened state i.e. for workability and strength of concrete using OPC (43 grade). As mineral admixture GGBS and Fly ash have been added to OPC which varies from 5% to 30% at interval of 5% by total weight of OPC and the same as partial replacement of OPC (43 grade) which varies from 5% to 30% at interval of 5% by total weight of OPC.Variousranges of addition and replacement of cement by GGBS and Fly Ash in the concrete. All mixes of concrete were examined for workability as slump test of fresh concrete. Hardened concrete was examined for Split tensile and flexure strength on 28 days. Slump was found higher in partial replacement at 30% (GGBS & Fly ash) as compared to that of addition of GGBS & Fly ash.

INTRODUCTION

Concrete is a versatile structural material in the modern construction industries. Now a day's concrete is utilized in abundance as man utilizes water for its survival. It has no doubt that with the development of world civilization the concrete will be the major construction material in the coming future. Also looking to the environment concern, concrete using waste shall be developed. About 1 tons of Carbon Dioxide (CO_2) is generated in manufacturing of each tons of Ordinary Portland cement (OPC). The cement production has 5% of total global CO_2emissions. So by replacing partially OPC by some waste materials shall not only add some additional properties to concrete but also controls the atmospheric pollution.

As to study the variations of concrete by using GGBS and Fly ash has been added into OPC in such a regular variation from 5% to 30% at interval of 5% by total weight of OPC and partial replacement of OPC by GGBS and Fly ash which varies from 5% to 30% at interval of 5% by total weight of OPC for M35.

Experimental Investigation

Material Used

Cement- Ordinary Portland cement,43 grade specified as per the is 8112-2003 was used for casting the different grade of concrete. Potable water with pH value 7the water cement ratio w/c is fixed to 0.40 according to mix design code IS 10262:2009 and to maintain the slump KavassuPlast SP-431/ Shaliplast SP-431 admixture is used 1.25% by weight of cement.

The initial and final setting time was observed by Vicat apparatus and it was found 32 and 590 minutes respectively. The soundness tested by Le-Chetelier was 8 mm.

Fine aggregate- Fine aggregate size range 150mm to 4.75mm.in present work Banash River (from district Tonk) sand was used with % finer 99.3 with specific gravity 2.62.

Coarse aggregates- Coarse aggregates are particles greater than 4.75mm, but generally range between 9.5mm to 37.5mm in diameter. In this case consider aggregate range 20mm and 10mm particles size was used with specific gravity 2.73.

Physical Analysis	Range
Bulk Density	700-900 kg/m^3
Surface Area	12000cm^2/gm
Particle Shape	Irregular
Particle Size	N/A
d50	5 micron
d95	9 micron
Specific Gravity	2.9

Mix Design and Experimental Work:

In present study work the nominal mix is taken M35 and it is mix design code IS 10262:2009. As discuss earlier the W/C ratio is fixed to 0.40 and to maintain the slump a suitable 1.25 % by weight of cement admixture is used.

GGBS- GGBS is a specially processed product based on slag of high glass contentwith high reactivity obtained through the process of controlled granulation. GGBS reduces the water demand and heat of hydration which tends to improve the compressive strength and workability of concrete. Hence, an attempt has been made to utilize low cost material in this study such as GGBS in preparation of high improved concrete.

Table 3.11 Control Mix Proportion For M35

S.No	Materials	Weight(Kg)	Slump(mm)
1	Cement(OPC-43)	402.5	103
2	Coarse Aggregate(20mm)	654	
3	Coarse Aggregate(10mm)	425	
4	Fine Aggregate	802	
5	Water	160	
6	Admixture @ 1.25% of	5.1	

	cement		
7	W/C Ratio	0.40	

Results and Analysis

Flexural Strength-

To determine the flexural strength of all the concrete mixes, beam specimen of size 700mm x 150mm x 150mm were used.The beam specimens were tested after curing period of 28 days fully submerged in water as per IS 516:1959 for method of tests for strength of concrete. The central point loading/single point loading method was used for this test.

Table 4.26 Comparison of Flexural Strength for 28 days on Addition & Replacement For M35 Grade

S.No	Percentage of GGBS and Fly ash	Addition (N/mm^2)	Replacement (N/mm^2)
1	0-0	6.03	6.03
2	5-5	6.63	6.58
3	10-10	6.96	6.89
4	15-15	7.40	7.31
5	20-20	7.21	7.12
6	25-25	6.89	6.75
7	30-30	6.55	6.49

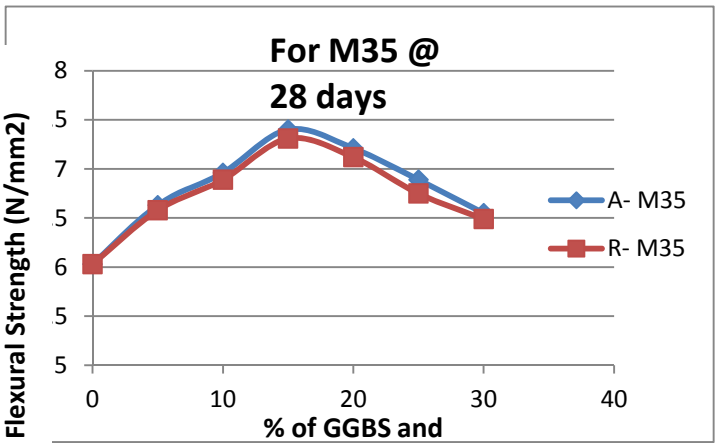

Fig. 4.30 Effect of GGBS and Fly ash on Concrete of M35 Grade on Addition & Replacement for 28 Days Flexural Strength of Beam

Splitting Tensile Strength

Cylindrical specimen of size 300mm(length) x 150mm(diameter) was used to determine splitting tensile strength of all the mixes. The specimens were cured for 28 days fully immersed in water tank as per IS 5816:1999 for method of test of splitting tensile strength of concrete.

Comparison of Splitting Tensile Strength for 28 days on Addition & Replacement For M35 Grade

S.No	Percentage of GGBS and Fly ash	Addition (N/mm^2)	Replacement (N/mm^2)
1	0-0	3.06	3.06
2	5-5	3.17	3.15
3	10-10	3.43	3.39
4	15-15	3.63	3.56
5	20-20	3.46	3.41
6	25-25	3.19	3.17
7	30-30	3.08	3.09

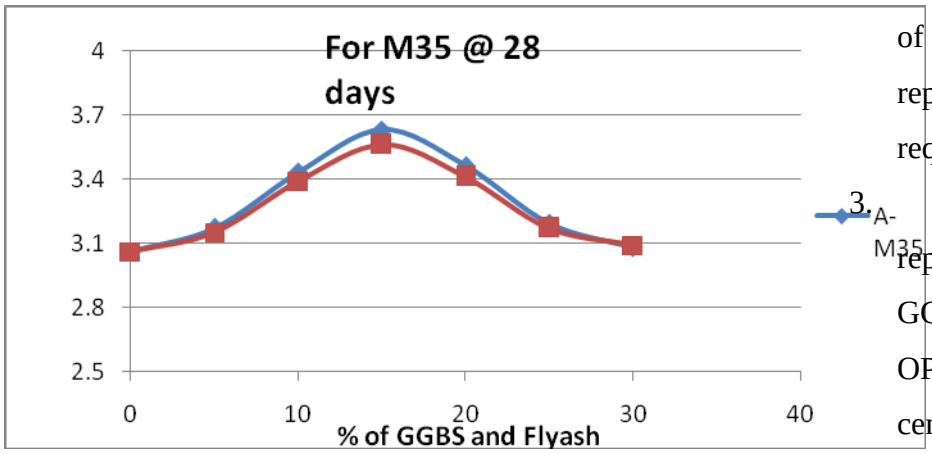

Fig. 4.38 Effect of GGBS and Fly ash on Concrete of M35 Grade on Addition & Replacement for 28 Days Splitting Tensile Strength of Cylinder

CONCLUSION

1. Flexural strength of concrete was increased in mix of M35 at 15% addition and replacement of GGBS & Fly ash , but when further GGBS & Fly ash was added to OPC or partial replacement of OPC by GGBS & Fly ash is done the Flexure Strength goes to decrease
2. Splitting tensile strength of concrete was increased in mix of M35 at 15% addition and replacement of GGBS & Fly ash , but when further GGBS & Fly ash was added to OPC or partial replacement of OPC by GGBS & Fly ash is done the Compressive Strength goes to decrease.

Future Scope of the Work

1. The durability study of M35 grade concrete with addition of GGBS & Fly ash into OPC and partial replacement of OPC by GGBS & Fly ash can be further studied.
2. The study on addition of natural fibers to improve upon the toughness and crack resistance of M35 grade concrete with addition of GGBS & Fly ash into OPC and partial replacement of OPC by GGBS & Fly ash is required to be done.
3. The study on use of crusher dust as partial replacement with natural sand and addition of GGBS & Fly ash into OPC & replacement of OPC by GGBS & Fly ash for M35 grade of cement is required to be done.

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