

FEASIBILITY STUDY OF CONCRETE BASED PAVEMENT BY USING FIBERS & CEMENTING WASTE MATERIALS

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Abstract

The main purpose of this investigation is to study the behavior of rigid pavement (concrete) which occurs when cementing waste material (GGBS) and steel fibers are added and to compare with normal concrete of M40 grade. For this study, concrete cubes and beams were produced of five partial GGBS replacement ratios (10%, 20%, 30%, 40% and 50%) with constant water-cement ratio (0.37) and cement dose of 486 kg/m³. To keep a constant workability, super plasticizer was used in concrete. The cubes and beams were tested at the age of 7, 28 and 56 days with continuous water curing condition. The comparison between normal concrete, GGBS concrete and with steel fiber concrete was made. After testing it was found that at 30% GGBS replacement we can get M40 strength of concrete. But flexural strength decreases by increasing percentage of GGBS so that to increase in flexural strength steel fibers of two different aspect ratios (7560 & 7530) was used. Steel fibers were added in concrete by 1% of total weight of concrete with different proportions. Thus the compressive and flexural strength reached up to considerable limit.

Keywords: GGBS, Steel Fibers, concrete.

1. INTRODUCTION

In India, we produce about 7.8 million tons of Ground Granulated blast furnace slag as a by product obtained in the manufacture of pig iron in the blast furnace. It is a non-metallic product consisting essentially of silicates and aluminates of calcium and other bases. The molten slag is rapidly chilled by quenching in water to form a glassy sand like granulated material. The disposal of such slag even as a waste fill is a problem and may cause serious environmental hazards with the projected economic growth and development in the steel industry, the amount of production is likely to increase many folds and environmental problem. It is seen that high volume eco-friendly replacement by such slag leads to the development of concrete which not only utilizes the industrial wastes but also saves a lot of natural resources and energy. This in turn reduces the consumption of cement

2. EXPERIMENTAL PROGRAM

Compressive strengths and flexural strengths of specimens with various percentage replacement of cement with GGBS is determined by casting concrete cubes of size 150 mm X 150mm X 150mm and beams of size 100mm X 100mm X 500mm and testing them after 7, 28 and 56 days of curing. Concrete use was standard (M40) grade of concrete mix.

3. CONCRETE MIX DESIGN

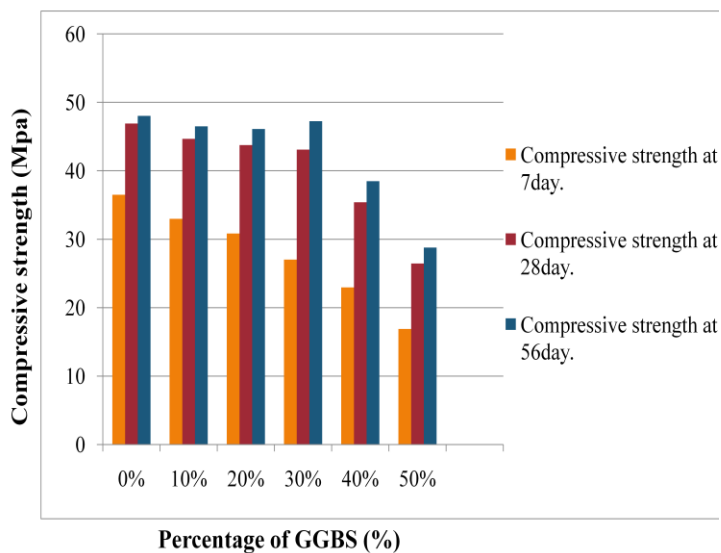
As per IS 10262:2009 (recommended guidelines for concrete mix design) concrete mix design was made for M40. Table 1 shows the mix proportion for M40 mix.

Table 1 - Quantity for 1m³ concrete

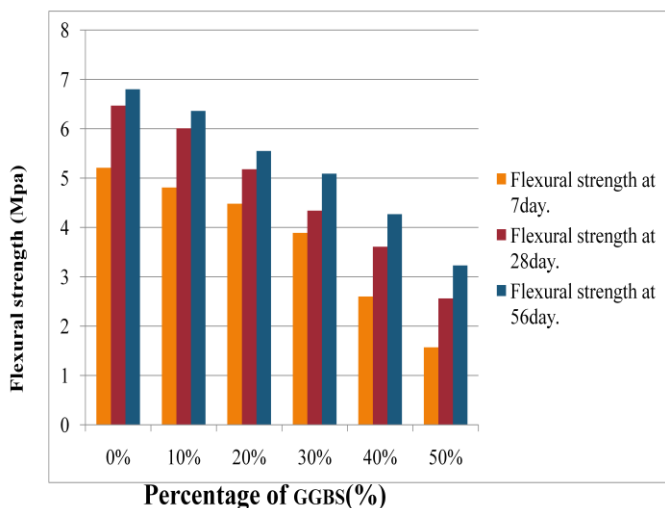
1	Cement	486 Kg
2	Water	18 Kg
3	Fine aggregate	435 Kg
4	Coarse aggregate	1305Kg
5	Chemical admixture	2.43 Kg

Table 2- Compressive strength of concrete at different ages.

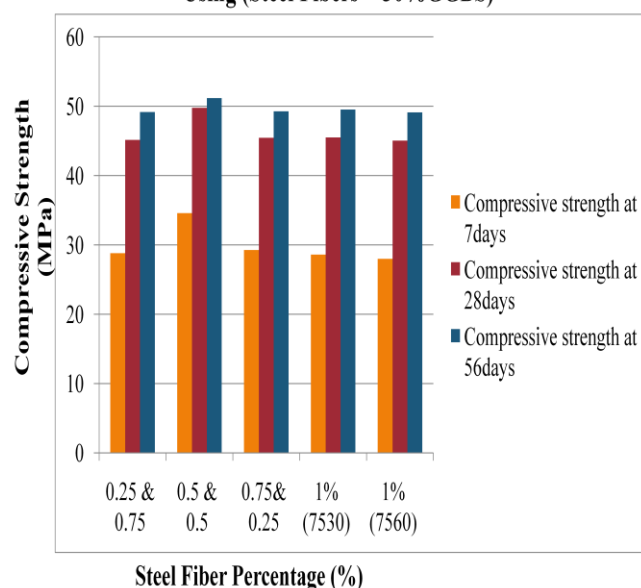
Sr.no	GGBS (%)	Compressive strength (MPa)		
		7days	28days	56days
1	0	36.5	46.90	48.01
2	10	32.98	44.66	46.50
3	20	30.83	43.74	46.10
4	30	27.03	43.10	47.24
5	40	22.95	35.40	38.47
6	50	16.88	26.44	28.78

Compressive strength of concrete at different ages.**Graph.2****Table 3- Flexural Strength of Concrete at different ages.**

Sr.no	GGBS (%)	Flexural Strength (MPa)		
		7days	28days	56days
1	0	5.21	6.47	6.80
2	10	4.81	6.01	6.36
3	20	4.48	5.18	5.55
4	30	3.89	4.34	5.09
5	40	2.6	3.61	4.27
6	50	1.57	2.56	3.23

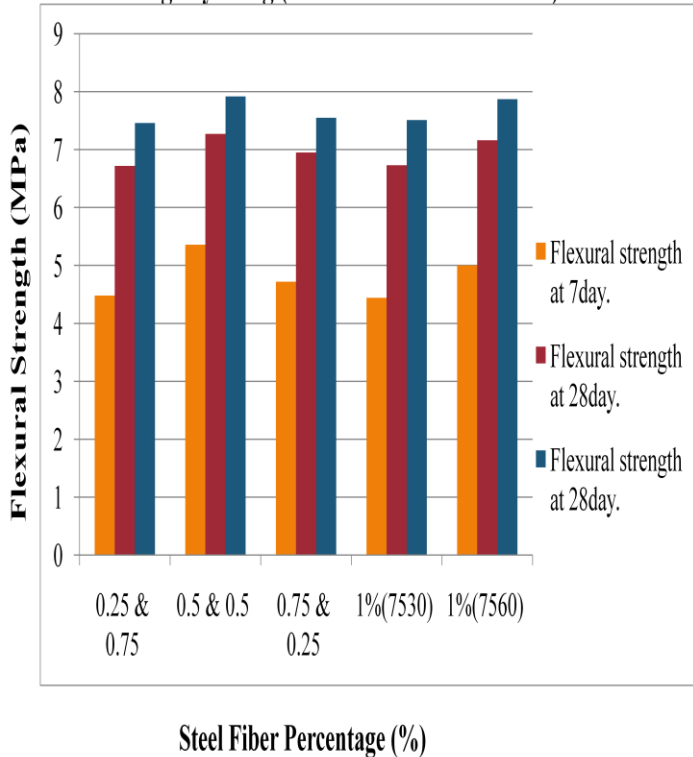
Flexural Strength of Concrete beams at different ages.**Graph 3****Table.4-Compressive Strength of Concrete at different ages Using (Steel Fibers+ 30%GGBS)**

Sr.no	GGBS (%)	Compressive Strength (MPa)		
		7days	28days	56days
1	0.25 & 0.75	28.81	45.13	49.16
2	0.5 & 0.5	34.59	49.77	51.18
3	0.75 & 0.25	29.27	45.44	49.26
4	1% (7530)	28.60	45.49	49.52
5	1% (7560)	27.98	45.03	49.10

Compressive Strength of Concrete Cubes at different age Using (Steel Fibers + 30%GGBS)**Graph 4****Table 5- Flexural Strength of Concrete at different ages Using (Steel Fibers+ 30% GGBS)**

Sr.no	GGBS (%)	Flexural Strength (MPa)		
		7days	28days	56days
1	0.25 & 0.75	4.48	6.72	7.46
2	0.5 & 0.5	5.36	7.27	7.92
3	0.75 & 0.25	4.72	6.95	7.55
4	1% (7530)	4.44	6.73	7.51
5	1% (7560)	5.00	7.16	7.87

Flexural Strength of Concrete at different age by using (Steel Fibers + 30% GGBS)



Graph 5

4. CONCLUSIONS

The following conclusions can be drawn from the experimental investigations conducted on the behavior of concretes with GGBS as partial replacements for cement-

- 1) With increase in percentage of G.G.B.S the flexural and compressive strength of concrete decreases.
- 2) With maximum 30% percent replacement of GGBS with cement the strength of concrete is found at considerable limits.
- 3) It was also observed that the early strengths (up to 28 days) of concrete mix (with 10%, 20%, 30%, 40 and 50% GGBS replacements) were lower than that of Portland cement concrete mixes.
- 4) By 56 days, the strength of 30% GGBS mix exceeded that of the 10%, 20%, 40%, & 50% GGBS mixes.

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BIOGRAPHIES



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