Experimental Study of Load Carrying Capacity of Precast RCC Slab Panel with the use of Pond Ash and Quarry Dust

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Abstract— the continuous use of sand from river beds leds to an environmental problem. The production of cement leads to the emission of a vast amount of greenhouse gases, forcing researchers to look for an alternative. The possibility of use of quarry dust and pond ash as a suitable replacement of fine aggregate and cement in concrete respectively is explored in this study. It has been estimated that 20% of rock comes out as dust during crushing from quarry site. In the thermal power station the ash which is fall at the bottom of boiler is mixed with water and then it is carried away from plant through pipes and finally dumped on open land. After evaporation whatever ash remains is called pond ash. The need to develop concrete with non-conventional aggregates is urgent for environmental as well as economic reasons. Here fine aggregate is partially replaced with quarry dust by 20%, 35%, and 50%. Along with that the cement is also partially substituted with Pond ash by 5% and 10%.Hence, there are seven batch mixes including conventional one. In this study the following tests will be done: (1) Compression test (2) Split tensile test (3) Flexural test.

Key words: Precast RCC Slab Panel, Pond Ash, Quarry Dust

I. INTRODUCTION

India's major source of power generation is through thermal power plants. These thermal plants require coal as a fuel for power generation. During the process of power generation fly ash and bottom ash is produced. Lot of research has been done on utilization of fly ash but very little emphasis is given on pond ash. The finer fraction of the ash, called as flyash, gets collected in the electrostatic precipitators (ESP) while the ash that is collected at the base of the boiler is called as bottom ash. In India, the flyash and bottom ash are mixed with water and dumped in ponds called as pond ash. The ash lying in ponds occupy more than 40000 hectares of land, which otherwise would have been fruitfully used for developmental purpose.

A. Material used

- Coarse aggregate: The aggregates having maximum size of 10 mm are used. Bulk density is 1600 kg/m^3. Specific gravity and water absorption of aggregates are 2.60 and1.2% respectively.
- Sand: The natural river sand having zone-3 and specific gravity and water absorption 2.58 and 0.2 % respectively is used. Bulk density of sand is 1650 kg/m^3.The fineness modulus is 2.48.
- Quarry Dust: The quarry dust having fineness modulus 2.87, specific gravity 2.24, Bulk density 1711 kg/m^3, SiO_2: 38.66%, Al_2O_3: 30.56% is used.

Fig. 1: Sample of Quarry Dust

- Pond ash : The Pond ash has specific gravity 2.026, Bulk density 848 kg/m^3, SiO_2 45.30%, Al_2O_3 30.23% is used.

Fig. 2: Pond Ash

- Cement: The cement is a material with adhesive and cohesive properties. The cement, when mixed with aggregates and water, binds the particles in to a compact whole.53 grade OPC Ultra tech cement has been used in this experimental work.
- Water: The Water is used for mixing and curing. Potable and drinking water is used satisfactory for mixing concrete.
- Super Plasticizer: The super plasticizer used here is FAIRFLO 120. It is high water reducing cum slump retainer admixture for concrete conforming to ASTM C-494 type 'G' and IS 9103-1999
- Mix Proportion: There are seven batch mix for different replacement percentage of fine aggregate and cement.

Batch mix	Pond ash Cement	Quarry dust: Natural sand	Admixture Dosage (%)
mix-1	0:100	0:100	0.25
mix-2	5:95	20:80	0.50
mix-3	5:95	35:65	1.00
mix-4	5:95	50:50	1.00
mix-5	10:90	20:80	0.25
mix-6	10:90	35:65	1.00
mix-7	10:90	50:50	1.00

Table 1: Mix Proportion

- Mix design: The desired grade of concrete is M25. The mix design is as per the IS 10262:2009 and is as below.

Mass of Cement (kg/m^3)	Mass of Water (kg/m^3)	Mass of Fine Aggregate (kg/m^3)	Mass of Coarse Aggregate (kg/m^3)
462.22	208	848.7	821.72
1	0.45	1.83	1.78

Table 2: Mix Design

– Casting of Cubes: The concrete cubes of standard size 150 mm×150 mm × 150 mm are casted. Total 21 cubes are casted for 7 different mixes and tested at 28days.

1) Compression test on cubes

Fig. 3: Compression test on cubes

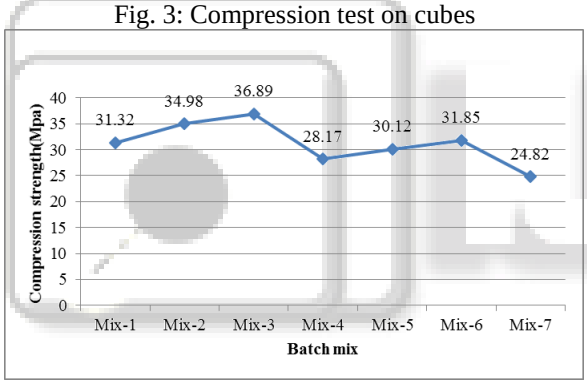

Fig. 4: Test result for compression test on cubes at 28 days (in N/mm^2)

– Casting of cylinder: The concrete cylinder of length 300 mm and diameter of 150mm are casted. Total 21 cylinders are casted for 7 different mixes and tested at 28days.

2) Split tensile test on cylinder

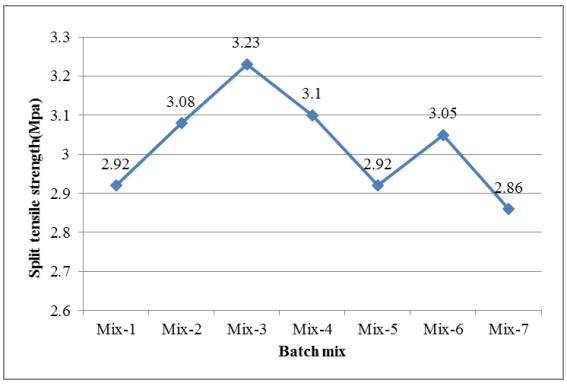

Fig. 5: Test result for Split tensile test on cylinders at 28 days (in N/mm^2)

– Casting of beam: The concrete beam of size 150mm X 150mm X 700mm are casted. Total 21 beams are casted for 7 different mixes and tested at 28days.

3) Split tensile test on beam:

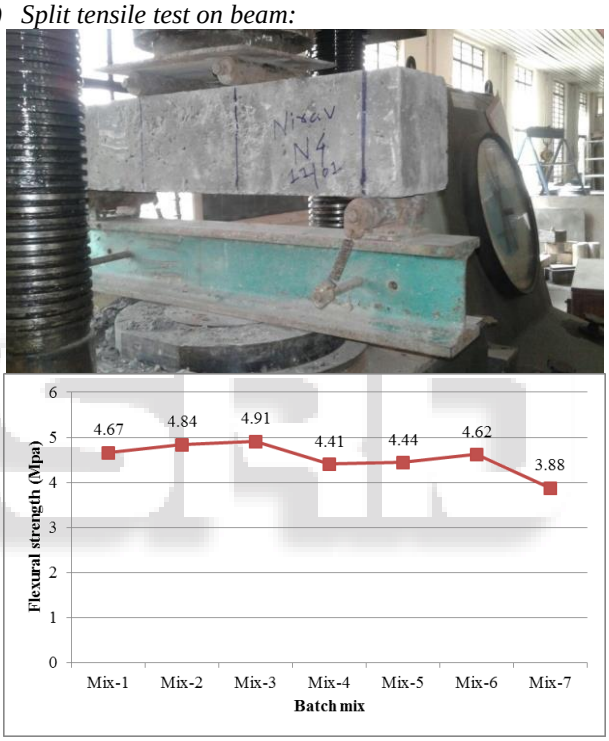

Fig. 6: Test result for flexure test on beam at 28 days (in N/mm^2)

II. Conclusion

From the above test results it is cleared that batch mix-3 i.e. 5% pond ash and 35% quarry dust gives the maximum result in terms of compressive strength, split tensile strength and flexural strength. The compressive strength of concrete increases with increase in percentage of quarry dust upto 35% and then it drops. The split tensile strength and flexural strength also follows the same pattern. The increment in strength is due to filling of pores of sand by finer particles of quarry dust.

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