Investigations on Mechanical Properties of Sintered Fly Ash Aggregate Concerte

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Abstract- *Construction industry plays a vital role in India, the material like cement, fine aggregate and natural coarse aggregate which is used to prepare concrete where once easily available in our country, but now there is a high demand in materials. In this project an experimental investigation is done on complete replacement of natural course aggregate with sintered fly ash aggregate. India produces approximately 221 million tons of fly ash annually as reported in the 7th edition FLY ASH UTILISATION 2018-CONFERENCE and its percentage utilization is very lesser and most of the fly ash is dumped at landfills it causes environmental flaws. So the SFA and Super plasticizer is intended into a concrete, casted in cubes, cylinder and prism for a concrete grade of M30. Properties of SFA were tested for suitability and also compared with standard values as per IS code. SFA concrete mechanical properties are compared with normal conventional concrete.*

I. INTRODUCTION

GENERAL

Concrete is the most widely used man-made building material in the world, owing to its versatility and relatively low cost. The main constituent of concrete is aggregate which occupies more than 70% of the concrete mix. The increase in demand for the natural ingredients is met by replacing the building materials with the waste materials obtained from various industries as by-products. In order to meet the shortage of availability of natural aggregate, artificially manufactured aggregates prepared from certain industrial by-products can be used as alternatives.

Although fly ash has been used in concrete industry for cement replacement, 60% of the fly ash remains unutilized. Hence, fly ash based artificial lightweight aggregates offer potential for large scale utilization in the construction industry.

FLY ASH

Fly ash is a by-product of the combustion of pulverized coal in electric power generation plants. When the pulverized coal is ignited in the combustion chamber, the carbon and the volatile materials are burned off. Mostly fly ash is used in the cement production which is called as Pozzolanic Portland Cement as it contains pozzolanic properties. Nowadays fly ash is widely used in the various applications such as mine reclamation, stabilization of soft soils, road sub base construction, etc. Mostly class F fly ashare produced in the thermal power plants.

SINTEREDFLY ASH LIGHTWEIGHT AGGREGATE

The most common use of fly ash is the partial replacement of cement in concrete. Though the partial replacement of cement has given positive results in concrete such as increase in strength, the density of concrete has not reduced much. Hence an attempt is taken to replace the coarse aggregate in conventional concrete with sintered fly ash lightweight aggregates where reduction in self-weight of concrete can beachieved.The constituents like cement, fly ash and water produces fly ash aggregates. Water is the binding material that paves way for the formation of the aggregates with good bond property.

Cement and fly ash are mixed in a concrete mixer by adding water. The contents are thoroughly mixed in the drum until the complete formation of fly ash aggregates. This method of formation of fly ash aggregate is called pelletization. The aggregates thus produced are called the sintered fly ash aggregates which are light in weight.

II. OBJECTIVE

- To provide analternative for the conventionally used coarse aggregate in concrete to reduce the demand for natural ingredients.
- To effectively use the fly ash generated as a by-product from thermal power plants in the form of sintered fly ash lightweight aggregate.
- To produce the lightweight concrete by using sintered fly ash aggregate.
- To develop M30 grade of concrete.
- To study the basic fresh concrete & mechanical properties is to be compared with control concrete.

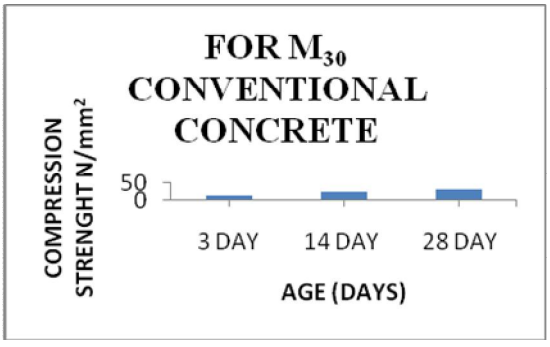
III. SCOPE

The main scope of the project is to find the feasibility of replacing the conventional coarse aggregate with the sintered fly ash lightweight aggregate in M30concrete. A comparative study has been done between conventional concrete and sintered fly ash aggregate concrete. The destructive tests such as compressive strength test,split tensile test and flexural strength test have been done on conventional concrete, sintered fly ash aggregate concrete. The results of the tests revealed the usefulness of sintered fly ash concrete.

MIX DESIGN FOR SINTERED FLY ASH AGGREGATE CONCRETE

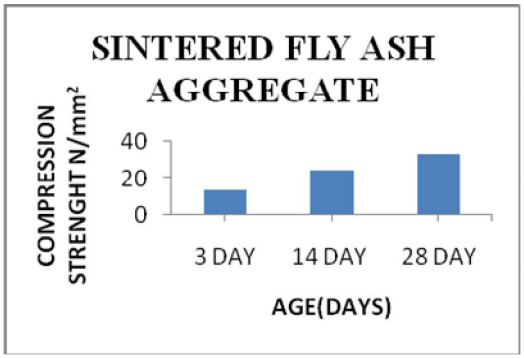
MIX RATIO

Cement: Fine aggregate: Coarse aggregate/ Water
438.88**:**617.16**:** 854.87/0.36
1**:**1.40**:** 1.94/ 0.36

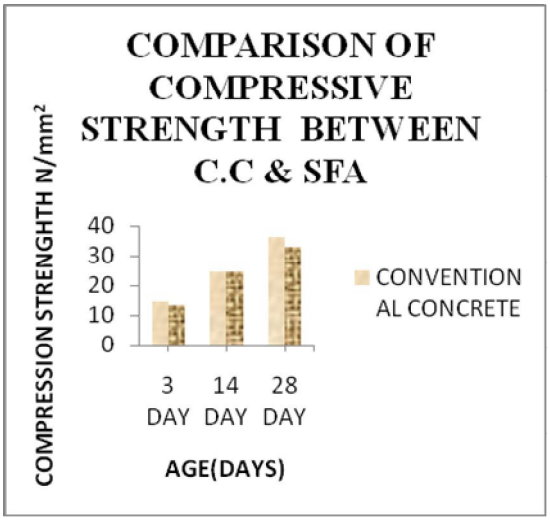


COMPRESSIVE STRENGTH TEST FOR SFA CONCRETE

S. No	Day	sample	Weight (kg)	Load (kN)	Compressive strength (N/mm²)
1	3rd	1	6.49	300	13.33
		2	6.52	300	13.33
		3	6.48	300	13.33
2	14th	1	6.820	560	24.88
		2	6.720	550	24.44
		3	6.750	560	24.88
3	28th	1	6.860	740	32.88
		2	6.790	750	33.33
		3	6.890	745	33.11



COMPARISON

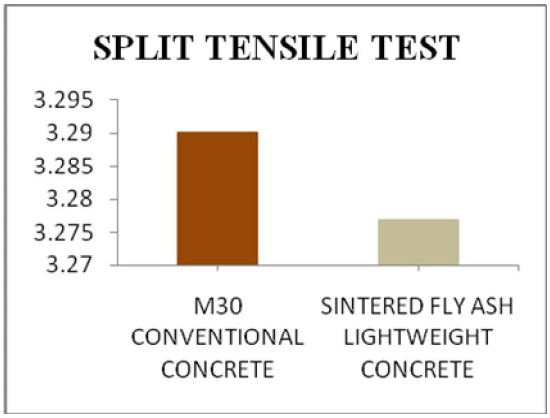


SPLIT TENSILE STRENGTH TEST

SPLIT TENSILE TEST RESULTS OF M30CONVENTIONAL CONCRETE

SPLIT TENSILE TEST RESULTS OF SFA CONCRETE

SPLIT TENSILE COMPARISON



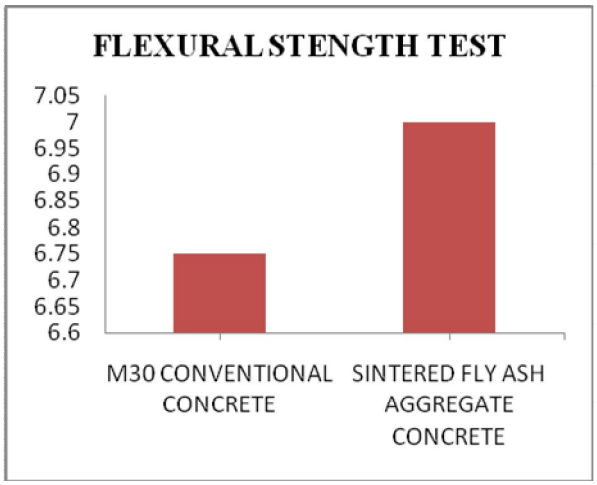
sample	Weight (kg)	Load (kN)	Split tensile strength (N/mm²)
1	12.93	240	3.39
2	12.85	220	3.11
3	12.91	240	3.39

FLEXURE STRENGTH TEST

FLEXURE STRENGTH TEST RESULTS OF SFA CONCRETE

sample	load (kn)	flexural strength (n/mm²)
1	14	7
2	14	7

FLEXURAL STRENGTH COMPARISON



IV. CONCLUSION

Based on the experimental results obtain from the investigation on sintered fly ash aggregate, the following conclusions are drawn.

The compression strength of concrete cube at 3-days, the sintered fly ash aggregate concrete cube is found has 10% lesser strength than conventional concrete cube and the strength gain for 3-days is 49.36% for the conventional concrete and 44.43% for the sintered fly ash aggregate concrete. The compression strength of concrete cube at 14-days, the sintered fly ash aggregate concrete cube is found has 0.60% greater strength than conventional concrete cube and the strength gain for 14-days is 81.93% for the conventional concrete and 82.43% for the sintered fly ash aggregate concrete. The compression strength of concrete cube at 28-days, the sintered fly ash aggregate concrete cube is found has 9.190% lesser strength than conventional concrete cube and the strength gain for 28-days is 121.5% for the conventional concrete and 110.33% for the sintered fly ash aggregate concrete.

The split tensile strength of concrete cylinder at 28-days, the sintered fly ash aggregate concrete cylinder is found has 0.40% lesser strength than conventional concrete cylinder.

The flexural strength of concrete prism beam at 28-days, the sintered fly ash aggregate concrete cylinder is found has 3.57% higher strength than conventional concrete cylinder.

After 100% replacement of coarse aggregate by SFA, the material property of SFA and mechanical testing of SFA concrete can be used as structural concrete (column, beam and slab), since the SFA material is an environmentally friendly and reduce the dependence of natural coarse aggregate and also handle the industrial fly ash waste management by using it in construction reduce dumping of fly ash.

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