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Split Tensile Strength of Fly Ash Based M20 Grade Cement Concrete

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Abstract: Cement is a binding material, a substance that sets and hardens singly, and can bind other accoutrements together. In ancient civilization the list accoutrements were of traditional type similar as jiggery, lead, jute, rice coconut etc., now in ultramodern civilization cement is main in the list of accoutrements. The use of concrete containing high volume of fly ash has lately gained fissionability as a resource effective, durable and sustainable option for variety of concrete operation (1). The use of fly ash in concrete at proportions in ranging from 30% to 65% of total cementitious binders has been studied considerably over the last twenty years. In present research cement is replaced by fly ash with suitable proportions. Target strength of M20 grade is fixed, by replacing cement with high volume fly ash as per the normal blend design (2). M20 target tensile strength is gained by replacing cement 60% of its mass by fly ash. Cylindrical specimens were cast and tested for 7 and 28 days. Thirty six concrete specimens were cast and tested in this design. Out of which eighteen were for 7 days and another eighteen for 28 days. Cement has been replaced with fly ash i.e., C100F0, C80F20, C60F30, C50F50, C30F70, C10F90, COF100. Eventually good strength results obtained by replacing the cement with fly ash (3, 4).

Keywords: Fly ash, M20 grade concrete, split tensile strength, mix design cylindrical specimen, compression testing machine.

INTRODUCTION

Cement is the alternate substantially used material in construction after water. It plays vital part in concrete structures either plain or R.C.C structures. Concrete is the top most extensively used man-made construction accoutrements in the world. It is attained by combine of fine summations, coarse summations and cement with water and admixtures in needed proportions. Fresh concrete or plastic concrete is lately mixed material which can be form into any shape hardens into a gemstone- such like mass known as concrete (5). The hardening is because of chemical response between water and cement, which continues for long session leading to stronger with age. The mileage and fineness as well as the continuity of concrete structures, erected during the first half of the last century with OPC and plain round bars of mild steel, the easy vacuity of the constituent material of concrete and the knowledge that nearly any combination of the construction leads to a mass of concrete have bred disdain. Strength was emphasized without a study on the continuity of structures. As a consequence of the liberties taken, this continuity of concrete and concrete structures is on a southward trip; a trip that seems to concrete structures which were constructed since 1970 or there about by which time the following developments are came latterly. The use of high strength rebar with face distortions started getting common. Significant changes in the ingredients and parcels of cement were initiated. Researchers were started using supplementary cementitious materials and combinations in concrete,frequently without acceptable considerations. The reversal in the health of recently constructed concrete structure urgedthe most direct and irrefutable substantiation of the last two or three decades on the service life performance of our construction and the performing challenge that confronts us is the intimidating and inferior rate at which our structure systems each over the world are suffering from deterioration when exposed to real surroundings. The OPC is one of the main constituents used for the product of concrete and has no alterative in the civil construction assiduity. Unfortunately, in the product of cement involves emigration of large quantities of carbon dioxide gas into the atmosphere. It is a major donation for g r e e n house effect and the global warming. Hence, it's ineluctable either to search for another material or incompletely replace it by some other accoutrements to save our terrain. The quest for any similar cementation's accoutrements. Which can be used as an alternative or as a supplementary for cement should lead to global sustainable development and smallest possible terrain impact.

EXPERIMENTAL INVESTIGATION:

Physical Properties

Physical properties help in disposing the coal ashes for engineering purpose and some are related to engineering properties. The properties discussed are specific staidness, grain size distribution, index properties.[6].

SPECIFIC STAIDNESS

Specific staidness is one of the important physical parcels demanded for the use of coal ashes for geotechnical and otheroperations. In general, the specific staidness of coal ashes varies around 2.0 but can vary to a large extent. Because of thegeneral low value for the specific staidness of coal ash compared to soils, ash fills tend to affect in low dry viscosity. Thereduction in unit weight is of advantages in the case of its use as a backfill material for retaining walls since the pressureapplied on the retaining structure.

GRAIN SIZE DISTRIBUTION

Grain size distribution indicates if a material is well graded, deficiently graded, fine or course, etc. Coal ashes are generally base sized with some sand- size bit. Leonard's and bailey have reported the range of gradation for fly and bottom ashes which can be classified as flaxen sand or flaxen silts.

CHEMICAL COMPOSITION

Chemical Composition suggests the possible operation for coal ash. The disquisition carried out on Indian cover ashes show that all the cover ashes contain silica, alumina, iron oxide and calcium oxide. The silica content in cover ashes is between 38 and 63%, 37 and 75% in pond ashes and 27 and 73% in nethermost ashes. The alumina content ranges between 27 and 44% for cover ashes 11and 53% for pond ashes and 13 and 27% for bottom ashes. The calcium oxideis in the range of 0 to 8% for bottom ashes.

TABLE :1 FLY ASH CLASSIFICATION

compaction	Bituminous	Sub-bituminous	Lignite
SiO_2	20-60	40-60	15-45
AI_2O_3	05-35	20-30	10-15
Fe_2O_3	10-40	4-10	04-15
SO_3	0-4	0-2	0-10
Na_2O	0-4	0-2	0-6
K_2O	0-3	0-4	0-4
LOI	0-15	0-3	0-5

Table :2 Properties of coarse aggregate

Properties	Results obtained
Specific gravity	2.74
Water absorption	0.4%
Fineness modulus	4.01

TABLE :3 PROPERTIES OF FINE AGGREGATES

Properties	Results obtained
Specific gravity	2.74
Water absorption	0.80%
Fineness modulus	2.47

Table :4 Properties of fly ash:

Properties	Results obtained
Specific gravity	2.96
Water absorption	25.5%
Fineness modulus	3849cm^2/g

SPLIT TENSILE STRENGTH OF SPHERICAL CONCRETE INSTANCE

The tensile strength of concrete is one of the introductory and important parcels which greatly affect the cracking in structures. also, the concrete is weak intension due to its brittle nature. Hence it isn't anticipated or pressure. So,concrete develop cracks when tensile forces exceed its tensile strength. thus, it's necessary to determine the tensile strength of concrete to determine the load at while members may crack.

Work procedure

After the admixture is set, it's poured into the oiled mould in layers roughly 5 cm deep. Also, each layer is compacted either by hand or by vibration. Distributed bar stroke slightly in order to compact it appropriately. Minimum tamping bar stroke for each sub layer is 30. Incipiently, the face of the concrete should be finished position with the top of the mould, using a trowel glass or essence plate to prohibit evaporation.

PROCEDURE OF SPLITTING TENSILE TEST

The cylindrical specimens were tested after 7, 28 days of curing. Weight and dimension of the specimen were noted. UTM machine is set for the requiredrange. Plywood strip and specimen were placed on the lower plate. Aligned the specimen so that the lines marked on the ends were perpendicular and cantered over the bottom. Other plywood strips were placed above the specimen. The upper plate brought down so that it just touches the plywood strip. The load was continuously applied without shock at a rate within the range 0.7 to1.4 MP/ min. Eventually, noted down the breaking load(P) [(7)].

TEST RESULTS

Split tensile strength of the cylinders is calculate by using the following relation,

$f_{ct} = 2P/\pi \times D \times L$

Where:

f_{ct}- split tensile strength of the instance

P = maximum applied load

D= Diameter

TABLE :5 SPLIT TENSILE STRENGTH VALUES REPRESENTED FOR BOTH 7&28 DAYS

Fly ash: cement	Split tensile strength (N/mm^2)	
	7 days results	28 days results
100:0	0.20	0.5
80:20	0.60	1.18
60:40	1.30	1.9
40:60	1.90	2.45
20:80	2.50	2.93
0:100	2.70	3.2

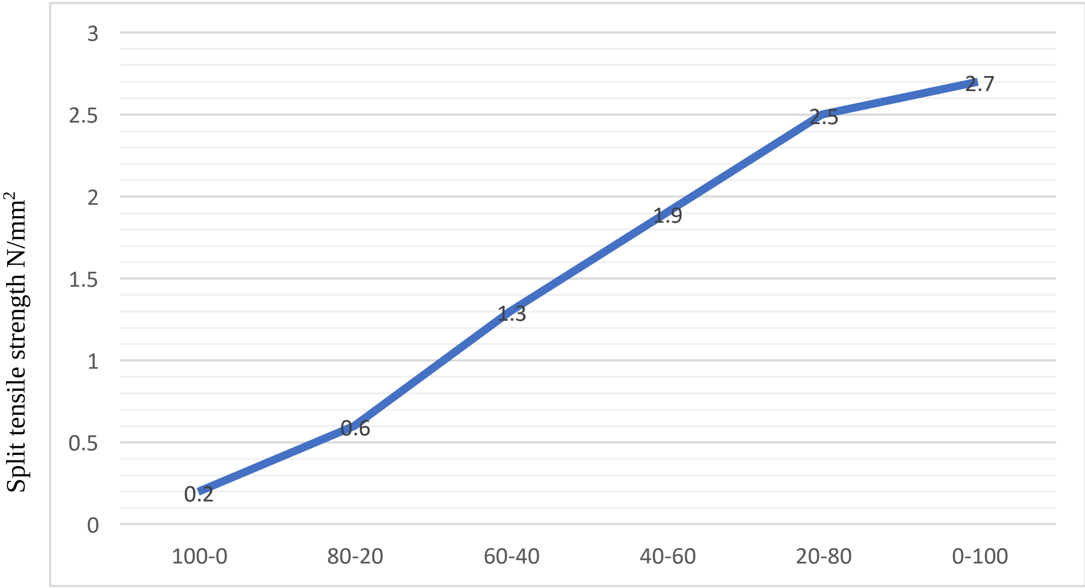

Fig1: variation of 7Days Split tensile strength with Fly ash-cement proportions.

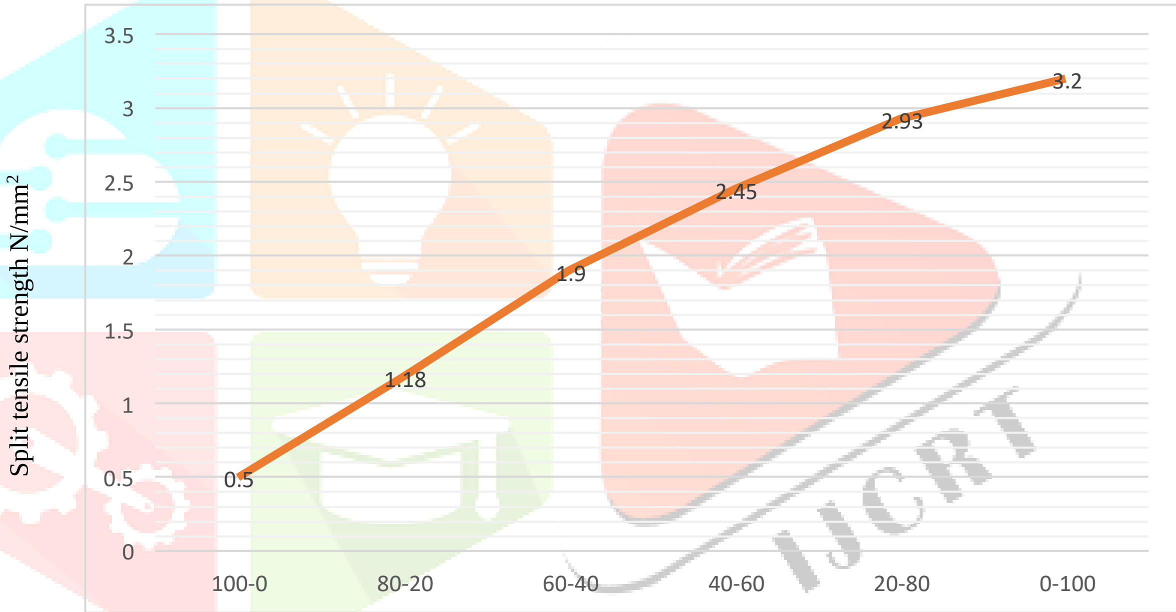

Fig2: variation of 7Days Split tensile strength with Fly ash-cement proportions.

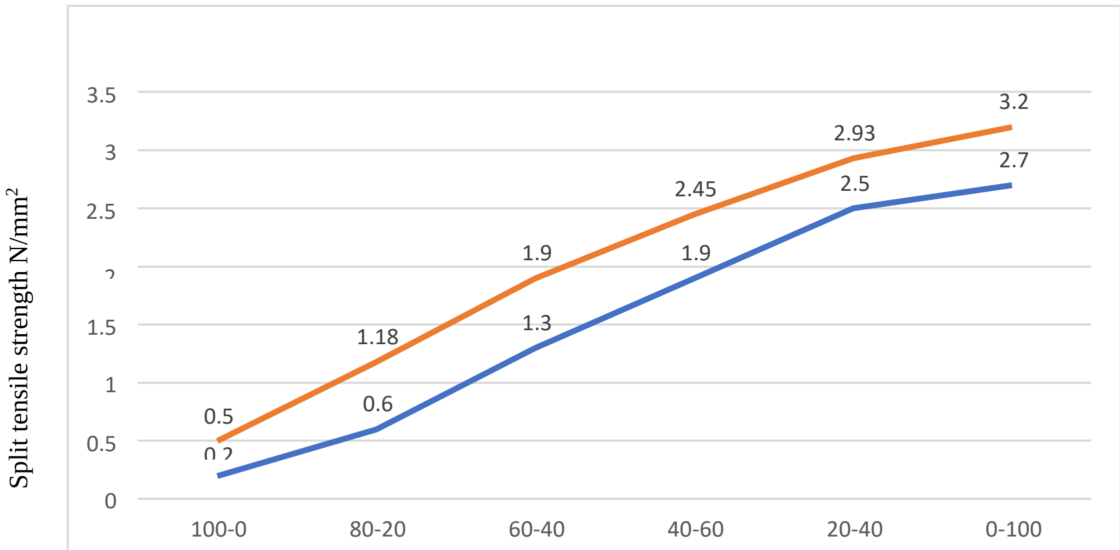

Fig3: variation of 7Days & 28Days Split tensile strength with Fly ash-cement proportions.

Conclusions

Based on experimental investigation the following conclusions are drawn.

1. Cement replaced with cement in combination of fly ash lead to increase in spilt tensile strength up to 0% to 100% replacement for M20 grade of concrete.
2. It is observed that at 7 days tensile strength of M20 grade concrete are increased by 14.80%, 20.1%, & 11.02%, and tensile strength of M20 grade of concrete was increased by 23.8%, 9.72%, & 3.96%, respectively for different combination of mix proportions over controlled concrete.
3. From the above observations it is concluded that the spilt tensile strength is increased normally 7 days and increasedrapidly for 28 days when compared with controlled concrete.
4. There is decrease in workability as the replacement level increased and hence water consumption will be more for higher replacements.
5. From the present study it is observed that, being fly ash is maintained 10% constant the optimum value, the total replacement of ternary blended cement was 0%, for M20 grade.
6. And it is observed that, being the fly ash is maintained 20% the total replacement of ternary blended cement was 0%, for M20 grade.
7. It is observed that, being the fly ash is 40% constant the optimum value of cement 60%. ie, the total replacement of ternary blended cement was 100%, for the M20 grade.
8. The addition of fly ash increased initial 7 days & 28 days split tensile strength as evident from the table.

SCOPE OF FURTHER STUDY

The experimental work on pozzolanic accoutrements along with OPC is still limited. But it has a greatScope for further studies. The following aspects are considered for future study and examinations.

1. Further studies can be conducted using super plasticizers.
2. Situations of replacement combinations of fly ash, GGBS (Ground granulated blast furnace slag) and cement.
3. Increase in the strength for the same M20 grade by adding the fibre reinforcement for the same replacement situations of fly ash and cement.
4. The examinations on mechanical properties of the high-performance concrete can be carried out by using fly ash and cement on admixture accoutrements.
5. For this work water cement ratio calculated were 0.40 for M20. The optimal water cement can be worked out.

It's requires a proper mixing proportion for the development of high strength, high performance concrete which may not be possible manually. so, it needs some global optimization techniques to develop the desired results with greater accuracy and time saving.

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