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Study on Creep and Shrinkage of High Strength Concrete with Fly Ash

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Abstract - *This paper examines the effects of creep and shrinkage on high strength concrete containing different percentage of fly ash. In the experimental part of the work creep frame was designed and assembled for application of load on the specimen. Concrete mixes having different percentage of fly ash like 15%, 30%, 45% respectively. Concrete with high strength usually contains fly ash as an admixture. Shrinkage is time dependant deformation of unloaded concrete. There are various instrument used to calculate the stain deformation, in this paper demountable mechanical strain gauge was used to measure the strain deformation.*

Key Words: creep of concrete, shrinkage, fly ash, high strength concrete

1. INTRODUCTION

High strength concrete has revolutionised the construction industry in the 1980's. High strength concrete offers significantly better structural engineering properties, such as higher compressive and tensile strengths, higher stiffness, and better durability.[5] Thermal power plants burn coal to produce fly ash, which is a by-product. Concrete is strengthened and made more workable by using fly ash. There are two kind of deformation take place in concrete, one is creep of concrete which is time dependant deformation on hardened concrete under continues load. And secondly even in unloaded condition, concrete may deform with time event if it is not loaded. The main objective of this project was to study the effect on creep and shrinkage of high strength concrete with different percentage of fly ash.

1.1 Creep of Concrete:

Creep refers to the deformity that occurs under sustained load. Concrete changes its shape under long term pressure or stress on it, that change usually occurs in the direction of load is being applied. In concrete elastic deformation occurs immediately when concrete is loaded and non elastic load under sustained load. The creep of concrete is affected by a number of factors: aggregate, cement, water-cement ratio, chemical admixture, mineral admixture, stress-strength ratio at loading, age at loading, size effect, curing condition, relative humidity.

1.2 Shrinkage of Concrete:

The shrinkage of hardening concrete with time is a decrease in its volume. There are two types of shrinkage, drying shrinkage results from the loss of moisture in the concrete and carbonation shrinkage is caused by the shrinkage in volume of hardened concrete. Factors affecting shrinkage of concrete: curing condition aggregate, cement, water to cementations, size effect, relative humidity.

2. EXPERIMENTAL WORK

2.1 Material Selection:

The ordinary Portland cement 43 grade, fineness of cement was 1.31 percentages. Natural sand of fineness modulus was 2.88(zone II), and specific gravity was 2.75. Density of fine aggregate was loose and dense. Different two sizes of coarse aggregates were used 20mm which is specific gravity was 2.83 and 10mm aggregate specific gravity was 2.50. Flakiness index, elongation index was 4.65 and 0.55 respectively. Class F fly ash used.

Table -1: Fly ash properties

Specific gravity	2.96
size and shape	10 to 100 micron
color	Grey

The admixture Algi-superplast N was premixed with total amount of water before application of fly ash.

Table -2: Mortar mix design

Content of Fly ash %	Mix, kg/m^3					
	cem	Fly ash	Fine Agg.	Coarse Agg.	water	Adm (ml)
0	10	-	14.1	27.0	5.5	30
15	7.5	2.5	14.1	27.0	5.5	23
30	5.5	4.5	14.1	27.0	5.5	16
45	3.25	6.75	14.1	27.0	5.5	10

2.2 The Specimen:

The used moulds were cylindrical conforming to the provisions of practice C192/C192M. The size moulds was 150mm X 300mm. Greasing was done mould is filled with concrete in three layers and 25 blows for each layer. Then mould is kept for 48hr to become hard. Concrete mixture were made by replacing cement with 0%, 15%, 30%, 45% of class F fly ash, with load age 7days, 28days and 90days respectively. Four groups are used for creep test, while the

rest of the group for shrinkage tests. Specimen is de-mould after 48hr and kept under water at temperature 27±2°C until the 28 days.

2.3 Creep Frame:

Creep frame was designed and assembled accordance with ASTM C512, 10mm thick five plates were used and holes are provided on each corner of plate. 24mm diameters of four bars were used. Spring is fitted between lower load plate and lower base plate. Spring was used to apply the load in the creep frame, and nuts on the treaded rods could be tightened for applying the correct load. The intensity of the applied load is 330KN at the age of loading. The specimen's length was measured by a demountable mechanical strain gauge. Precision of strain gauge is 0.00005 in.

For the measurement of deformation or change in length three readings are taken for each specimen and average reading was selected as the final reading.

Fig. 1. Creep deformation in the experimental set

Fig. 2. Shrinkage deformation of specimens

3. Result and Analysis:

Table-3: Compressive Strength Results:

Percentage of fly ash	Compressive strength (Mpa)
FA0	52.91
FA15	49.5
FA30	42.75
FA45	40.03

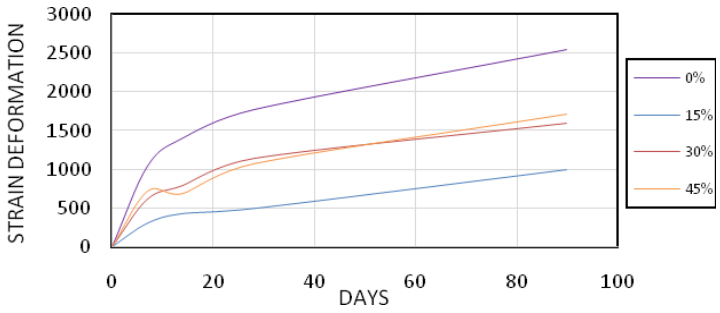

Fig. 3. Creep strain deformation of specimen

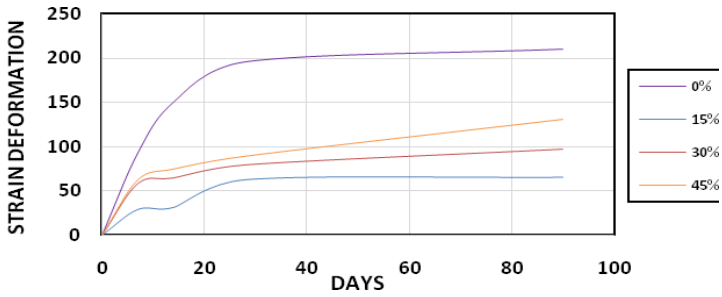

Fig.4. shrinkage strain deformation of specimen

4. CONCLUSION

According to the experimental work, Creep and shrinkage of concrete decreases as increase in fly ash. We got the best results for 15percentage fly ash replacement with cementations material creep of concrete decreases up to 72percentage and shrinkage of concrete decreases up to the 69percentage.

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