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STUDY ON BEHAVIOUR OF GEOPOLYMER CONCRETE BY USING DIGITAL IMAGE CORRELATION

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ABSTRACT:- In the present insights of India, the assets for development work, for example, manufacturing of cement has expanded carbon dioxide emissions into the environment. In the preset project, we have utilized two by products that are GGBS and fly slag to fabricate geo polymer concrete. In this project, we are utilizing sodium hydroxide pellets and Sodium silicate answer for the expansion in the quality of geo polymer concrete. There are three different propositions made in geo polymer concrete in this task. The geo polymer concrete has low Carbon Foot print and gives another option to typical ordinary cement. In light of execution criteria i.e., strength and workability, optimum mix discovered. In view of the outcome result, we have casted beam of 2 propositions. The beam result are caught in DSLR camera for image correlation. Beams result obtained by using software "MATLAB". By this we can know strength, stretch strain curve and so on. This examination will help in outlining the structures that can fulfill all the strength conditions.

Keywords: **GPC, GGBS, Fly ash, alkaline liquids, flexural strength, MATLAB and DIGITAL IMAGE CORRELATION**

1. INTRODUCTION

Geopolymer concrete is a new material that does not need the presence of Portland cement as binder instead, activated the source material such as fly ash that are rich in silicon(Si) and aluminum (Al) using high alkaline liquids produces binder for manufacturing concrete. The major problem that the world is facing today is the environmental pollution In the construction industry mainly the production of ordinary Portland cement (OPC) will cause the emission of pollutants which result in environmental pollution. The emission of carbon-di-oxide during the production of Portland cement is tremendous because the production of one ton of Portland cement emits approximately one ton of CO2 into atmosphere The term of global warming the geopolymer concrete significantly reduces the CO2 emission into the atmosphere caused by the cement industries.

2. LITERATURE REVIEW

Anurag et al investigated results of an experimental study on the strength and absorption characteristics of Geopolymer concrete. In this experiment Total nine mixes were prepared with NaoH concentration as 8M, 12M, 16M and curing time as 24hrs, 48hrs, and 72hrs. Compressive strength, water absorption and tensile strengths tests were conducted on each of the nine mixes.

Parthiban et al investigate the Chemical Admixture does not show any impact on Compressive Strength but shows considerable increase in the workability of the concrete. The Specimens have been cured in ambient temperature condition to check the suitability of Geopolymer concrete for cast-in-situ conditions. 7 day strength was found to be 70% of its 28 days strength, the 28 days strength is higher compared to OPC.

3. COMPOSTION OF GEOPOLYMER CONCRETE

Fallowing materials used for producing geo polymer concrete:

- Fly ash
- GGBS
- Fine aggregates and Course aggregates
- Alkaline solution

The experimental investigation carried on production of Geo polymer concrete mixes with varying percentage of binders composition (Fly ash + GGBS) of 12 morality and also explains the detail procedure of casting and testing of specimen of geo polymer concrete.

4. GEOPOLYMER MIX DESIGN

Mix design geo polymer concrete the aggregates occupy 77% of total volume. Fly ash contains silicon and aluminum it gets actuated when combined with alkaline activators (sodium hydroxide and sodium silicate).

Table1: Mix Propositions value

Constituents	Density (Kg/m³)
Fine aggregates	692.91
Course aggregates	1033.96
Fly ash	410
Sodium silicate	137
Sodium hydroxide	55.15
Super plasticizer	6.12

5. DESIGN OF GEOPOLYMER CONCRETE

Experiment investigation trails carried to check workability and strength parameters of such mixes were not satisfactory such a thing is possible because GPC involves more constituents in its binder (GGBS, Fly ash, Sodium silicate, Sodium hydroxide and water), whose interactions and final structure and chemical composition are strongly dependent on the source of the material and their production process and blunder method was to acquire satisfactory cohesive good workability mix Geopolymer concrete preparation adding by cementitious material.

Table2: Proposition of Geopolymer Concrete

MIX ID	BINDER (%)	
	FLY ASH	GGBS
Fly ash 50 - GGBS 50	50	50
Fly ash 40 - GGBS 60	40	60

6. MIXED PROPOSTIONS

TOTAL AMOUNT OF FINE AND COURSE AGGREGATE = 77% of total volume

RATIO (FLY+GGBS) = 0.45

RATIO (NaOH–Na2Sio3) = 0.2

FOR 1 CUBIC METER

FLY ASH + GGBS = 375kg/m³

SODIUM HYDROXIDE = 85.14kg/m³

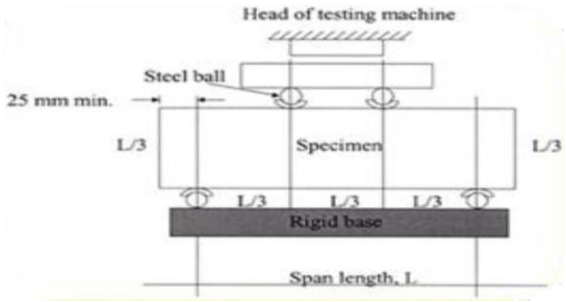
SODIUM SILICATE = 212.85kg/m³

FINE AGGREGATE = 692.91kg/m³

COARSE AGGREGATE =1033kg/m³

Two geopolymer beams is casted of 2 different binder percentages...i.e. Fly ash 50%-GGBS 50% and Fly ash 40% - GGBS 60% .The casted beam is kept for curing for 28 days and casted beam is tested in load testing machine with proper experimental setup. It consist of fallowing

- Loading frame
- Hydraulic jack
- Load applying system
-



7. DETAIL OF RC BEAM

Length of beam : 1.5m

Width of beam : 0.2m

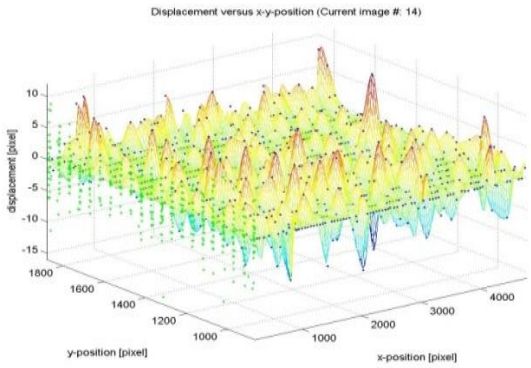
Depth of beam : 0.3m

The deflection of cracks of beams is captured by digital camera and capture image result are run to obtain the result by using software MATT lab to get **IMAGE COORULATION RESULT.**

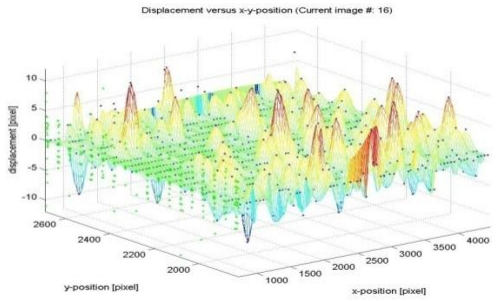
DIGITAL IMAGE CORRULATION RESULT PHOTOS

7.1 HORIZONTAL DISPLACEMENT

- GEOPOLYMER CONCRETE FLY ASH 50% AND GGBS 50%



- GEOPOLYMER COCNCRETE (FLY ASH 40%- GGBS 60%)

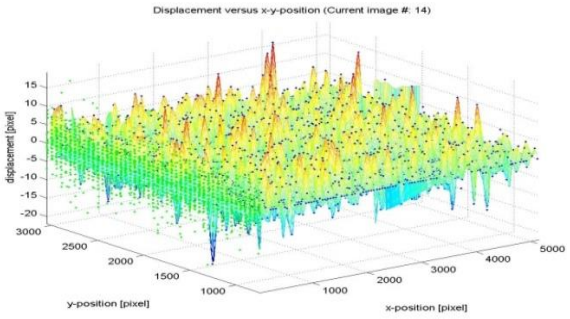


Result:-

For binder proposition 40 -60 the average peak displacement value 3.6mm and binder proposition 50 -50 the average peak displacement value 3.3mm.

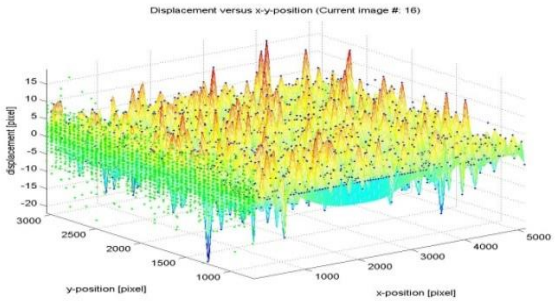
7.2 VERTICAL DISPALCEMENT

- FOR GEOPOLYMER CONCRETE (FLY ASH 50% - GGBS 50%)



Result: The average peak vertical displacement value 4.5mm.

- FOR GEO POLYMER CONCRETE (FLY ASH 40% - GGBS 60%)



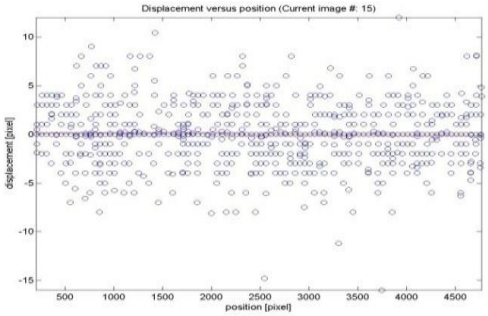
Result:-

The average peak vertical displacement value 4.8 mm.

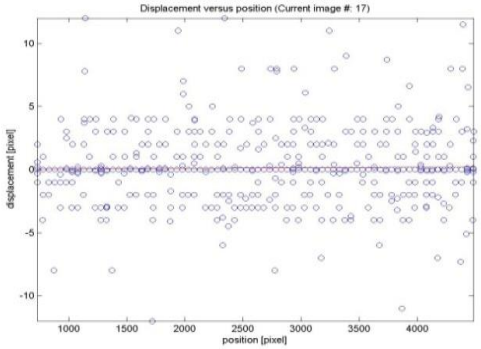
The average peak vertical displacement value 4.8 mm.

7.3 VERTICAL STRAIN SLOTS

- FOR GEOPOLYMER CONCRETE (FLY ASH 50% - GGBS 50%)



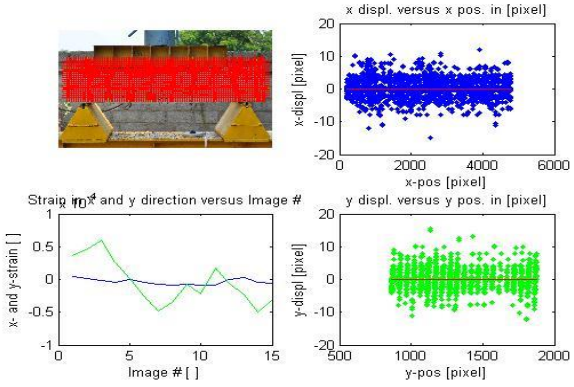
- FOR GEO POLYMER CONCRETE (FLY ASH 40% - GGBS 60%)



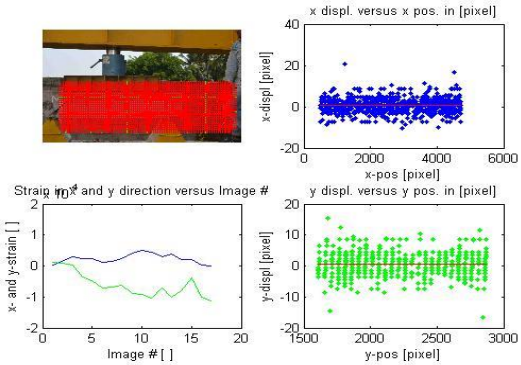
On comparisons with the above strain plots it can be inferred that Horizontal strains are greater than vertical strains due to bending.

7.4 RTT CORE RESULT

- FOR GEOPOLYMER CONCRETE (FLY ASH 50% - GGBS 50%)



- FOR GEO POLYMER CONCRETE (FLY ASH 40% - GGBS 60%)

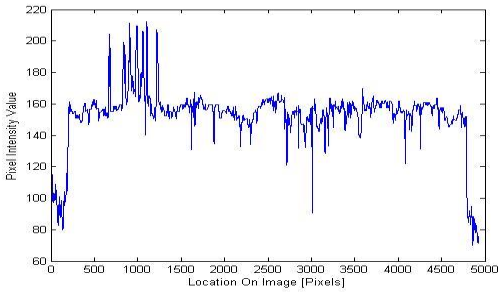


Result:-

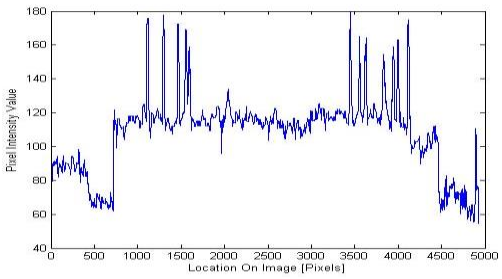
- Horizontal Displacement=5.43mm and vertical displacement =1.92 and 50-50 proposition.
- Horizontal Displacement=5.6mm and vertical displacement =2.9 for Geo polymer concrete 40-60 proposition

7.5 PEAK DISPLACEMENT

- FOR GEOPOLYMER CONCRETE (FLY ASH 50% - GGBS 50%)



- FOR GEO POLYMER CONCRETE (FLY ASH 40% - GGBS 60%)



Result:-

Peak displacement for Geopolymer (50-50) propositions= 5.9mm

Peak displacement for Geo polymer (50-50) propositions= 5.1mm

8. CONCLUSIONS

- ✓ By MAT lab-DIC in this project crack expansion can be analyzed
- ✓ Also stress strain displacement
- ✓ MAT lab can be used to determine max load and cracks formation length.
- ✓ Crack initiation and crack expansion cab be analyzed by 3 point test
- ✓ Different binder propositions Geo polymer concrete and normal concrete crack expansion can be studied.
- ✓ Structure life can be analyzed by help software MATT lab.

9. REFERENCES

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