DIGITAL IMAGE CORRELATION ON RCC BEAM WITH PARTIAL REPLACEMENT OF GGBS.

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ABSTRACT

The cracks are common problem in all structural building ,the identification of micro cracks which are present in structure can be easily identified by the mat lab software. The beam is been tested in three point loading machine for the flexural strength of the beam and the displacement and stress also been identified using the digital image correlation technique. The image are been captured during the testing are used in the digital image correlation for the crack identification, strain, deformation.The micro crack which are present in inside the structure can also be identified using this software. The high resolution camera as been used in this technique for the high resolution pixel. This pixel will run on the mat lab programme for the deformation, displacement, strain .which occur in the beam without any contact process.

Keywords: *Micro Cracks, Flexural Strength, Strain, Deformation.*

1 INTRODUCTION:

Digital image correlation the image will play a vital role. The beam photo can be taken in a regular interval of time for the process of an dic. The programme basically works on the matlab where the programme runs on the image which has been captured during testing. Basically the digital image correlation is used to identify the cracks, stress and strain , displacement, where the vertical displacement and also micro cracks.DIC techniques is used for micro and nano scale mechanical testing application.The cracks will appear on the structure due to low tensile strength of concrete and to increase the tensile strength the reinforcement will be provide on the structure so due to this the minor cracks will appear on the surface of the structure.
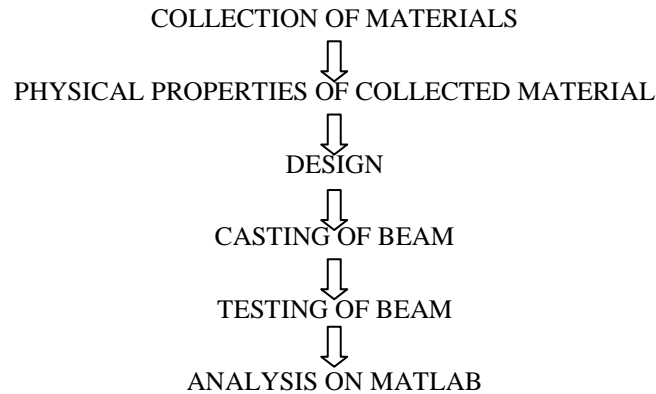
1.1 Relevance To The Field

During the past year any technology as not been present so the damages that are being present in the structure will be checked manually without any help of the instrument ,and it is one of the time consuming technique and in this process we cannot get the proper fracture which are been present in the internal structure and the research are been made for this identification of cracks such as micro and macro cracks which are invisible to the eyes and it should be determined without any external contact process so the new technology as been developed for the betterment of the human being known as digital image correlation and commonly work on the matlabprogramme.The researcher developed the programme to find the solution to this problem so the matlabprogrammeas been developed and due to this now a day the micro cracks can be identified in structure without any external

contact of the surface by taking a image onhigh definition camera so the programme run on the image and correlate the different image so the cracks on the internal structure can also be determined.

2 METHODOLOGY:

The step by step process which have been carried out in project are explained below such as test on material in laboratory ,casting , testing and results are been tabulated as per the experimental testing .

COLLECTION OF MATERIALS

⇩

PHYSICAL PROPERTIES OF COLLECTED MATERIAL

⇩

DESIGN

⇩

CASTING OF BEAM

⇩

TESTING OF BEAM

⇩

ANALYSIS ON MATLAB

2.1 Cement :

Cement is an extremely fine material having binding or sticking property. For construction workit is used with materials like stones, sand, bricks, building blocks. The cements have property of setting in under water by chemical reaction releasing heat of hydration.

Table 1 .physical properties of cement

Normal consistency in %	Specific gravity	Initial setting time in mm	Final setting time in mm
29	3.11	1.53	2.77
-	-	Not less then 30 mm	Not less then 30 mm

2.2 Fine Aggregates:

These materials are very important in the field of constructions which are obtained by crushing of large stones to get smaller fragments. Aggregates are broadly classified into two groups based on their size:

Table 2. Physical properties of FA

Specific gravity	Water absorption(%)	Zone
2.56	3.8	II

2.3 Coarse Aggregate:

The aggregates which are retained on 4.75mm IS sieve are known as CA. In the present, work aggregates of size 20mm were used.

Table 3. Physical properties of CA

Specific gravity	Water absorption(%)	Impact value (%)	Crushing value (%)	Flakiness index (%)	Elongation index (%)
2.62	0.7	18.46	20.73	18.63	19.48

2.4 Ground Granulated Blast Furance Slag:

The GGBS is a by-product in the manufacture of iron and the amounts of iron and slag obtained are of the same order. Iron ore, coke and limestone are fed into the furnace and the resulting molten slag floats above the molten iron at a temperature of about 1500°C to 1600°C. After the molten iron is tapped off,.. The GGBS required in this study obtained from Ispats steel plant Surat. The GGBS which is used passes, 90% through 90 micron sieve. The aim of this work is to ascertain the performance of concrete mix containing GGBS as replacement of OPC and to compare it with the plain concrete mix of M30 grades. The chemical composition of GGBS is obtained is show in table.

2.5 The project is finished in three stages:-

Preparations of the testing member

Testing of a concrete beam by way of three point load test

Analysis of stress displacements making use of DIC

 Preparation of the testing member involves:

Concrete mixdesign

Cube strength of the member

Design and casting of beam.

3 MIX DESIGN

Mix Design of M30 grade concrete by using IS10262-2009

Table 4: Mix Proportion For M30 Grade Concrete.

Particulars	Cement (kg/m^3)	GGBS (kg/m^3)	Water (kg/m^3)	Fine aggregate (kg/m3)	20mm aggregate (kg/m3)	12.5mm aggregate(kg/m3)	w/c ratio	Admixture in %
M30 100%	340	-	152	813	662	441	0.45	0.4
M30 80% + 20%	300	75	152	799	650	434	0.41	0.4
M30 65%+ 35%	265	145	152	784	638	425	0.37	0.45
M30 50%+50%	220	220	152	720	627	418	0.35	0.45

4 CASTING AND TESTING OF SPECIMENS:

Concrete cubes of size 150mm x 150mm x 150mm ; cylinder of size 150mm dia and 300mmlength and prism of size 100mm x 100mm x 500mm is casted and curried in normal water curing tank; 3% concentration hydrochloric acid curing tank and 3 % concentration sodium sulfate curing tank for a period of 3 days , 7days and 28 days; after respective days of curing compressive strength, tensile strength and flexural strength are carried out to the concrete specimens

4.1 Rcc Beam Design Detail:

Beam cross section = 200*300 mm.

Grade of concrete = M30.

Grade of steel = Fe 500.

Clear spacing of beam = l= 1.25m.

Total depth D = 300 mm.

Provide 2 main bars of

10mm dia hanger 2 no 10mm dia.

Let us provide 8mm dia

Leg vertical stirrups at spacing of 190 mm.

5 RESULTS AND DISCUSSION

5.1 Cubes Average Compression Test Results Of M30 Grade

Table 5: Average Compression M30 Grade

Compression of M30 grade comparision test result					
Sl no	Age of curing	100%	80%+20%	65%+35%	50%+50%
1	3 days	28.11	27.15	27.61	24.97
2	7 days	35.67	33.52	32.31	34.5
3	28 days	47.43	44.77	44.97	43.33

Bar Chart For Compression Results
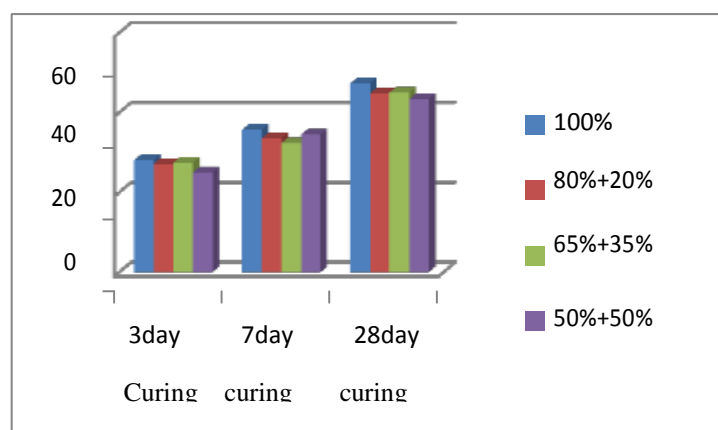
Figure 1 : Curing Strength For The Respective days In Bar Chart

5.2 Beam Results For M30 Grade Concrete

Table 6: flexural strength of m30 grade concrete beam

FlexuralStrengthResultsofM30gradeconcrete					
	Proportion		Load at crack initiation	Load at1stcrackin mpa	
1	100%	A2	11	108	8.99
2	80%+20	A3	12	118	9.81
3	65%+	B3	11	108	8.99
	35%	C1	10	98	8.18

6 DIGITAL IMAGE CORRELATION ON MATLAB RESULTS

6.1 Introduction :

Digital image correlation is a an optical method to find the cracks, using the high definition camera for the capturing a images on different interval on loading .DIC is a versatile, non- contact displacement measuring technique that can be adopted for the wide variety of test scenarios. It can be used to obtain the three dimensional measurement .Digital image correlation is an optical method that employs tracking and image registration technique for accurate 3d measurements of changes in the image. This is often 9.5

.**The General Commands In Matlab:**

1) FILELIST_GENERATOR.

2) GRID _GENERATOR.

3) AUTOMATE _IMAGE.

4) DISPLACEMENT.
    a) VERTICAL DISPLACEMENT.
    b) HORIZONTAL DISPLACEMENT.

5) RTCCORR_IMAGE.

6) MULTIPEAK.

7) MICRO CRACKS.

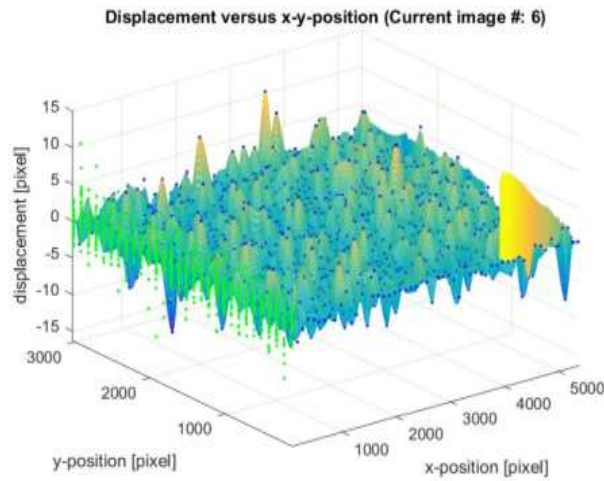**6.2 Mat Lab Result**

6.2.1 Horizantal Displacement

Fig 2: horizontal displacement results

The crack propogation is present in beam .red signifies the higher intensity, and blue signifies the lower intensity.

Average peak displacement :2.78mm.

Crack growth :discontinious at irregular intervals
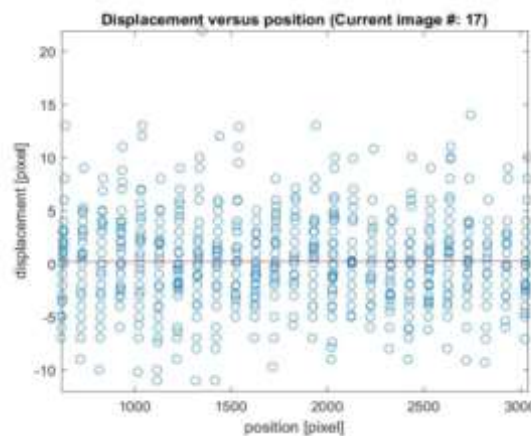
6.2.2 Horizantral Strain Plots

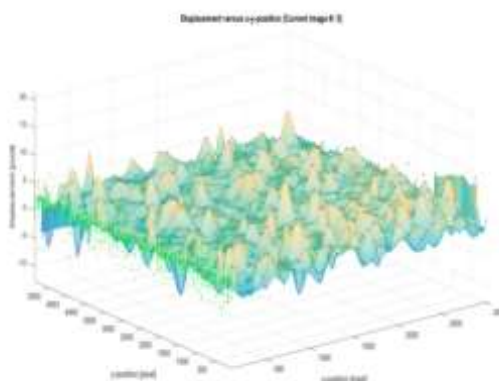**Fig 3: Horizontal Strain Plots**

6.2.3 Vertical Displacement

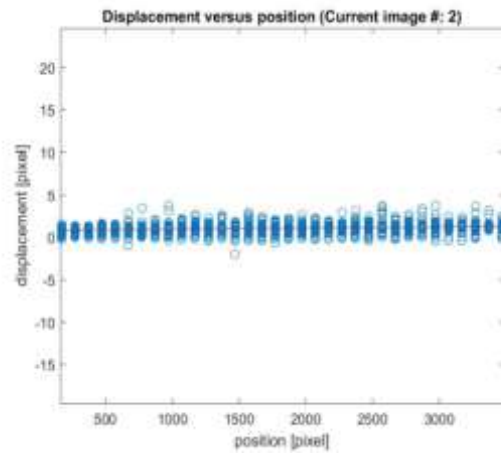**Fig 4: Vertical Displacement Results**

6.2.4 vertical strain plots .

Fig 5 : Vertical Strain Plots
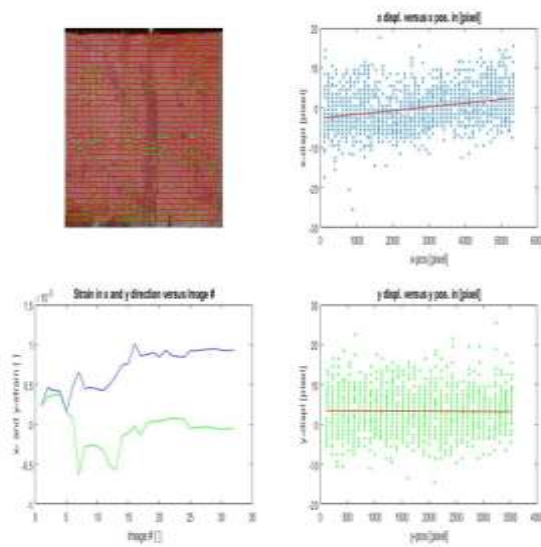
6.2.5 Rt Core Code .

Fig 6: Rt Core Code Results
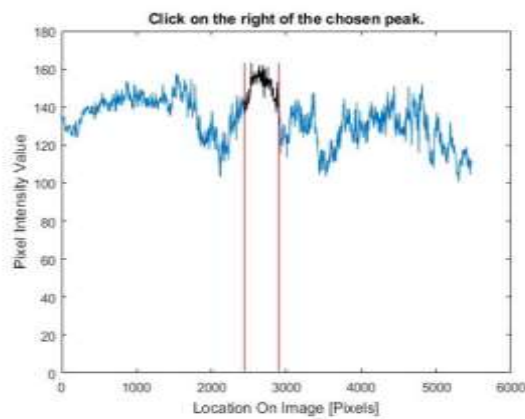
6.2.6 : Multipeak Results .

Fig 7: Multipeak Results

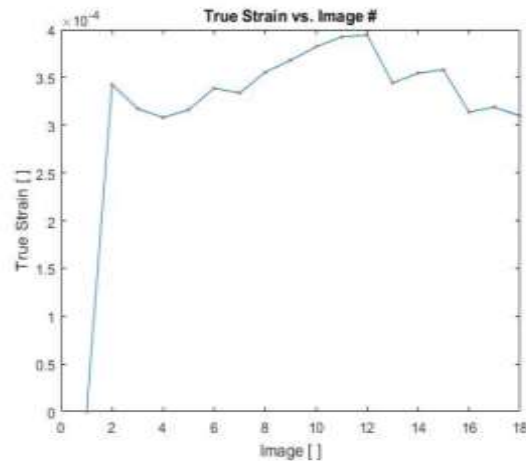**6.2.7 True Strain Results** .

Fig 8: True Strain Results
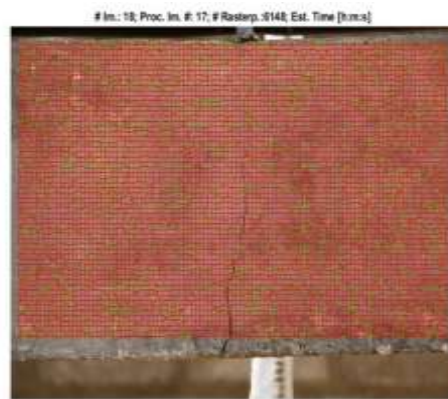
6.2.8 Micro Cracks .

Fig 9: Micro Cracks Results .

7 CONCLUSION.

The fracture are the main problem of all structural building and it is been micro and macro cracks are present in structure so for identification of this cracks in the internal structure cannot be determined 100% so some of the researcher are carried out for this method to find the cracks without any contact process . matlabprogramme as suitable for the crack identification . Matlab programme should be installed and the photos should be arranged in serial order for the programme running and the several commands are been present for the determination of the displacement , stress and strain . the pixel which run the programme it will fix some of the fixed point on the pixel and the displacement in the pixel will form a sub pixel and it decide the displacement in the pixel .the peak of all point will joining and form a curve called true strain .

The concrete as the low tensile strength to increase it strength the reinforcement as been provide so cracks are presented and it been identified using the matlabprogramme in the present scenario.

Scope For Future Work :

1) The renovation of the structure the matlabprogramme play a vital role . the renovation structure the cracks are the major problem ,the micro and macro cracks are present and also the internal cracks also present in structure so by using the dic technique can solve the problem .
2) Now a days the matlabprogramme is been used in the maintance work for the tunnel and bridges .

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