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Experimental and Analytical Behavior of Geopolymer Concrete Interior R.C. Beam Column Joint with Glass Fibres under Cyclic Loading

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Abstract*: *The beam column joint is the most crucial zone in a fortified solid minute opposing edge. Its principle work is to empower the bordering individuals to create and manage their definitive quality. Under seismic stacking, the shot of shear disappointment which is weak in nature is high and isn't adequate. In this way, the plan and specifying ought to be done appropriately to oppose these seismic burdens. Considering the natural impacts delivered by bond, a compelling option named geo-polymer concrete integrated from side-effects of steel and warm power plants, is in effect broadly utilized and furthermore have indicated demonstrated enhanced after effects of increment in quality properties like compressive, split elasticity and flexural quality of basic individuals as indicated by late investigations. This paper presents conduct of geo-polymer solid inside pillar segment joint fortified with glass filaments which when consistently circulated over its whole mass, gets reinforced tremendously, along these lines rendering the framework to carry on as a composite material with properties altogether unique in relation to regular cement is tried tentatively under cyclic stacking and is thought about systematically utilizing ANSYS.

Key words: Geo-polymer, Glass fibre, ANSYS, Load cell, UPV Test etc.

I. INTRODUCTION

1.1 General

Reinforced Concrete (RC) structures intended for IS 456-2000 have been observed to be feeble under seismic conditions.

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Examinations on RC outlines have demonstrated that the real harm or disappointment of shaft segment joints, prompt the aggregate fall of a building despite the fact those other basic individuals comply with the plan necessities. New retrofitting procedures are getting to be noticeably important as the vast majority of urban areas and towns in India are moved up to higher seismic zones than some time recently. This outer imprisonment of cement by high quality fiber fortified polymer (FRP) composites can altogether upgrade the quality and flexibility and in addition result in huge vitality ingestion limit of auxiliary individuals .FRP materials, for example, basalt, glass and half and half fiber, accessible today as sheets, are being utilized to reinforce an assortment of RC components to improve the flexural, shear and hub stack bearing limit of components. Shaft section joints are especially powerless against disappointments amid quakes and thus their retrofit is frequently the way to effective seismic retrofit system.

1.2. Glass fiber reinforced concrete

Glass fiber strengthened cement (GFRC) involves hydration results of concrete, or bond in addition to sand, and the glass filaments. Glass strands are utilized are utilized as support for concrete.Glass filaments were first used to strengthen bond and cement in Russia. In any case they were consumed by the profoundly soluble Portland concrete grid. Consequently, antacid safe glass strands have been in this manner created in UK and different nations. Glass filaments are accessible as ceaseless roving's, cleaved strand mats, crenate, fleece, and ropes and woven texture. Glass strands covered with epoxy sap mixes have additionally been gone for to shield them from soluble base assault by Portland concrete.Concrete is a standout amongst the most generally utilized development material. It is normally connected with Portland bond as the primary part to make concrete. Common Portland bond (OPC) is ordinarily utilized as the essential folio to deliver concrete. Generation of Portland concrete is right now surpassing 2.6 billion tons for every year worldwide and developing at 5 percent every year. Five to eight percent of all human-produced environmental carbon-di-oxide overall originates from the solid business. Among the nursery gasses, carbon-di-oxide contributes around 65% of an unnatural weather change. Despite the fact that the utilization of Portland bond is as yet unavoidable until the not so distant; numerous endeavours are being made with a specific end goal to lessen the utilization of Portland bond in concrete.

Then again, an enormous volume of fly cinder is created far and wide. The majority of the fly cinder isn't viably utilized, and an expansive piece of it is arranged in landfills which influences aquifers and surface groups of crisp water. Fiber fortified bond or cement is a generally new composite material in which strands are presented in the grid as smaller scale support, in order to enhance the ductile, breaking and different properties of cement. Glass Fiber Reinforced Concrete (GFRC) is a kind of fiber strengthened solid which is primarily utilized as part of outside building exterior boards and as engineering precast cement.The term „geo-polymer" was first acquainted by Davidovits in 1978 with portray a group of mineral covers with substance piece like zeolites however with an indistinct microstructure. Wallahet. al, (2006) Explained that, warm cured fly powder based geo-polymer concrete experiences low crawl and next to no drying Shrinkage in the request of around 100 smaller scale strains following one year. Also, it has a superb protection from sulphate assault. Aleemet. al, (2012) specified that, Geo-polymer Concrete can be utilized as a part of the precast ventures, so colossal creation is conceivable in brief term and the breakage amid transportation should likewise be limited. It might be viably utilized for the shaft segment intersection of strengthened solid structures and framework works. Notwithstanding that the GGBS might be viably utilized and subsequently no landfills are required to dump the GGBS. Anuaret. al, (2011) clarified that the higher convergence of sodium hydroxide arrangement inside the geo-polymer solid will deliver higher compressive quality of geo-polymer concrete; in light of the fact that NaOH will make the great holding amongst total and glue of the solid. In this regard, the geo-polymer innovation proposed by Davidovits demonstrates extensive guarantee for application in solid industry as an option cover to the Portland bond.

Figure.1. Usage of Glass fiber in elevation of the structure

II. REVIEW OF LITERATURE

Glass fiber Reinforced solid bar section joints have an essential capacity in the auxiliary idea of many structures. Regularly these joints are powerless against loads because of effect, blast or seismic burdens. These joints are likewise delicate to consumption of steel support. Then again, repression has turned out to be extremely productive in expanding solid quality and malleability of individuals. Wrapping by methods for FRP fortification improves the basic conduct of solid pillar segment joints extensively. This part exhibits the vast majority of the accessible writing on the use of FRP composites in the fortifying of fortified solid bar section joints.

Ze-Jun Geng et al (1998) did an examination on the malleability of solid segment to-pillar association and the ability of associations containing deficient advancement length. CFRP sheets were wrapped around the segment close to the joint locale. Rehashed stacking emptying reloading were done on the examples for mimicking seismic burdens. Nineteen solid segment to-shaft association examples were tried and it was accounted for that noteworthy change in flexibility was seen and a definitive stacking limit expanded in the range from 24% to 35%.

Yan Li et al (2000) detailed that sisal fiber is a promising fortification for use in composites because of its ease, no wellbeing hazard, accessibility in a few nations and sustainability. They introduced an outline of later.

Parvin.A and Granata.P (2000) did an examination on the utilization of fiberfortified polymer composite overlays to outside shaft section joints to build their minute conveying limit. Three bar segment joint models with different fiber composite covers and wraps with different thicknesses made out of epoxy and strands, for example, glass, carbon, and Kevlar were analyzed. One shaft section joint model without FRP fortification was utilized as a control example for correlation. The other two shaft section joint models utilized for the examination included overlays attached to the pliable countenances with and without wraps. The wraps were given to keep the peeling of the covers. The after effects of the limited component examination demonstrated that the decision of the fiber composite materials, the cover, course of action of wraps and thickness influenced the improvement of the basic joint execution altogether. Besides, an expansion at the time limit of up to 37% was watched when the joints were strengthened with FRP overlays contrasted with the control example.

Ahmed Ghobarah and Said.A (2002) detailed that shear disappointment of bar section joints is recognized as the primary reason for crumple of numerous minute opposing casing structures amid late quakes. Powerful and prudent restoration methods to overhaul the shear-protection limit of the joints in existing structures are required. Diverse fiber-wrap recovery plans were connected to the joint board with the goal of redesigning the shear quality of the joint. The tried restoration strategies were observed to be effective in enhancing the shear protection of the joints and in dispensing with or postponing the shear method of disappointment.

El-Amoury.T and Ghobarah.A (2002) introduced the strategies for updating fortified cement beam– segment joints. Glass fiber-fortified polymer sheets were wrapped around the joint to keep the joint shear disappointment. Three beam–section joints were tried in particular, a control example and two restored examples. The control example showed consolidated fragile joint shear and bond disappointment modes while the restored examples displayed bendable disappointment mode.

Oral Buyukozturk et al (2004) displayed the utilization of fiber fortified polymer composite materials for reinforcing and repair of basic individuals. From an auxiliary mechanics perspective, an essential concern with respect to the viability and security of this technique is the capability of fragile deboning disappointments.

Such disappointments unless enough considered in the outline procedure, may altogether diminish the adequacy of the fortifying or repair application.

As of late, there has been a centralization of research endeavours on portrayal and demonstrating of deboning disappointments.

Abhijit Mukherjee and Mangesh Joshi (2005) completed an examination on the execution of strengthened solid shaft section joints under cyclic stacking. Joints were thrown with satisfactory and lacking obligation of fortifications at the bar section joint. FRP sheets and strips have been connected on the joints in various arrangements. The sections were subjected to a pivotal power while the shafts were subjected to a cyclic load with controlled uprooting. The sufficiency of relocation is expanded monotonically utilizing a dynamic actuator. The hysteretic bends of the examples were plotted. The vitality dispersal limit of different FRP arrangements was thought about. What's more, the control examples were reused in the wake of testing as harmed examples that are possibility for recovery. The recovery was completed utilizing FRP and their execution was contrasted and that of the undamaged examples.

Tarek H. Almusallam and Yousef A. Al-Salloum (2007) exhibited a method for logical expectation of joint shear quality of inside bar section joints, fortified with remotely fortified fiber-strengthened polymer sheets. To execute the accessible definition for shear limit expectation, a program was created. Utilizing this program, shear limit of the joint and joint shear push variety at different phases of stacking were anticipated and contrasted and trial perceptions. It was watched that even a low amount of FRP can improve shear limit of the joint fundamentally.

Sandeep S. Pendhari et al (2008) evaluated the uses of fiber fortified polymer composites (FRPC) for outer reinforcing in common developments. They concentrated on exploratory and additionally investigative and numerical research commitments. The primary auxiliary parts, for example, bars, segments and pillar section joints were checked on and basic conduct of every segment was talked about quickly. General closing comments were made alongside conceivable future bearings of research.

Lakshmi.G.A et al (2008) conveyed a nitty gritty examination on fortifying of shaft segment joints under cyclic excitation utilizing FRP composites. Three commonplace methods of disappointment flexural disappointment of bar, shear disappointment of bar and shear disappointment of segment were talked about. Correlation was made in the terms of load conveying limit. Three outside pillar segment joint sub collections were thrown and tried under cyclic stacking. Every one of the three examples was retrofitted utilizing FRP materials and the outcomes were contrasted and controlled examples. Limited component investigation has been completed utilizing ANSYS to numerically recreate each of these cases. They inferred that the shear disappointment was exceptionally weak and consequently retrofitting ought to be done in such a way, to the point that the disappointment happens in the bar in flexure.

III. MATERIAL PROPERTIES & METHODOLOGY

3.1. overview

In this part, the different materials utilized and the preparatory tests that are led on the materials were examined. These tests are led out according to Indian standard codal arrangements.

3.2. cement

Common Portland bond is utilized for general developments. The crude materials required for make of Portland concrete are calcareous materials, for example, limestone or chalk and argillaceous materials, for example, shale or dirt.

The accompanying tests according to Seems to be: 4031-1988 is done to discover the physical properties of the concrete as appeared in Tables The aftereffects of the tests are contrasted with the predetermined estimations of IS: 4031-1988.

3.3. fine aggregate

Coarse sand locally accessible to us was utilized as fine total. The test methods as said in Seems to be 383(1970) were taken after to decide the physical properties of fine total as appeared in Table 1.

3.4. coarse aggregate

20 mm measure totals were utilized. The totals were tried in agreement to IS-383:(1970).

3.5. ground granulated blast furance slag (ggbs)

It is a nonmetallic item comprising basically of silicates and aluminates of calcium and different bases the liquid slag is quickly chilled by extinguishing in water to frame a smooth sand like granulated material GGBS is tried according to May be: 12087: 1987 is done to find out the physical properties of the GGBS. The aftereffects of the tests are contrasted with the predetermined estimations of IS: 4031-1988.

Table 1. Physical properties of GGBS

S. No.	Property	Test results
1	Physical form	Off white powder
2	Specific gravity	2.92
3	Bulk density(kg/m^3)	1200
4	Specific surface(m^2/kg)	450

3.6. water

Consumable water was utilized for throwing of all examples of this examination. According to suggestion of Seems to be: 456 (2000), the water to be utilized for blending and curing of cement ought to be free from injurious materials. In this manner consumable water was utilized as a part of the present investigation in all operations requesting control over water quality.

3.7. glass fiber

Glass fibber is a completely common material, biologically unadulterated and nonunsafe to human wellbeing; it is shaped from one the earth`s most inexhaustible materials, quartz sand mineral more than 25 million years of age, which is softened in a heater at 1580°C with other crude materials. The resultant fluid glass soften is spun into fibbers. Folios are added to make the material stable and water repellent.Glass fiber can be turned, distorted, woven, and treated like some other fiber. Its numerous uncommon attributes render it particularly important, including quality, adaptability, non-instability, water and compound protection. It is more than glass; it is enhancing the personal satisfaction for many individuals.

The quality and toughness of our glass fiber items have been demonstrated in industry, enduring all through the lifetime of high innovations and an extensive variety of various modern items.

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The numerous uncommon and one of kind qualities guarantees their unique esteem:

Glass fibbers are made of silicon oxide with expansion of little measure of different oxides In this examination soluble base protection glass fibbers of 12mm length and 14 microns ostensible breadth having thickness of 2680Kg/m3 were utilized. From the smaller scale to the full scale fiber run, these fibbers control the splitting procedures that can happen amid the life expectancy of cement. The particulars of these fibbers are introduced in beneath table .2.

Figure.2. Glass fiber particles

3.7.1. Applications of glass fibers

The glass fiber strengthened cement often discovers applications in following development works:

- Building redesign works
- Water and waste works
- Bridge and passage lining boards
- Permanent formwork technique for development
- Architectural cladding
- Acoustic boundaries and screens

Table .2 properties of glass fiber s

Property	Observed value
Density	2.55-2.6
Bulk modulus	43-50
Compressive strength	4000-5000 Mpa
Young's modulus	72-85 Gpa
Poisson ratio	0.21-0.23

3.8. alkaline liquid

A blend of Sodium hydroxide arrangement and sodium silicate arrangement was utilized as soluble activators for Geo-polymerisation. Sodium hydroxide is accessible economically in pieces or pellets shape. For the present investigation, sodium hydroxide pellets with 98% virtue were utilized for the arrangement of basic arrangement. Sodium silicate is accessible monetarily in arrangement shape and consequently it can be utilized all things considered. The concoction creation of sodium silicate is Na2O:7.5-8.5%, SiO2:25-28%% and water: 1.35 g/ml. To get ready 16molarity convergence of sodium hydroxide arrangement, 640 grams (Morality x atomic weight) of sodium hydroxide pellets was broken down in refined water and cosmetics to one liter.The sodium hydroxide arrangement hence arranged is blended with sodium silicate arrangement one day before blending the solid to get the coveted antacid arrangement. The solids constituents of the GPCC blend i.e. GGBS and the totals were dry blended in the container blender for around 3 minutes. After dry blending, antacid arrangement was added to the dry blend and wet blending was improved the situation 4 minutes. At last additional water alongside super plasticizer was added to accomplish workable GPC blend.If there should arise an occurrence of glass fibber strengthened GPCC blend, fibbers were added to the wet blend in three unique extents, for example, 0.75%, 1% and 1.25% volume of the solid..

3.9. super plasticizer

Utilization of super plasticizer allows the lessening of water to the degree up to 30 percent without decreasing the workability, rather than the conceivable diminishment up to 15 percent if there should be an occurrence of plasticizers. The utilization of super plasticizer is polished for creation of streaming, self-levelling, self-compacting, and for generation of high quality [10-11] and superior cement. The sulphonated naphthalene-formaldehyde (super plasticizer) is utilized as a part of this investigation.

3.10 preliminary tests on materials

3.10.1. Tests for cement:

The tests that were conducted on the cement are fineness, initial and final setting time normal consistency and specific gravity. The results were tabulated below.

Table.3. Properties of cement

S. No	Property of Cement	Result
1	Fineness of cement	10%
2	Standard consistency	31%
3	Initial setting time	38 minutes
4	Final setting time	220 minutes
5	Specific Gravity	3.14

3.10.2. Tests for fine and coarse aggregate:

The tests for fine and coarse aggregates are tabulated below

Table 4 Properties of fine aggregate

Physical Properties	Observed Values
Grading Zone	II
Fineness Modulus	3.173%
Specific Gravity	2.5

Table 5 Properties of coarse aggregate

Physical Properties	Observed Values
Fineness Modulus	7.11%
Impact Value	22.10%
Crushing Value	25.13%
specific gravity	2.7

3.11. preparation of specimens

For the compressive strength study, the cubes of size 150x15ox150mm are used and a cylinder of 150mm diameter and 300mm long cylinder is used. The concrete mix design was carried out as per IS 10262-2009 for M30 grade of geo polymer concrete with and without glass fiber of 0.75%,1% and 1.25% were used.

3.13. proposed work

3.13.1. ANSYS Modelling of Exterior Beam Column Joints under Static Loading

ANSYS models and examination under static and dynamic stacking with various stacking conditions utilizing steel fibbers, corner to corner steel bars in the joint and at stretched out in segment and bar headings to think about the safe of shear or bond disappointment. Steel fiber = 1% by volume and reaching out in segment and bar bearings. Concentrate on Use of fiber mixed drinks to expand the seismic execution of bar section Joints [12-].

3.13.2. Shaft Column Joint Design points of interest for ANSYS Modelling

Section estimate 230 mm x 300 mm,

- Strength of cement fck-20 N/mm2
- Yield quality of steel fy-415 N/mm2.
- Column longitudinal steel-16 mm distance across 8 nos
- Column sidelong tie-8 mm breadth @ 150 mm c/c

Bar measure 300 mm (D) x 230 mm (B),

- Beam principle fortification steel-12 mm breadth 4 nos.
- Beam stirrups-8 mm @ 100 mm c/c.
- Maximum stack on segment – P max. - 336 kN.
- Beam point stack W max-17 kN.
- Column stature 1500 mm,
- Beam length-1600 mm.

CC pillar section joints were intended for examination in view of IS 1893- 2002 Criteria for Earthquake Resistant outline of structures and specifying in light of IS 13920-1993 Edition 1.2 (2002-03) on Indian Standard Code of Practice Ductile Detailing of Reinforced and alluding to pertinent books.

IV. ANALYSIS RESULTS

4.1 general

In this chapter the comparison of results with conventional concrete and Geo-polymer concrete having glass fiber s under static cyclic loading was done. The test procedure and results were tabulated in the tables.

4.2. compressive strength test [16]

4.2.1. Test procedure for compressive strength:

After curing of specimens, the specimens are taken out and out for dry for some time. Apply a compressive axial load to a cube specimen at a prescribed rate until it will fail. Calculate the compressive strength by using formula.

Compressive strength = Maximum load/cross sectional area of specimen.

4.3. split tensile strength

4.3.1. Test procedure for Split tensile strength:

After curing of specimens, the specimens are taken out and cured for air for some time and tested. The cylinder is placed in an area and load is applied gradually until it gets split

4.4. results of compressive and tensile strength

The comparative results of compressive strength and tensile strength of a geo-polymer concrete without fiber s and glass fiber Geo-polymer concrete (GFGPC) various percentages of a period of 28 days are tested and tabulated in the given table below.

Table 6 Compressive and split tensile strength results for Geo-polymer concrete with and without glass fibers

Mix Id	Glass Fiber Proportion	Cube Compression Test N/mm^2	Split Tensile Test N/mm^2
GPCC	0%	36.2	4.12
GFGPC1	0.75%	38.33	4.35
GFGPC2	1%	40.25	4.73
GFGPC3	1.25%	42.5	4.89

4.5 reinforcement details

Three main bars of 10 mm diameter are provided in beam and tied with stirrups of 6 mm diameter at 30 mm c/c for a distance of 2D i.e., 300 mm and at 60 mm c/c for remaining length of the beam. 8 bars of 8 mm diameter are provided in the column and tied with stirrups of 6 mm diameter bars at 30 mm c/c for a distance of 150 mm from face of column and at 60 mm for remaining length of beam as shown in Figure.3.

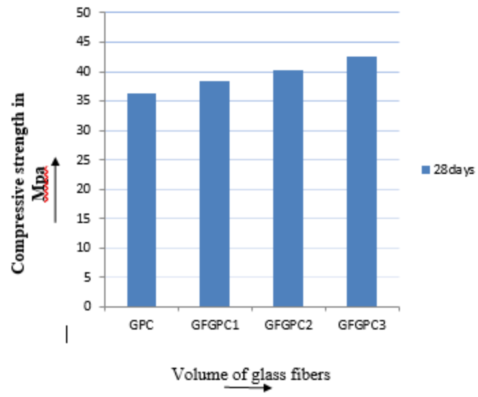


Fig.3 compressive strength of specimens

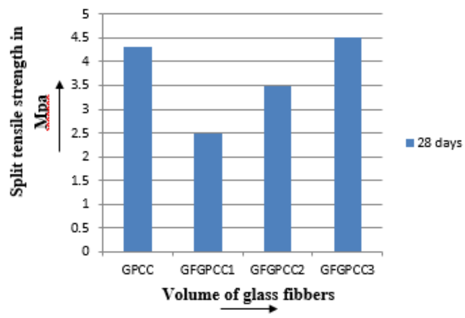


Fig. 4.split tensile strength of specimens

4.5 reinforcement details

Three main bars of 10 mm diameter are provided in beam and tied with stirrups of 6 mm diameter at 30 mm c/c for a distance of 2D i.e., 300 mm and at 60 mm c/c for remaining length of the beam. 8 bars of 8 mm diameter are provided in the column and tied with stirrups of 6 mm diameter bars at 30 mm c/c for a distance of 150 mm from face of column and at 60 mm for remaining length of beam as shown in Figure.5.

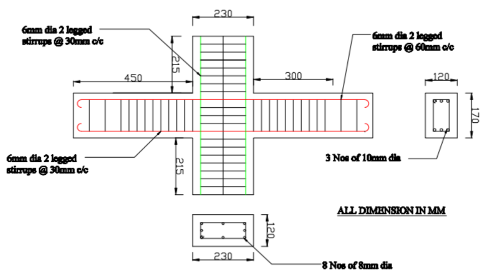


Figure 5. Reinforcement detailing of beam column joint

4.6 casting of beam column joint

The form is organized legitimately and put over a smooth surface. The sides and base of the form were oiled well to encourage simple expulsion of the example. The support confines were set in the melds with an unmistakable front of 25 mm from end of pen. Solid blend intended for M30 and water bond proportion is 0.45.Bond mortar square pieces w cement, for example, bond; sand, total and water were weighed precisely and blended consistently. The solid was set into the form instantly in the wake of blending and very much compacted. The test examples finish of 24 hours of throwing and are cured in water for 28 days. Following 28 days of curing the example was dried in air and whitewashed. The fortification of shaft segment joint is appeared in Figure 6.

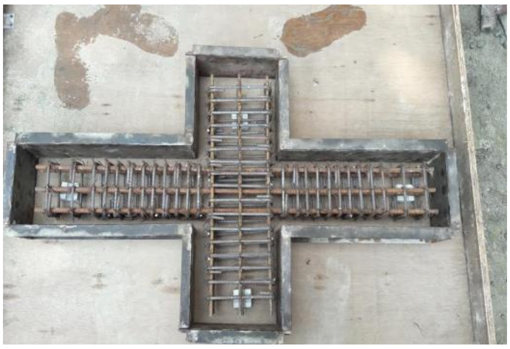


Figure:6 Reinforcement of Beam Column Joint

The casting stage of beam column joint is shown in Figure 7.

Figure 7 casting of beam column joint

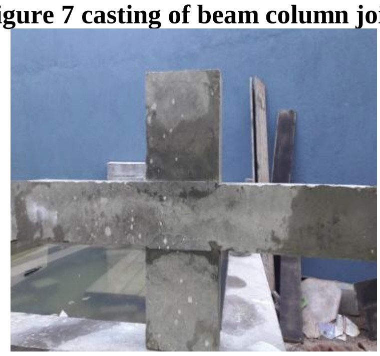


Figure 8 cured beam column joint

4.7 test setup

The pillar segment joint examples are tried under cyclic stacking. The heap was connected in forward and turn around bearing through a water powered jack. The heaps are connected at approach additions of 5kN forward way till the disappointments of example are connected forward way and redirections are measured. So also the heaps are connected backward heading and diversions are measured. Test setup for Beam section join is appeared in Figures .9

Figure:9. Test setup of Beam-Column joint

4.8 results (experimental program)

4.8.1 ultimate load

From Table 6, the cracking load and ultimate load for geo-polymer concrete with and without glass fiber reinforced beam column joint is observed and the bar chart shows the increase in the strength for GFRC beam column joint

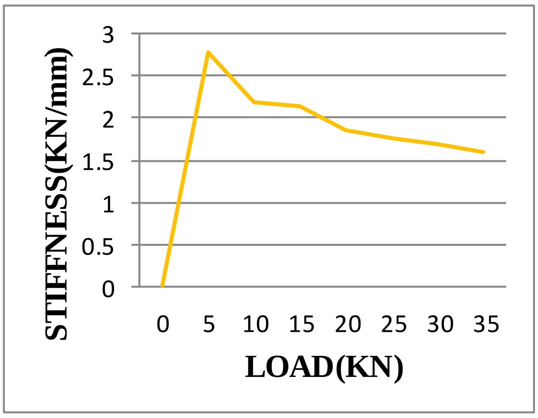
The results are shown in Table 7.

Table.7. cracking and ultimate load of glass fiber

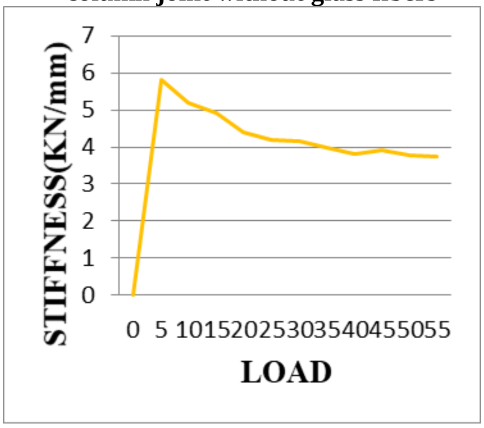
S. No	Type of Beam column joint	Cracking load in kN.	Ultimate load in kN.
1.	Geo-polymer beam column joint without glass fibbers	14	47
2.	Glass fiber reinforced geo-polymer beam column joint with 0.75% fibbers	15	58
3.	Glass fiber reinforced geo-polymer beam column joint with 1% fibbers	17	59.5
4.	Glass fiber reinforced geo-polymer beam column joint with 1.25% fibbers	19	61

reinforced geo-polymer beam column joint

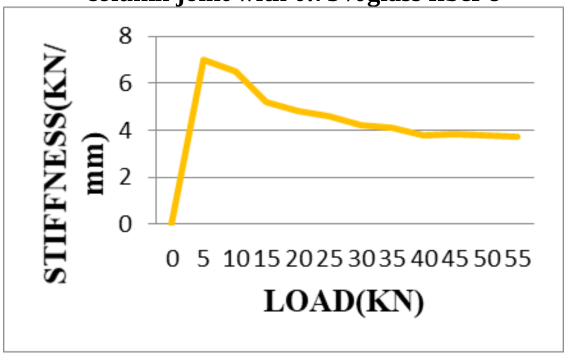
The stiffness of both the beam column joints with and without GLASS fibers is shown in the graph 1and .2. In the conventional beam column joint about 73% of the stiffness is observed, where as in GLASS reinforced interior beam column joint about 84% is observed.



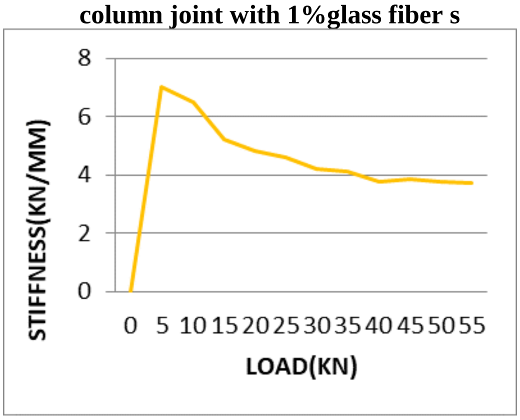
Graph.1 Load Vs stiffness curve of geo-polymer beam column joint without glass fibers



Graph.2 Load Vs stiffness curve of geo-polymer beam column joint with 0.75%glass fiber s

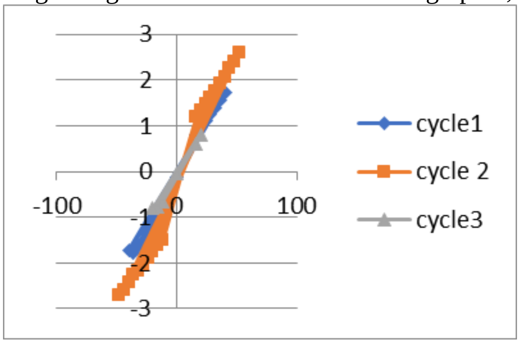


Graph.3 Load Vs stiffness curve of geo-polymer beam column joint with 1%glass fiber s

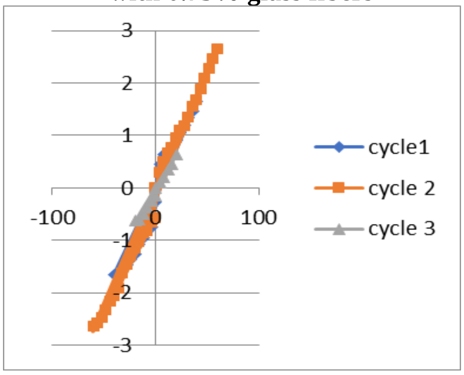


Graph.4 Load Vs stiffness curve of geo-polymer beam column joint with 1.25%glass fibers

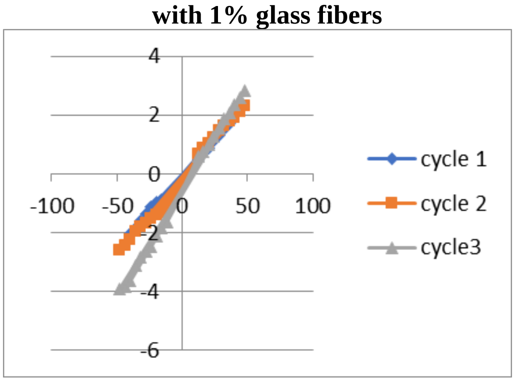
Cyclic Loads were applied in different cycles and the deflections of beam column joint were noted and the graphs representing the load vs. deflection curves were plotted for geo-polymer concrete beam column joint with different percentages of glass fiber s and are shown in graph 3, 4&5.



Graph.5 Load Vs deflection curve of beam column joint with 0.75% glass fibers



Graph.6 load Vs deflection curve of beam column joint with 1% glass fibers



Graph 7 Load Vs deflection curve of beam column joint with 1.25% of glass fibers

4.8.2 Crack pattern

All the column segment joints display a sensibly malleable execution and the disappointment come about because of the yielding of superior cement took after by the devastating of cement. At around 10kN of load, the underlying break showed up in the example as appeared in Graph 6 and 7. With additionally increment in the heap, routinely dispersed vertical breaks were watched.

Figure .10. Bottom corner crack in beam column joint

Figure 11 Failure pattern of Beam column joint

4.9 ANALYTICAL PROGRAM

4.9.1 Analysis of beam column joint

The conduct of RCC shaft segment joint and SFRC pillar segment examples under cyclic stacking are talked about underneath unpredictably. In the wake of specifying stacking and limit states of example, the subtle elements of step end time, initial sub step, least sub step, most extreme sub step and solver controls are determined and the required parameters like directional distortion, greatest central anxiety, least important anxiety, and so forth are inserted. At that point, at long last examination is done for the given parameters.

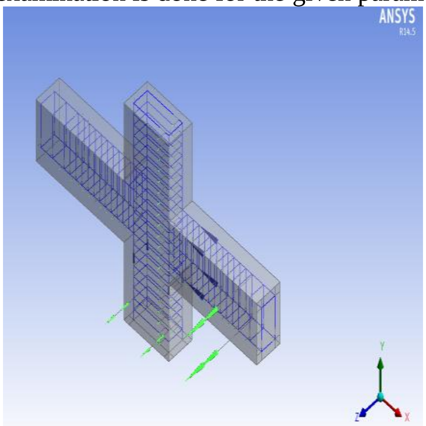


Figure .12 modeling of beam column joint

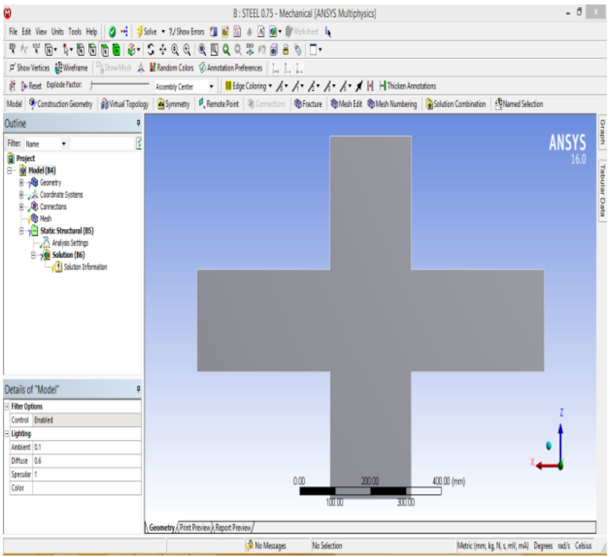


Figure 13 Applying material properties to beam column joint

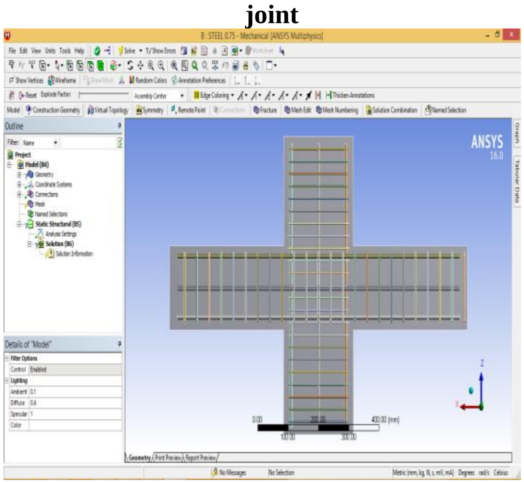


Figure 14 applying reinforcement to beam column joint

When a suitable load is applied to the beam column joint, the stresses will vary from point to point. The stresses are observed at the corners of the beam column joint and it is shown in Figure 15.

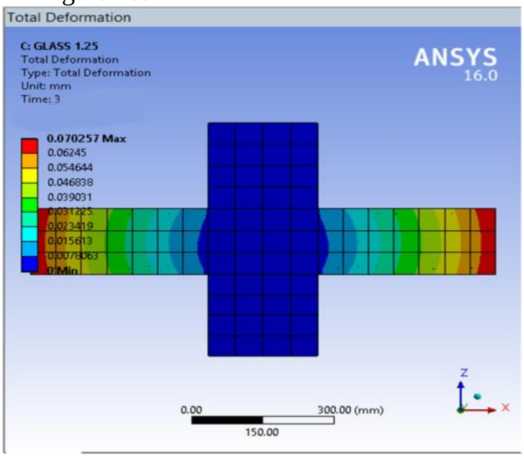


Figure 15 Total Deformation of beam column joint

When an arbitrary load of 25 kN. Is observed and the deformation of 0.0011131mm of deformation is observed and the deformational behavior of beam column joint is given below in figure 16.

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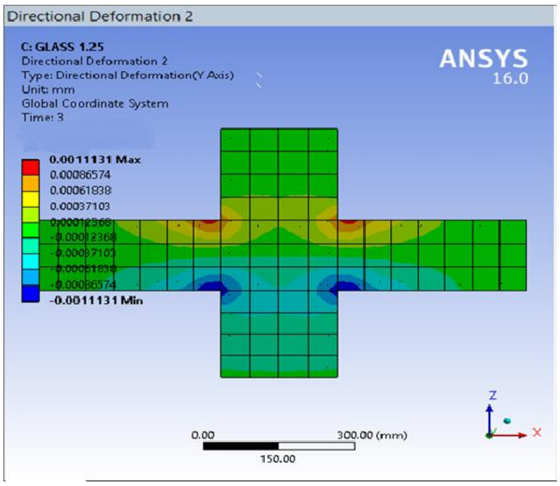

Figure 16 Directional deformations (y axis)

During the cyclic loading process, the stresses are increased with the incremental load application and the maximum stress are observed at the 25KN load condition, the maximum 4.0922 Mpa is shown and the maximum principal stresses are shown in the Figure .17.

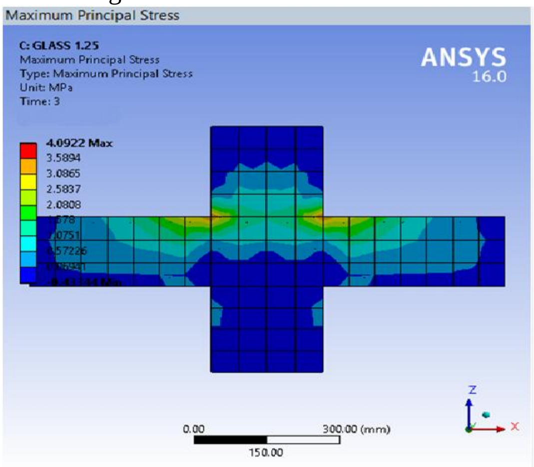

Figure.17 Maximum principal stress

When the initial load is applied to the beam column joint, being the intial applied load condition, the stresses are very low at the beam column and the stresses observed for beam column is 0.39025 MPa and the minimum stresses are shown in the Figure 18.

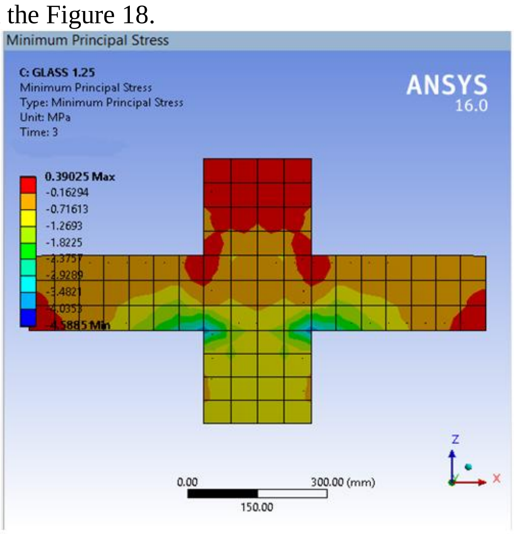

Figure.18 Minimum Principal Stress

During the incremental application of load, the maximum stresses are observed at the beam column joint and it leads to the failure pattern of the beam column joint and it is shown in Figure 19.

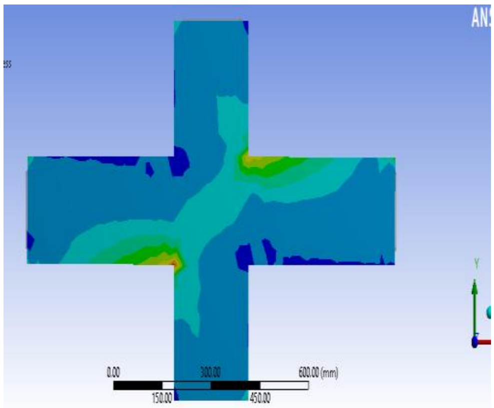

Figure 19 Failure pattern of beam column joint

The different total and directional deformations and maximum and minimal stress graphs are shown in above figures.

4.10 COMPARISON OF EXPERMENT STUDY AND FEM ANALYSIS

Experimental results are compared with FEM model analysis in ANSYS, the behavior of the interior beam column joint are similar. Maximum stresses are occurred at the beam column junction. The crack patterns are formed and clearly visible in the above model.

V. DISCUSSIONS & SUMMARY, CONCLUSIONS

5.1. DISCUSSIONS

From the above results and comparison following point are observed:

1. Compressive quality, flexural quality and split rigidity was observed to be more for expansion of 1.25% glass fibbers by volume of cement.
2. Compressive quality, flexural quality and split rigidity observed to be expanded with the regard of increment in rate volume part of glass fibbers from 0.75%, 1.0% and 1.25%
3. Only 85% substitution of OPC in the blend of GPC demonstrated better estimations of compressive quality, flexural quality and split rigidity when contrasted with the 100% substitution of OPC.
4. The misshapening at various glass fiber rates had little varieties and max. Key anxieties varieties were practically consistent.

5.2. SUMMARY

1) Geo-polymer concrete is an amazing contrasting option to Portland bond concrete.

2) Density of Geo-polymer concrete is like that of standard Portland bond concrete.

3) GGBS based Geo-polymer concrete includes astounding compressive quality inside brief period (3 days) and appropriate for basic applications. Consideration of glass strands in Geo-polymer solid shows significant increment in compressive and flexural quality of GPCC as for GPC without filaments.

4) Compressive quality and Flexural quality of glass fiber fortified geo-polymer solid increments as for increment in rate volume part of glass strands from 0.75%, 1.0%, 1.25%.

5) Addition of 1.25% volume portion of glass filaments demonstrates most extreme increment in Compressive quality and Flexural quality by 18.9%, and 54% separately regarding GPC blend without strands.

VI. CONCLUSIONS

In the experimental study of beam-column joint a trial was made to improve this joint area providing some fibres material. Three scale model of beam-column joint was considered. The first specimen who was made of RC was treated as control specimen. Second specimen was cast by adding 1% of polypropylene fiber and similarly third specimen was cast by adding 1% of steel fiber. All specimens tested under cyclic loading to make a comparative study. The result were comparison in various plot like envelope curve, stiffness, energy dissipate and ductility. Based on the interpretation of result the following major conclusion are drawn.-column joints, the following conclusions were drawn.

- The addition of fibres plays an important role for arresting, delaying and propagating of cracks.
- There was remarkable increase in load carrying capacity due to addition of fiber (ranging from 8.95% to 17.37%)
- The initial stiffness for fibres specimen increased tremendously (ranging from 27.9% to 43.2%).
- The energy dissipation increased considerably for fibres specimens (ranging 12.62% to 35.83%).
- The ductility increased tremendous for fibres specimens (ranging 99.4% to 105%).

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