MECHANICAL BEHAVIOUR OF RECTANGULAR BEAMS

A Thesis

Submitted in partial fulfillment of the requirements for the award of the degree

Of

MASTER OF TECHNOLOGY

in

CIVIL ENGINEERING

with specialization in

STRUCTURAL ENGINEERING

Under the guidance of

Dr. Gyani Jail Singh
(Assistant Professor)

By

Sandeep Thakur
(162662)

To

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY
WAKNAGHAT, SOLAN – 173234
HIMACHAL PRADESH, INDIA

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CERTIFICATE

This is to certify that the work which is being presented in the thesis titled **“Mechanical Behavior of Rectangular Beams”** in partial fulfillment of the requirements for the award of the degree of Master of Technology in Civil Engineering with specialization in “**Structural Engineering**” and submitted to the Department of Civil Engineering, Jaypee University of Information Technology, Waknaghat is an authentic record of work carried out by Sandeep Thakur (Enrolment No. 162662) during a period from July 2017 to May 2018 under the supervision of **Dr. Gyani Jail Singh (**Assistant Professor), Department of Civil Engineering, Jaypee University of Information Technology, Waknaghat.

The above statement made is correct to the best of our knowledge.

Date: **/05/2018**

Dr. Ashok Kumar Gupta (Prof.& Head of Department) Department of Civil Engineering JUIT Waknaghat	Supervisor Dr. Gyani Jail Singh (Assistant Professor) Department of Civil Engineering JUIT Waknaghat	External Examiner

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ABSTRACT

It is a fact that the strength and ductility of the concrete is highly dependent on the confinement level provided by the lateral reinforcement. In this work extra confinement is provided by using GI welded wire mesh which was wrapped inside and outside the periphery of reinforcement cage. A total of 22 beams were casted in which 12 beams are confined by double layer welded wire mesh and 4 beams were confined by triple layer of welded wire mesh internally and externally. These beams were tested for 2 point flexure test and load deflection curve were observed. Confining beams give better results.

Keywords: beams, welded wire mesh

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

It is exceptional that the quality and pliability of concrete are exceedingly subject to the level of suppression given by level of the sidelong stronghold. In the flexural framework of reinforced bond (RC) shafts, the quality and deformability, which are interrelated, ought to be pondered in the meantime. In any case, in current arrangement codes, layout of value is disconnected with deformability, and evaluation of deformability is self-ruling of some key parameters, like strong quality, steel yield quality and constrainment content. Therefore, game plans in current layout codes may not give sufficient deformability to bars. To look into the effect of the transverse sustaining extent on the column adaptability, a test program is coordinated. Six no's of columns are tossed with fluctuating c/c scattering between stirrups of two legged and three legged. In the seismic arrangement of strengthened strong light outflows, the potential plastic turn regions ought to be purposely unmistakable for adaptability with a particular true objective to ensure that the shaking from immense shudders won't cause fold. Attractive flexibility of people from sustained strong edges is furthermore critical to ensure that moment redistribution can happen. Past tests have exhibited that the constrainment of concrete by sensible blueprints of transverse help achieves an enormous augmentation in both the quality and the malleability of the part. In particular, the quality change from limitation what's more, the inclination of the dropping branch of the strong weight strain bends extensively affect the flexural quality and malleability of strengthened strong bars.

The cover solid will be unconfined and will inevitably wind up incapable after greatest permitted strain is achieved, however the centre solid will keep on carrying worry at high strains. The compressive pressure disseminations for the centre and cover concrete are definedby restricted and unconfined solid pressure strain relations. Great constrainment of the cement is fundamental if the column is to have malleability. The deformability of RC flexural individuals relies on various elements, including level of tractable reinforcement, level of compressive support, level of parallel fortification furthermore, quality of cement. Examination with respect to ductility of flexural individuals using ordinary weight total and light weight total has been investigated in number of studies. Albeit satisfactory flexural malleability is basic for structures in high seismicity areas, numerous significant issues identifying with the conduct of RC structures under serious seismic activit Learning of post top disfigurement attributes of strengthened solid individuals are extremely alluring for appropriate comprehension of the commitment of sidelong support and to understand the disappointment components under seismic conditions where, higher pliability demands are set on fortified solid individuals. can be followed because of the poor specifying of fortified cement.

In Indonesian Standard SNI 1726-2012 expressed that the earthquake safe structures must be intended to oppose earthquake forces with return time of 2500 years. Essentially the method of seismic plan in SNI 1726- 2012 [allows to diminish the earthquake forces with adjustment factor of structure response (R) that speak to of structure flexibility level. This idea empower the structure experiences plastification in certain area shape plastic hinges as a mean vitality dispersal when the high seismic happen. In any case, the structure must not fall. Ductile structures must be upheld by basic components that are ductile in any case, in light of the fact that the auxiliary components with high ductility will have the capacity to keep up its strength after a sizeable inelastic disfigurement without crumple. Ductile auxiliary components that will have the capacity to rotate increasingly and ready to keep up the vitality scattering capacity by keeping up the hysteresis loop stable and not squeezed [3]. With ductile auxiliary components, they will guarantee a plastic hinge instrument to spread in places that have been resolved. All together for the component of vitality scattering that happens is extremely ductile, at that point the area picked as the vitality dissemination fortification itemizing ought to be great and adequate, for example, imprisonment in the solid fortification. One of the component of ductile basic plan is Beam Sidesway Mechanism and among different instruments there is Column Sidesway Mechanism with results that the structure of the section ought to be arranged more grounded than the bar structure, with the goal that the plastic hinges will be framed first on the pillar. To get the Beam Sidesway Mechanism, column ought to have the capacity to be have ductile.

However the adequacy in design of structural components, particularly under-reinforced pillars, is low. This is on the grounds that the concrete compression area turns out to be little contrasted with the entire concrete segment. This is since the strain on the adjust conditions will make the area of the neutral axis progressively moved towards the compression fiber, so that the littler the zone of stressed concrete

Albeit systematically moment limit builds, the beam with bigger reinforcement proportion of solid will be in the first place squashed before reinforcement yields with potentially a sudden failure. This is the thing that ought to be maintained a strategic distance from as far as structural design. ductility of beams by giving extra confinement stirrup-formed in cross-segment pressure zone, keeping in mind the end goal to acquire more positive conditions as far as moment limit and ductility when contrasted and the standard beam without extra confinement

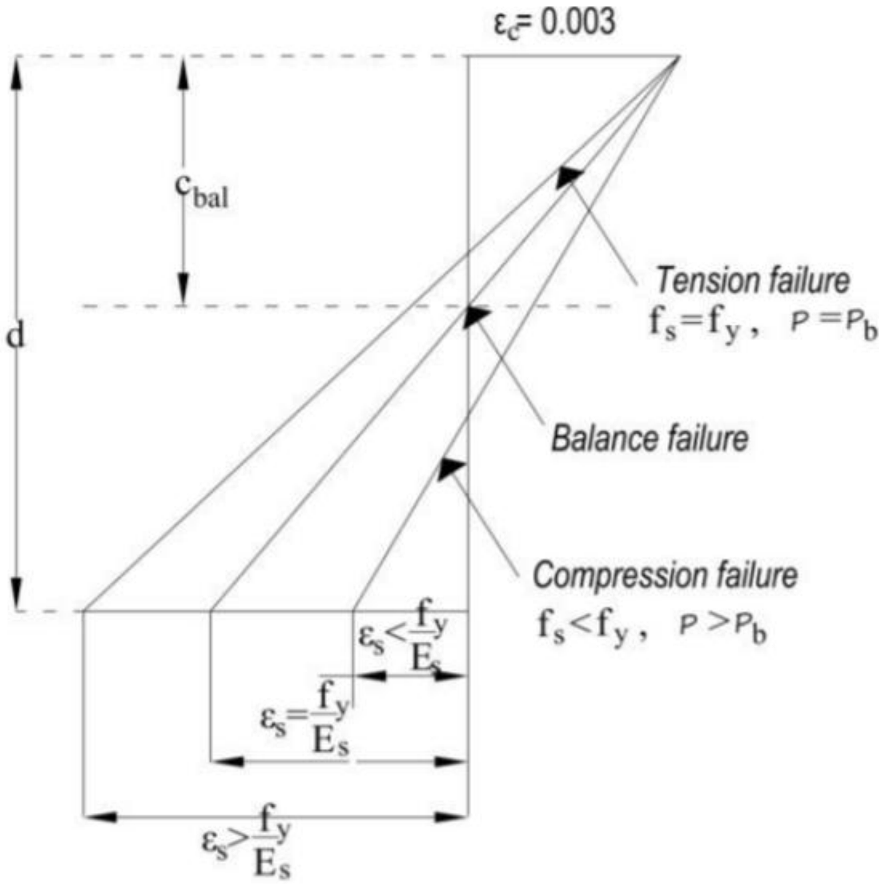

Figure 1.1 Shifting of neutral axis

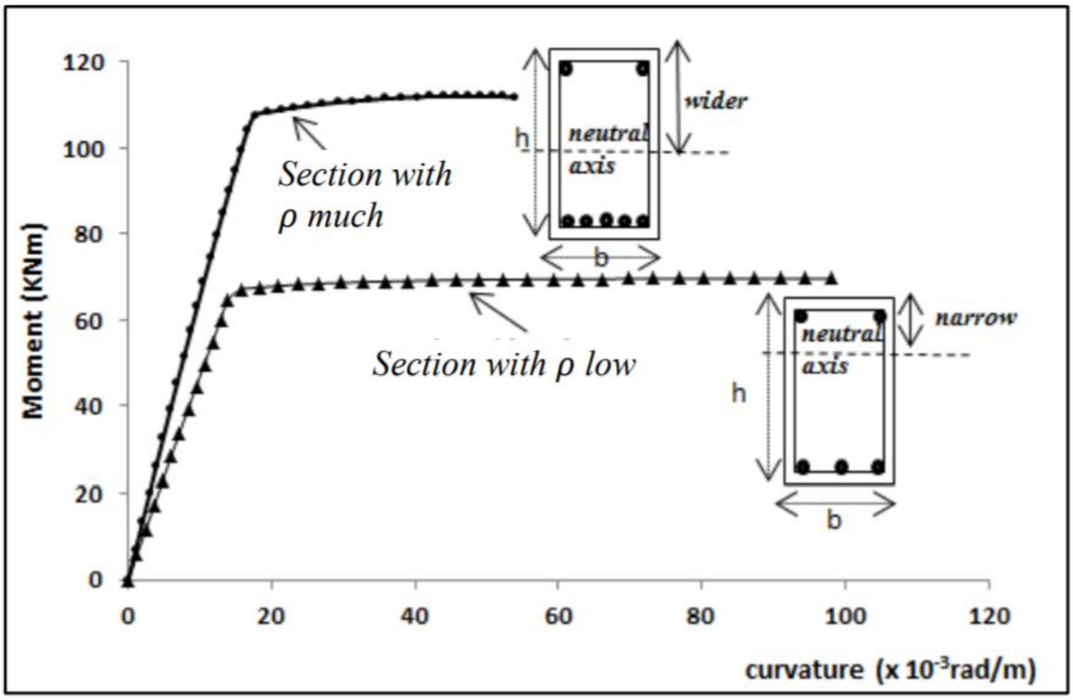

Figure 1.2 Moment curvature relationship with same section but different reinforcement

CHAPTER 2

LITERATURE REVIEW

2.1 GENERAL

Various examinations have produced exceptionally helpful data on the quality and twisting qualities of fortified solid individuals. However these investigations are constrained to extreme load stage and disappointment modes, and there is no data accessible on post crest arrange distortion of strengthened solid individuals. It has been pointed by number of specialists that the testing technique impacts the method of disappointment and post top conduct of cement. For instance the disappointment of cement under uncontrolled compressive stacking cause fragile write disappointment where as under controlled condition moderately bendable disappointment happens. It would be excessively costly, making it impossible to outline a structure in view of the "flexible" range, and the code (IS 1893) permits the utilization of a "Reaction Lessening Component" (R), to decrease the seismic burdens. In any case, this diminishment will be conceivable, pliability is in-worked through appropriate outline of the auxiliary components. Consequently to get a right reaction non-direct examination.of RCC structures ought to be completed. The inelastic investigation displays conduct past the yielding stage which can be spoken to as far as arrangement of plastic pivots, redistribution of minutes and so on.

2.2 PREVIOUS STUDIES

Porter and Carl (1976) cold formed steel deck sections utilized as a part of composite floor pieces. Amid the development stage, the steel deck fills in as the auxiliary load conveying component. Design methods were prescribed for composite steel deck-fortified floor by using the use of the most extreme quality ideas. The design limit fundamentally depends on the calculation of shear security quality. However the condition for flexural limits is likewise created from the similarity of strains and the harmony of inward force. Extra design contemplations are given on throwing and shoring prerequisites, redirections and span/depth relations.

Abdel-Sayed (1982) in one of the early investigations who utilized stay in place shape for beam development. The test examples used cool shaped steel solidified channels as part of the side formwork and in addition fortification supplanting customary steel bars. Soffits made in the type of stiffened channels with emblazonments, performed exceptionally well as basic parts of the composite beam. The joined activity of the emblazonments and the solidifying lead to fantastic bond qualities between the soffit and the concrete. The creator infers that supplanting the standard strengthening bars by a cool framed steel area the auxiliary execution of the beam is unaltered, while sparing is accomplished in the cost of structures and shoring.

According to creator's examinations, the beams proposed utilized the stay-in shape just for some bit of the profundity. He proposed removable formwork for the rest of the part. This did not bring about full economy of formwork. Moreover, no huge logical work was embraced.

Binienda et al. (1992) The greatest load and the area of cracks framed amid failure were estimated for testpieces with fibers arranged at different edges to the bar hub. Since most of the bars flopped close to at least one of the load points, the strength of the bars was assessed as far as a proposed demonstrate for the local stress distribution. In this model, a correct answer for the issue of a localized contact drive following up on a unidirectionally strengthened half plane is utilized to portray the local stress field. The stress singularity at the load point is treated in a way like the stress singularity at a break tip in crack mechanics problems. Utilizing this approach, the impact of fiber edge and versatile material properties on the strength of the shaft is portrayed as far as a 'Heap force factor. For fiber points under 45 degree from the bar hub, a single split is started close to one of the load points at a basic estimation of the load force factor. The basic load force factor diminishes with expanding fiber edge. For bigger fiber points, multipleracks happen at areas both close furthermore, far from the heap points and the load force factor at failure increments strongly with expanding fiber edge.

Oehlers (1993) proposed critical work utilizing profiled sheeting. He performed an experimental examination on the quality of composite profiled beams. The creator utilized the steel profiled sheets as lasting formwork to the sides and base of strengthened cement beams. Experimental tests on vast scale beams by the creator demonstrated that the expansion of profiled steel sheets to the sides of RCC beams generously increments both their flexural and shear qualities without loss of ductility and that this framework isn't inclined to shear bond disappointment at the profiled sheet - solid interface. The composite quality of the profiled beams depended fundamentally on forces typical to the ribs in the side of profiled steel sheets. These typical powers are actuated by the mechanical activities from flexural and shear relocations. Of optional significance are the shear bond forces, which just expanded the quality somewhat. Moreover, from hypothetical examinations the creator proposed that the expansion of side – profiled sheets considerably lessen the long haul deflections because of creep and shrinkage of the solid and the traverse/profundity proportion is expanded by around 20% since the profundity of the beam is diminished.

Maeda et al. (1995) It is important to prevent bond splitting failure during earthquake previous experiment by lateral reinforcements was effective to improve bond behaviour of longitudinal bar in rcc member.In this paper the raltionship between bond stress and confinement stress was obtained. Analytical method was used to evaluate confinement stress.

Redirection confinements take after the arrangements of Segment 9.5 of the ACI construction standard. The prescribed effective moment of inertia for composite deck redirection impediments is taken as just the normal of the standard cracked and uncracked sections

Mohamad M. Ziara et al. (1995) The central point of this paper is to look at, both hypothetically and tentatively, the flexural conduct of structural solid beams in which confinement stirrups have been brought into the compression regions. The lab based piece of the examination included 12 under-reinforced beams, eight of which had the solid pressure locales, as characterized by the compression force path (CFP) idea, limited with rectangular closed stirrups. The rest of the beams were customarily point by point. In an examination with customarily point by point beams, the nearness of confinement was appeared to build the ductility of the beams; in any case, no practically identical increment was found in their separate flexural limits. A technique for the assessment of the flexural capacity of beams in which confinement of the pressure areas is available has been proposed. A strategy for the plan of over-reinforced beams using the ductility coming about because of confinement has likewise been plot and examined tentatively utilizing four kinds of over-reinforced pillar chose from another broad test program. The outcomes acquired have demonstrated that in spite of the fact that the beams with confinement could accomplish a flexural capacity of up to 246 percent of the esteem relating to the most extreme longitudinal reinforcement proportion rho max permitted by the ACI code, regardless they failed in a bendable way. A novel connection between rho b' (upgraded longitudinal reinforcement proportion under the new adjusted ductile failure conditions) and rho b (as characterized by the ACI code) was observed to be a component of the confinement qualities. Every one of the outcomes anticipated utilizing the proposed approaches for both under-and over-reinforced beams were observed to be in close concurrence with the relating estimated values got from the beams incorporated into the test programs.

Rusell and burns (1996) For this examination, transfer lengths were estimated on a wide assortment of factors and on diverse sizes and sorts of cross areas. The factors included number of strands, measure 10 of strand (0.5 and 0.6), debonding, restriction support, and size and state of the cross segment. The quantity of specimens and the factors incorporated into the testing speak to one of the biggest groups of transfer length information taken from a solitary research venture. Inside and out, transfer lengths were estimated on each finish of 44 specimens. Of these specimens, 32 were built with concentric prestressing in rectangular transfer length prisms. The remaining 12 specimens were worked as scale demonstrate AASHTO compose bars with four, five, or on the other hand eight strands.

Xiao and Wu (2003) "Huge research efforts have been composite materials have been connected to retrofitting as of late did to investigate the viability of fiber reinforced polymer (FRP) composites in retrofitting or fortifying reinforced cement (RC) structures. Because of its great material properties including lightweight, high-quality and modulus, consumption protection and designed execution, FRP offers numerous invaluable potential to structural building. A FRP composite jacketed column can be ordered as the tubed system, from the way that the FRP coat, once introduced, frames a tube to give fundamentally extra transverse reinforcement to the first column. Contingent upon how and when the coat is made, FRP jacketing can be ordered as in situ fabricated system and prefabricated system."

Jeffry et al. (2008) "High strength concrete (HSC) gives high strength in any case, bring down ductility than ordinary strength concrete. This low ductility limits the advantage of utilizing HSC in building safe structures. On the other hand, when outlining reinforced solid beams, creators need to restrict the measure of pliable reinforcement to keep the fragile failure of cement. In this way the maximum capacity of the utilization of steel reinforcement can not be accomplished. This paper introduces the thought of binding cement in the compression zone so that the HSC will be in a condition of triaxial compression, which prompts changes in strength and ductility. Five beams made of HSC were thrown and tried. The cross segment of the beams was 200×300 mm, with a length of 4 m and a reasonable traverse of 3.6 m subjected to four-point loading, with accentuation put on the midspan redirection. The primary beam filled in as a reference beam. The rest of the beams had distinctive tractable reinforcement and the confinement shapes were changed to measure their adequacy in enhancing the strength and ductility of the beams. The compressive strength of the solid was 85 MPa and the rigidity of the steel was 500 MPa and for the stirrups and helixes was 250 MPa. After effects of testing the five beams demonstrated that putting helixes with various diameters as a variable parameter in the compression zone of reinforced solid beams enhance their strength and ductility"

Birrcher et al. (2009) A test talks about was directed in which 37 fortified solid profound beams examples were tried. The specimens are a portion of the biggest profound bars at any point tried in the historical backdrop of shear inquire about. The information from the experimental program and from a database of 179 profound beams tests in the writing were utilized to address eight tasks related with the strength service ability outline and execution of profound beam.

Russell et al. (2011) "said that there has been practically zero estimation or displaying of composite sandwich beams with lattice cores—as examined above, upgrades in execution are normal by supplanting the froth core with a lattice material. This paper along these lines has two goals. In the first place, we research the bending reaction of a composite sandwich shaft with a novel lattice core over an extensive variety of bar geometries. Specifically, we fabricate and test sandwich bars with confront sheets also, square honeycomb cores each produced using a carbon fiber composite; the columns are stacked in three-point bending, with both target of this examination is to explore the devotion of the suitably aligned constitutive models of paper in anticipating harm movement in the composite sandwich beams. This is accomplished by developing itemized 3D FE models that incorporate all the geometric points of interest of the beams and cores.”

Lughart et al. (2013) For a little force the conguration of a straight bar is steady. For a substantial force the straight pillar is a temperamental conguration and a twisted, or clasped, shaft is the stable conguration. This is depicted by a pitchfork bifurcation with the force as bifurcation parameter.

Priastiwi et al. (2014) this paper clarifies the conduct of both reinforced solid beams with and without confinement in compression zone to assess the impact of confinement in compression zone to the expanding of beam ductility. Four beams with reinforcement proportion ρ = 1.9% and ρ = 2.5% have been tried with monotonic loading. The outcomes demonstrated that an expansion up to 300% in solid strain for beams with confinement on the compression zone than beams without confinement. The expansion likewise happened in the load capacity and the curvature of beams with confinement, while the moment capacity did not demonstrate noteworthy change.

Bouamraa et al. (2015) Keeping in mind the end goal to give higher mechanical viability of bound solid beam, the new strategy proposed in this work comprises to outline at the closures of the steel reinforcement two restricting half barrel shaped plates, making an incited pressure connected in the tended zone of the solid beam component, when the steel support is subjected to ductile forces created by the bending load.

Teel et al. (2017) This examination is to explore the conduct of over-adjusted High Strength Fortified Concrete Beams with the pressure zone bound with winding/helical steel reinforcement. The investigation secured beam conduct as for flexural strength, shear strength, redirection and breaking identified with kept concrete.

Priastiwi et al. (2017) “This paper clarifies the conduct of beam with the confinement hoops in compression zone subjected to cyclic loading. The test thinks about intends to decide the ductility and vitality dispersal of beam with hoops confinement in compression zone at the plastic hinge locale under cyclic loading. Two half-scale beam examples that directed as a improvement model of beam plastic hinge area at column confront were tried. The one example was kept with hoops and would be looked at by un-confinement beam in compression zone. The beam will be stacked with stack focused on the centre of the traverse so it will get the best moment and shear. The cyclic loading framework by utilizing uprooting control with the static quasi loading slowly achieves a definitive state. The test demonstrates that keeping with hoops in the compression zone of beam's segment increments up to 50 percent in removal of ductility, furthermore, around 65 percent in curvature of ductility. Further, the combined file of vitality dispersal of beam increment up to 2 times contrasted and un-confinement beam in compression zone. The confinement hoops of compression zone inconsequential increment regarding quality capacity and moments and additionally in monotonic loading test".

The principle subject of this report was to ponder the effect of 0.7" breadth prestressing strands in connect supports. The majority of the investigation included creating and testing span 14 braces with the bigger measurement strand for its incorporation into AASHTO and acknowledgment by state DOT's. Incorporated into the examination is one test performed on four exchange crystals which considered and adjusted the confinement reinforcement put exhaustive them.

The example were seven inches square and eight feet long with a solitary 0.7" breadth strand worried to 0.75fpu (59.5 kips) set longitudinally down the inside. The confinement ties comprised of five inch square #3 Grade 60 hoops set at three, six, nine, and twelve inch focuses. Figure 2.2 presents the confinement design for the subjects tried by Maguire.

CHAPTER 3

THEORY

3.1 TESTS ON BEAM

3.1.1Flexural test

“Flexure tests are by and large used to decide the flexural modulus or flexural quality of a material. A flexure test is more reasonable than a tensile test and test comes about are marginally extraordinary. The material is laid evenly more than two points of contact (bring down help traverse) and after that a force is connected to the highest point of the material through possibly maybe a couple points of contact (upper stacking range) until the point that the example comes up short. The most extreme recorded force is the flexural quality of that specific example.”

3.1.1.1 Importance of Flexure Loading

Not at all like a compression test or tensile test, a flexure test does not measure fundamental material properties. "Right when a case is put under flexural stacking each one of the three main stresses are accessible: tensile, compressive and shear along these lines the flexural properties of an illustration are the delayed consequence of the joined effect of every one of the three stresses and furthermore (however to a lesser degree) the geometry of the case and the rate the heap is associated."

"The most understood inspiration driving a flexure test is to measure flexural strength and flexural modulus. Flexural strength is described as the best stress at the outermost fiber on either the compression or tension side of the case. Flexural modulus is figured from the grade of the stress versus strain redirection bend. These two characteristics can be used to survey the case materials ability to withstand flexure or bending forces."

3.2 FLEXURAL TEST TYPES

3.2.1Three point loading

The two most normal kinds of flexure test are three point and four point flexure bending tests." A three point bend test comprises of the example set on a level plane upon two points and the power connected to the highest point of the example through a solitary point with the goal that the example is bowed in the state of a "V". A four point bend test is generally the same aside from that rather than the power connected through a solitary point on top it is connected through two points with the goal that the example encounters contact at four distinct points and is bowed more in the state of a "U". The three point flexure test is perfect for the testing of a particular area of the example, while, the four point flexure test is more suited towards the testing of a huge segment of the example, which features the deformities of the example superior to anything a 3-point bending test."

"A bend test is like a flexure test in the kind of equipment and test methodology included. Bend tests are utilized with ductile materials while flexural tests are utilized with fragile materials."

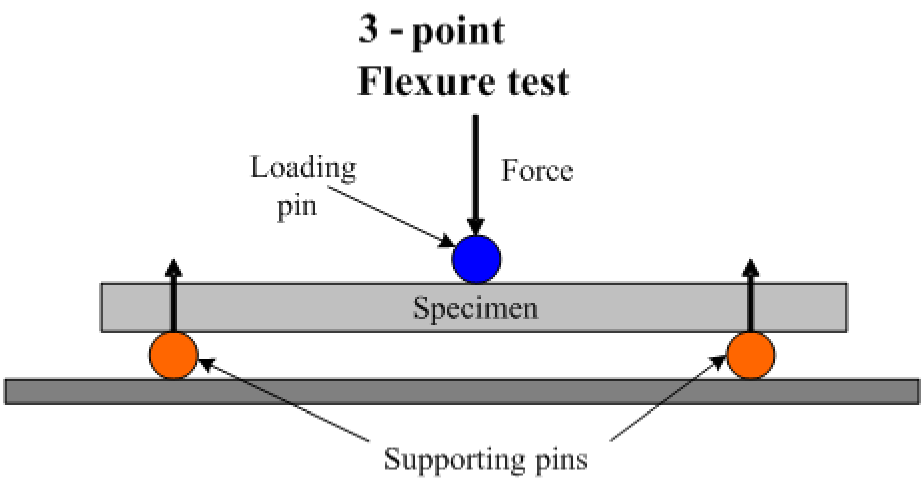

Figure 3.1 3-point flexure test

3.2.2 Four point loading

The four-point bending flexural test gives esteems to the modulus of versatility in bending and the flexural stress-strain reaction of the material. This test is fundamentally the same as the three-point bending flexural test. The significant contrast being that the expansion of a fourth bearing brings a substantially bigger bit of the pillar to the most extreme stress, rather than just the material directly under the focal bearing.

This distinction is of prime significance when contemplating fragile materials, where the number and seriousness of imperfections presented to the greatest stress is straightforwardly identified with the flexural strength and split start.

It is a standout amongst the most broadly utilized contraption to describe fatigue and flexural stiffness of asphalt mixtures

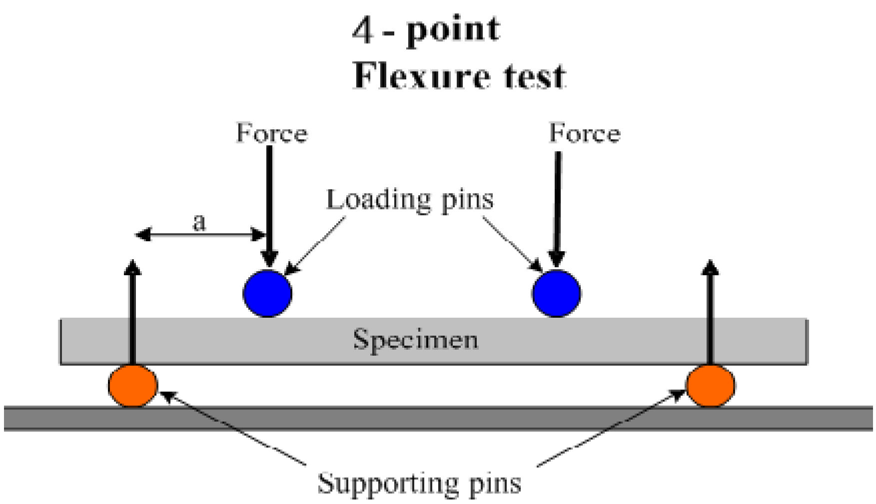

Figure 3.2 Flexure test

3.3 TYPES OF CRACKS IN BEAMS

Flexure word additionally signifies "Bending". Cracking in reinforced solid bars subjected to bending more often than not begins in the tensile zone i.e. soffit of the pillar. The width of flexural splits in reinforced solid pillars for here and now may remain limit from the surface to the steel. Be that as it may, in long haul under constant loading, the width of split may get expanded and turn out to be more uniform over the part

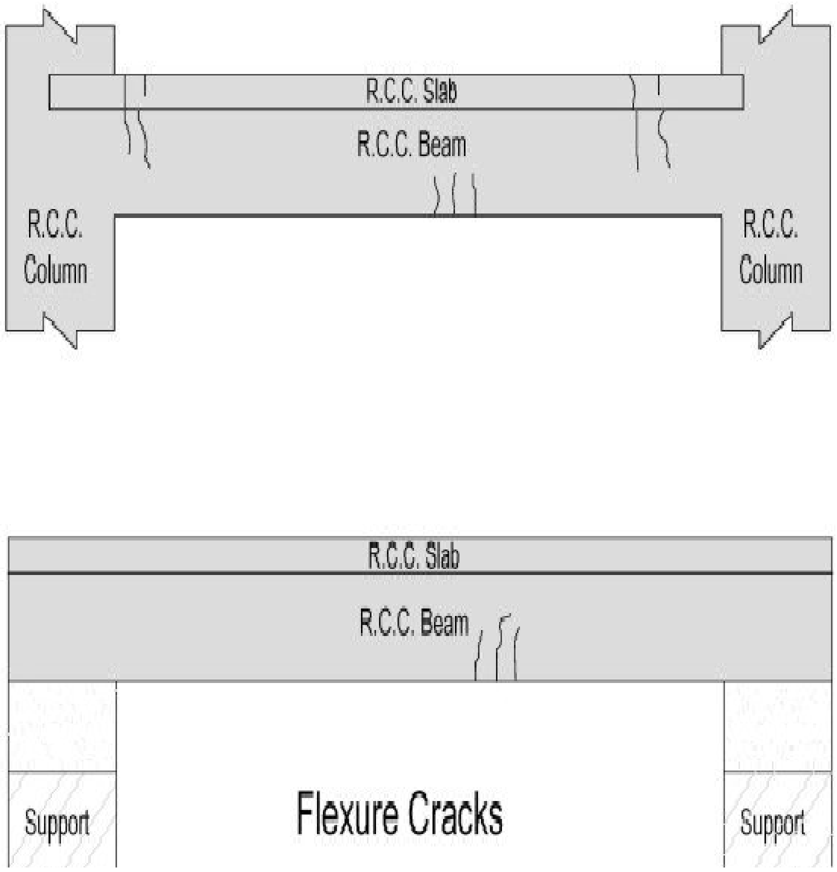

Figure 3.3 Flexure cracks in beams

3.3.1 Shear cracks in RCC beams

Shear cracks in reinforced solid columns happens in solidified stage and it is normally caused by auxiliary (self weight) loading or development. These sorts of cracks are better outlines as corner to corner tension cracks because of joined impacts of flexural (bending) and shearing action.

3.3.2 Torsional cracks in RCC beam

Generally, bars are subjected to torsion alongside bending moment and shear force. Bending moment and shear force happens as burdens acts ordinary to the plane of bending. Be that as it may, load away from the bending plane wil cause torsional movement.

Corrosion cracks in rcc beams Corrosion cracks in reinforced solid pillars keep running along the line of reinforcement. It generally isolates the solid from fortifying bars. It is for the most part manifested by discolouration of paint or stains of rust

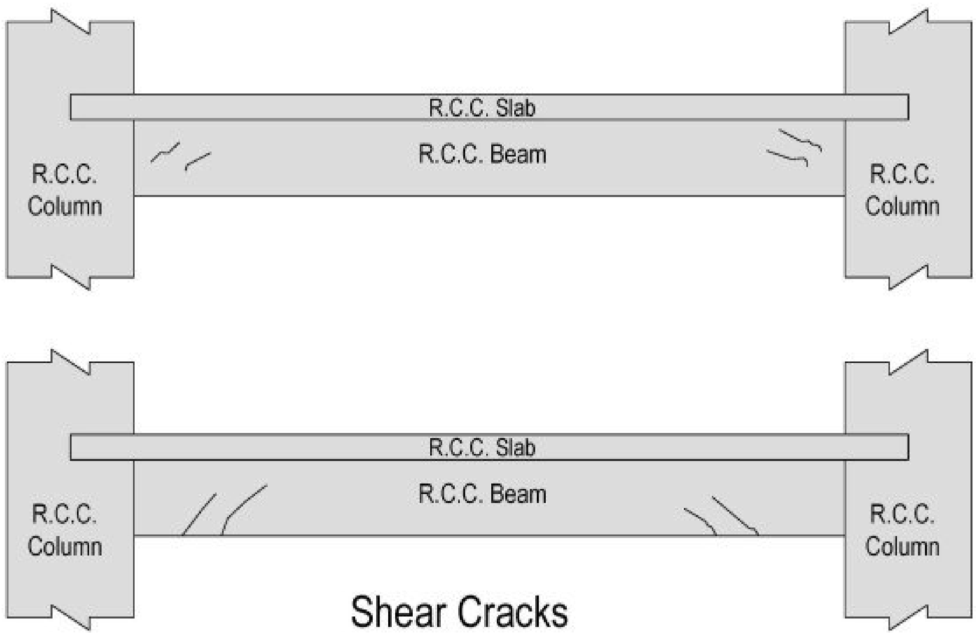

Figure 3.4 Shear Cracks in beams

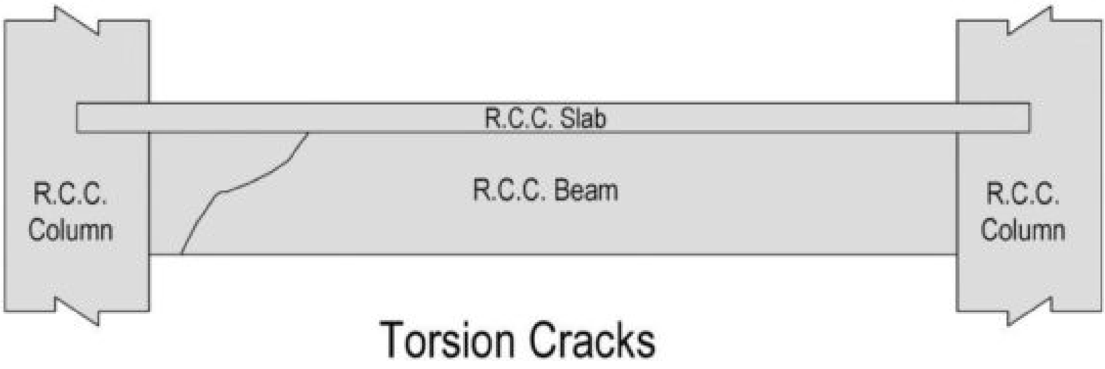

Figure 3.5 Torsion cracks in beams

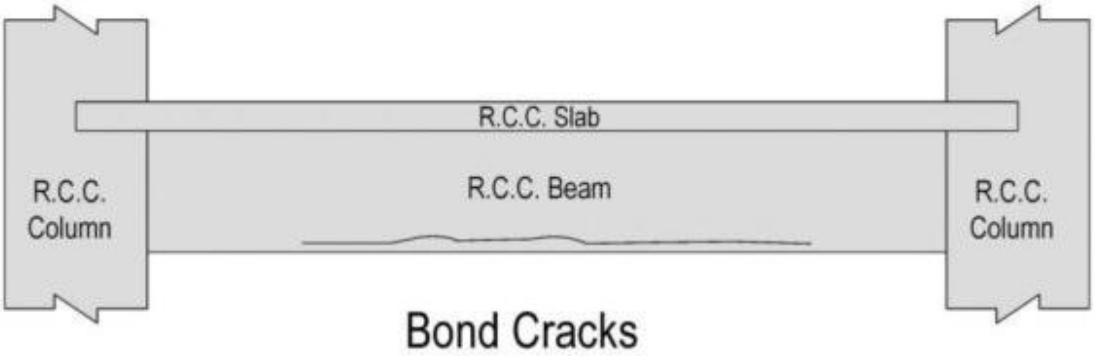

Figure 3.6 Bond cracks in beams

3.3.3 Shrinkage crack in RCC beams

Shrinkage cracks in reinforced solid shafts happen amid two stages, which are a pre-hardening stage and solidified stage. In pre-hardening stage, these sorts of cracks are called as plastic shrinkage cracks and in the solidified stage they are known as drying shrinkage cracks. Shrinkage cracks happen when crisp cement is subjected to an extr

Figure 3.7 Shrinkage cracks in concrete

CHAPTER 4

WORK METHODOLOGY

4.1 CONSTRUCTION OF MOULDS

Six moulds have been constructed of 150X150X700 in dimension in which the overall casting will be done as shown in figure 4.1

Figure 4.1 Mould of beam

4.2 OILING OF MOULDS

Oiling of the moulds have been done so that the mould's surface can be made smoother for casting and after the casting is done, the sample can be easily taken out from the mould as shown in figure 5.2

Figure 4.2 Oiling of moulds

4.3 PREPARATION OF REINFORCED CAGES

Spacing of stirrups

8 stirrups 100mm

6 stirrups 200mm

4 stirrups 100mm

Un-confined cages of beams were prepared. Figure 4.3 shows the unconfined specimen having 8 stirrups and 100 mm spacing center to center.

Figure 4.3 Un-confined

External confinement were prepared by using double layer of mesh which was wrapped outside the periphery of reinforcement cage as shown in figure 4.4.

Figure 4.4 External confinement

Internal confinement was done using double layer of wire mesh which was wrapped inside the reinforced cage as shown in figure 4.5

Figure 4.5 External confinement

Autocad Models

8 stirrups beam model with spacing 100 mm c/c and externally confined with GI wire mesh is shown below in figure 4.6

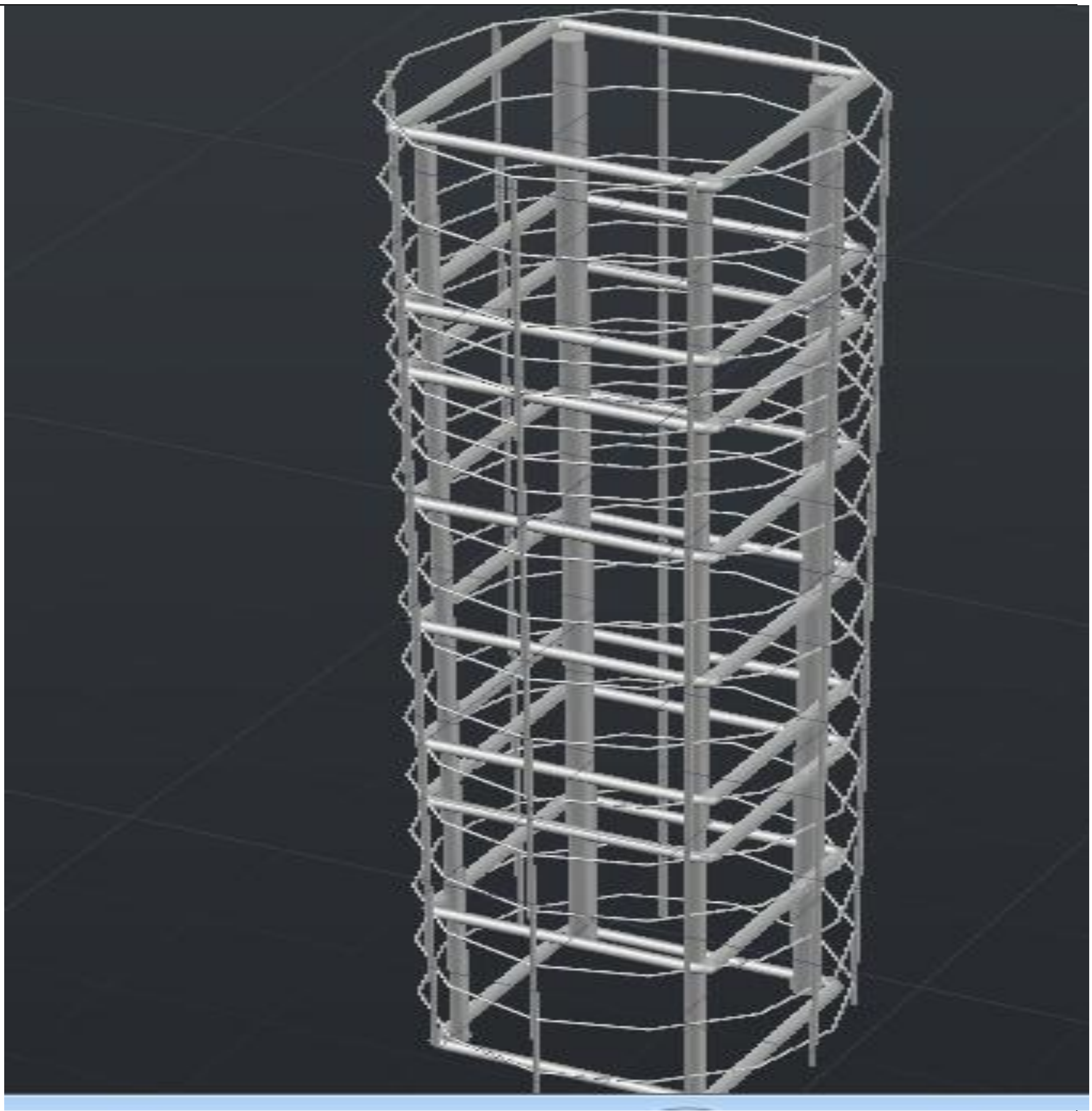

Figure 4.6 AutoCAD Model 1

8 stirrup unconfined beam model with spacing 100 mm c/c is shown below in figure 4.7

Figure 4.6 AutoCAD Model 2

CHAPTER 5

RESULT AND DISSCUSSIONS

5.1 CYLINDER STRENGTH

Cylinder prepared were tested under UTM and Compressive strength of cylinder was calculated as shown in table 5.1

Table 5.1 Cylinder strength

Water-cement ratio	Cylinder strength (N/mm^2)
0.55	21.4
0.55	21.8
0.55	19.4

5.2 SAMPLE -1 (2 LEGGED STIRRUPS SPACING 300 MM C/C)

Testing of beam was done and moment curvature relation for sample-1

Table 5.2 Moment curvature relation for sample-1

S.No.	Moment *(kN-m)*	Tension zone Readings *(mm)*	Compression zone Readings *(mm)*	Strain $*10^{-3}$	Curvature (1/mm) $*10^{-6}$
1	0	100	100	0	0
2	5	100	100	0	0
3	10	100.07	100.03	1	4
4	15	100.09	100.03	1.2	4.8
5	20	100.13	100.05	1.8	7.2
6	25	100.61	100.18	7.9	31.6
7	30	101.00	100.23	12.3	49.2
8	35	102.09	100.26	23.5	94
9	40	103.03	100.37	34	136
10	45	104.65	100.45	51	204
11	50	105.79	100.48	62.7	250.8
12	55	106.87	100.56	74.3	297.2

5.3 SAMPLE -2(2 LEGGED STIIRUPS SPACING 200 MM)

Testing of beam was done and moment curvature relation for sample-2

Table 5.3 Moment curvature relation for sample-2

S.No.	Moment *(kN-m)*	Tension zone Readings *(mm)*	Compression zone Readings *(mm)*	Strain $*10^{-3}$	Curvature (1/mm) $*10^{-6}$
1	0	100	100	0	0
2	5	100.01	100	0.1	0.4
3	10	100.06	100	0.6	2.4
4	15	100.09	100.02	1.1	4.4
5	20	100.21	100.04	2.5	10
6	25	100.56	100.05	6.1	24.8
7	30	101.29	100.15	14.4	57.6
8	35	102.20	100.20	24	94
9	40	104.58	100.31	48.9	195.6
10	45	105.73	100.50	62.3	249.2
11	50	106.90	100.73	76.3	305.2
12	55	108.20	100.95	91.5	366

5.4 SAMPLE-3 (2 LEGGED STIIRUPS SPACING 100MM)

Testing of beam was done and moment curvature relation for sample-3

Table 5.3 Moment curvature relation for sample-3

S.No.	Moment *(kN-m)*	Tension zone Readings *(mm)*	Compression zone Readings *(mm)*	Strain $*10^{-3}$	Curvature (1/mm) $*10^{-6}$
1	0	100	100	0	0
2	5	100	100	0	0
3	10	100.03	100.00	0.3	1.2
4	15	100.07	100.01	0.8	2.8
5	20	100.11	100.03	1.4	5.6
6	25	100.36	100.06	4.2	16.8
7	30	100.84	100.12	9.6	38.4
8	35	101.76	100.37	21.3	85.2
9	40	102.83	100.61	34.4	137.6
10	45	106.75	100.85	76	304
11	50	108.24	101.07	93.1	372.4
12	55	109.85	101.65	114	456
13	60	113.73	102.05	157.8	631.2

CHAPTER 6

CONCLUSIONS

6.1 CONCLUSIONS

1. Stresses in concrete increase in light of confinement and the corresponding strains are increases in view of confinement

2. Bend ductility increases as the stirrup spacing diminishes following both the confinement models.

3. There is no huge increase in Curvature ductility if the stirrup's vertical legs increase.

4. Confinement proves to be more effective and external confinement is the best.

6.2 FUTURE SCOPE

In future there is chance to improve the flexure capacity of beam by increasing percentage of confinement and changing the quality of concrete to increase the effect of confinement.

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