A Vibrant Strengthening Of Uniformly Distributed Loads

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Abstract: According to practical thought on pre-stressed bridge girders, one 30mm diameter longitudinal hole was provided underneath the neutral axis within the tension zone out of all beams for future strengthening, service lines along with other consideration. This research handles experimental analysis for improving the flexural and shear capacity of RC beams using Glass fiber reinforced polymers (GFRP) and Carbon fiber reinforced polymers (CFRP). 15 concrete beam examples with size of 110mm width, 200mm height and 1300mm length were fabricated within the laboratory. The geometry of beams was stored constant, while steel reinforcement varied according to initial design. From 15 beams four were control beams. One beam is made with no steel reinforcement strengthened with two layers of GFRP fabrics U-jacketed within the full span. Five beams were weak in flexure, strengthened using GFRP fabrics with different configurations in greater flexural zone. Four beams were weak in shear, strengthened using GFRP fabrics with different configurations in greater shear zones near both supports. One beam is made weak in shear, strengthened with CFRP fabrics in greater shear zones near both supports. All of the beams were simply supported at both sides with 1000mm effective span, 150mm bearings, loaded under more realistic loading conditions, i.e. uniformly distributed load (UDL) and tested as much as failure by progressively growing super enforced load. The preparation of concrete surface ended meticulously and demonstrated no bond failure in most U-jacketed and inclined stripped beams. One beam glued with GFRP fabric within the soffit bottom only unsuccessful because of deboning. The flexural and shear capacities from the beams are in contrast to the theoretical conjecture using coda provisions.

Keywords: Carbon Fiber Reinforced Polymers (CFRP); Glass Fiber Reinforced Polymers (GFRP);

I. INTRODUCTION

There is lots of existing bridge and building structures around the world, that do not fulfill specified design needs. This can be because of upgrading from the design standards, elevated loading because of change useful, ageing, corrosion from the reinforcement bars, marginal design, construction errors and poor construction, utilization of inferior material, and accidents for example fires and earthquakes, which renders the dwelling not capable of fighting off the applied service loads. The answer in such instances is finished dismantling and new construction or growing the burden transporting capacity through strengthening from the effected structures in a variety of ways. The strengthening and retrofitting of concrete structures represents probably the most challenging problems faced by engineers today [1]. At the moment there are many research teams around the globe undertaking research in this region. The primary benefits of FRP fabrics, sheets or plates are their high strength-to-weight ratio and corrosion resistance. The previous property results in great ease in site handling; reducing work cost and interruptions to existing services, while latter ensures durable performance. FRP plates are usually a minimum of two times but could be over 10 occasions as strong as steel plates, while how much they weigh is just 20% of this of steel. FRP composites utilized in aerospace industry for several years as well as their superior qualities are very well known. The limited utilization of FRP in civil engineering applications is a result of their expensive. However, the prices are coming lower quickly, enabling their wider use within civil engineering. For application within the strengthening of structures, the fabric cost is just one aspect and can be a small area of the total price involved including work cost, loss because of interruptions to services. FRP composites frequently supply the most cost-effective overall means to fix civil engineering applications. Fiber Reinforced Polymer (FRP): Fiber reinforced composite materials contain fibers of high strength and modulus baked into or glued to some matrix with distinct interfaces together. Within this form, both fibers and matrix retain their physical and chemical identities, yet they produce a mix of qualities that can’t be achieved with either from the constituents acting alone. Fibers would be the principal load transporting people, as the matrix keeps them within the preferred location, orientation and safeguard them from ecological damages. The fiber imparts the force, while matrix keeps the fiber in position, transfer stresses between your fibers, supplies a barrier against a bad atmosphere for example chemicals and moisture, protects from abrasion. FRP is short for...
Fiber Reinforced Polymer and identifies a category of composite materials composed of brittle, high strength and stiffness fibers embedded at high volume fractions in ductile low stiffness and strength polymeric resins known as matrix. FRP with polymeric matrix can be viewed as like a composite. They're broadly utilized in strengthening of civil structures for example beams, girders, slab, posts and frames. There are lots of benefits of FRP because of lightweight, corrosion-resistant, good mechanical qualities. The primary purpose of fibers would be to carry load, provide strength, stiffness and stability. The part from the matrix would be to keep fibers in place and connect it towards the structures. You will find mainly three kinds of fibers dominating the civil engineering industry for example glass, carbon and agamid fibers. Each features its own pros and cons.

Ways of FRP application in structures: The connecting of unstrained FRP plates towards the soffit / webs of RC beams is easily the most common and it has received the finest quantity of theoretical and experimental research up to now. Three schemes exist for the adhesion of unstrained FRP plate towards the soffit / webs of the RC beam. Resin is used towards the concrete surface, and layers of material are impregnated in position using steel roller. Here the adhesive also forms the matrix from the FRP which results in a strong bond using the RC beam. This process is however responsive to unevenness from the RC beam soffit / webs and the like unevenness can result in deboning of FRP from concrete surface.

II. METHODOLOGY

The geometry of beams are 1300mm overall length, 1000mm effective length (bearing 150mm both sides), 110mm width and 200mm depth with different reinforcement according to design. The length of all beams are stored same through the experiment [2]. Provision of the 30mm diameter service hole is supplied along longitudinal direction underneath the neutral axis within the tension zone of beams for future strengthening using steel bars, FRP bars or strands in prestressed girders according to practical consideration. All of the beams are initially designed according to limit condition approach to design, simply supported at both sides and applied with multiple concentrated loads equal to uniformly distributed load (UDL).

All of the beams in CB, RB, RF and RS series are progressively test loaded as much as failure/collapse. Portland Slag Cement (PSC) conforming to IS 455 of Konark Brand can be used through the analysis. It's tested because of its physical qualities in compliance with Indian Standard specs. The coarse aggregate utilized in this analysis is crusher damaged hard granite chips, maximum dimensions are 20 mm with specific gravity 2.70, grading confirming to IS-383-1970. The fine aggregate used is clean river sand passing through 4.75 sieves with specific gravity of two.50 and grading zone III confirming to IS-383-1970. All longitudinal reinforcement used is HYSB bars confirming to IS 1786: 1979. The stirrups used are 8 mm dia HYSB bars/6 mm dia mild steel bars. The tensile yield strength of HYSB bars used is acquired by testing within the Electronic UTM (FIE make) Model No.UTES 100. Glass and Carbon fibers are utilized as reinforcing material for FRP. Epoxy can be used because the binding material between fiber layers. Glass fibers made by OWEN’S CORNING weighing 360 gms/sqm and Carbon fibers 8H SATIN (T-300) made by TORAY Industries weighing 420 gms/sqm can be used for this analysis. Before preparation of samples test coupons are ready for portrayal of materials for FRP strengthening. Glass fibers, carbon fibers and epoxy can be used for output of test examples. The exam coupons are ready according to ASTM: D3039M-08 in the FRP plates. Polymeric resins are utilized both because the matrix for that FRP and because the connecting adhesive between your FRP and also the concrete. The second function is of particular concern here, as weak glues may cause interfacial failures. Epoxy resins are usually utilized in the flexural and shear strengthening of beams. The prosperity of the strengthening technique mainly depends upon the performance from the epoxy resin employed for connecting of FRP to concrete surface. Numerous kinds of epoxy resins with an array of mechanical qualities are commercially available for sale. The epoxy resins are usually obtainable in a double edged sword, a resin along with a hardener. Fresh concrete being plastic requires good form try to mould it towards the needed size and shape. The joints at bottom and sides are sealed to prevent leakage of cement slurry. Mobil oil ended up being put on the interior faces of form work. The underside rests over thick polythene sheet laid over rigid AS floor [3]. The reinforcement cage will be decreased, put into position within the form work carefully having a cover of 20mm on sides and bottom by putting concrete cover blocks. Concrete mix proportioning: The style of concrete mix is completed according to guidelines of IS 10262: 2009 having a proportion of just one: 1.85:3.70 by weight to attain a grade of M25 concrete. The utmost size coarse aggregate used is 20 mm. Water
cement ratio is bound at .50 along with a slump of fifty to 55 mm. The blending of concrete is completed utilizing a standard mechanical mixer submission with IS 1791 and it is 12119. First coarse and fine aggregates are given alternately, adopted by cement. Then needed volume of water is gradually added in to the mixer to help make the concrete workable until a uniform color is acquired. The blending is completed for 2 minutes in the end ingredients are given within the mixer according to IS 456-2000. All of the examples are compacted by utilizing 30mm size needle vibrator permanently compaction of concrete according to IS 2505. The edges from the form work are tamped having a hammer to obtain a neat finish. Excellent care is come to avoid displacement of reinforcement cage within the form work while vibrating the concrete. Finally, the very best the surface of concrete leveled, finished smooth using a trowel and wooden float [4]. Red carpet hrs, the specimen detail and date of concreting is presented on the top surface to recognize it correctly. The examples are removed from the mould after 24 hrs, now use concrete floor, covered over-all with wet jute bags. Potable water is sprinkled 6 occasions each day to help keep the jute bags wet, to permit concrete for perfect curing. The curing is ongoing for 4 weeks. Along the way of strengthening, the FRP fabrics are glued towards the concrete surface utilizing an appropriate resin and hardener according to manufacturer’s instructions. The formulations from the concrete surface are an essential work. Following an available research papers as indicated, corners of concrete are rounded, uneven the surface of concrete are evened utilizing a grinder, adopted with an iron filing and lastly rough sand papering. The top of concrete are grinded using rough carbonundum gemstones (employed for cutting mosaic floors) adopted by rough sand papering. The concrete surface is easily wiped utilizing a linen wet cloth. This method is repeated three occasions to acquire even rough surface, corners put together and lastly easily wiped utilizing a clean bit of cloth. This process is adopted to prevent premature deboning of FRP from concrete surface. When the surface is ready, FRP fabrics tailored to needed size are stored ready to be used. Epoxy resin is combined with hardener according to manufacturer’s instructions. Within this situation FRP fabric for use is considered, equal weight of epoxy resin is taken (50:50 by weight), stored inside a plastic container, then 10% of hardener (with regards to the epoxy resin) by weight is taken, combined with epoxy resin already within the plastic container, stirred with a stick before the mixture is within uniform colour. Then your epoxy resin is used towards the concrete surface having a hands brush uniformly, the other layer of composite fabric is positioned regarding this, surface pressed-folded having a iron hands roller to squeeze out more than epoxy resin in the surface. Any air bubbles entrapped within the concrete-resin-fabric interface should be squeezed out and eliminated for perfect connecting. Then your second layer of epoxy resin is used within the lower layer of FRP already pressed over concrete surface, again second layer FRP fabric is positioned within the lower layer, pressed-folded having a hands roller, excess resin squeezed out, any entrapped air bubble eliminated in the interface and lastly pressed with hands within the concrete surface. The sticking process is repeated for that third here we are at some examples within the experiment. Along the way full contact between your epoxy resin, the layers of FRP fabrics and also the concrete surface should be ensured to prevent premature deboning failure of FRP layers. This operation should be done very rapidly to prevent hardening of epoxy resin-hardener mix and hands brush stored within the plastic container [5]. The procedure is transported out at 70 degrees, cured for minimum three days before testing.

![Fig.2.Failure of beam CB1](image)

### III. CONCLUSION

This describes the outcomes of CB series (control beams), RF series (weak in flexure) and RS series (weak in shear) beams. From 15 beams, 4 are control beams with no FRP strengthening, one beam is created with no steel reinforcement, but strengthened with FRP, 5 beams are created weak in flexure, but strengthened in flexure with FRP and 5 beams are created weak in shear, but strengthened with shear with FRP fabrics in a variety of configurations. The compressive strength of controlled concrete cubes will also be presented combined with the flexural and shear strength of test beams. Their behavior through the test as much as failure are described regarding initial and supreme load transporting capacity, deflection conduct, rigidity, ductility, crack pattern and mode of failure. The beams weak in flexure after strengthening demonstrated outstanding flexural strength with 33% to 83% rise in cracking load capacity with regards to the control beam with respect to the configuration of GFRP. The 4 beams weak in shear after strengthening demonstrated 25% to 81% rise in cracking load capacity with regards to the control beam with respect to the configuration of GFRP. One beam shear strengthened with CFRP demonstrated outstanding increase of 131% in cracking load capacity and rigidity with regards to the control beam that is
greatest within the number of tested beams. There is rise in the stiffness of strengthened beams when compared to control beams.

IV. REFERENCES


AUTHOR’s PROFILE

Golla Sreenivasulu completed his Btech in SKR College of Engineering & Technology in 2014. Now pursuing Mtech in Civil Engineering in SKR College of Engineering & Technology, Manubolu

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