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Review of Retrofitting of Simply Supported Beam by BFRP and AFRP Wrapping

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1. ABSTRACT

Until recently, repair and retrofit options were limited and costly. The usual solution for asick building is to add steel beams underneath sagging floors and a concrete topping. But while this method may achieve its objective, the cost, disruption to utility services, and unsightlysteel work may be unacceptable to building occupants and owners. Rather than face these obstacles, some owners opt to tear down and start from scratch. Alternative retrofitting techniqueby FRP wrapping has an advantage due to lightweight, flexibility, non-welding, and easyhandling in construction works. The most preferable retrofitting technique for the existingbuilding being in use is jacketing RC columns with carbon or aramid fiber sheets because ofthe advantage above.

Retrofitting of existing concrete structures has become an important issue nowadays in the construction industry. Such necessity had been caused by several factors, especially whenconcrete is subjected to severe environmental and loading conditions. In such situations, the remedy is either to demolish the existing structure and construct a new one or to retrofit the existing structure by an appropriate strengthening methodology.

The analysis of simply supported concrete beam externally wrapped with aramid fiber reinforcement polymer (AFRP) and basalt fiber reinforcement polymer (BFRP) unidirectional sheet is carried out. The wrapped and unwrapped specimens were loaded. Result shows that externally wrapping of simply supported concrete beam by AFRP and BFRP sheets can significantly enhance flexural strength.

Keywords – Retrofitting, Compressive strength, Flexural strength, Basalt Fiber ReinforcedPolymer (BFRP), Aramid Fiber Reinforced Polymer (AFRP), Compression Testing Machine (CTM), Universal testing machine (UTM)

2. BACKGROUND:

Reinforced concrete structures often have to face modification and improvement of their Performance during their service life. The main contributing factors are change in their use,new design standards, deterioration due to corrosion in the steel caused by exposure to an aggressive environment and accident events such as earthquakes. In such circumstances there are two possible solutions i.e. replacement or retrofitting. Full structure replacement might have determinate disadvantages such as high costs for material and labour, a strongerenvironmental impact and inconvenience due to interruption of the function of the structure e.g. traffic problems. When possible, it is often better to repair or upgrade the structure by retrofitting.

3. INTRODUCTION:

The application of such new materials like the basalt and aramid fiber as structural materialsbegan to gain popularity in around the mid-1980s. In those days, efforts were being made toestablish a technology for forming such new materials into continuous fiber reinforcing barsusing resin bond, etc. which could be substituted for the reinforcing bars. By around 1993, it became clear that basalt and aramid fibers could be used as structural materials. In the early 1990s, the durability of concrete structures came to attract growing attention as a problem which was strongly calling for the establishment of techniques to repair or retrofit existing concrete structures. This triggered research and development on the application of continuous fiber sheet reinforcement.

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In the last decade, the development of strong epoxy glue has led to a technique which has great potential in the field of upgrading structures. Basically, the technique involves gluing steel plates or fiber reinforced polymer (FRP) plates to the surface of the concrete. The platesthen act compositely with the concrete and help to carry the loads. FRP can be convenient compared to steel for a number of reasons. These materials have higher ultimate strength andlower density than steel. The installation is easier and temporary support is not required dueto low weight and high rate of strength gain. They can be formed on site into complicated shapes and can also be easily cut to length on site.

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Retrofitting requires strengthening of a floor slab and beam, sometimes steel tendon
are placed within the beam at precise locations. The tendons are then tensioned, and theyapply a vertical, upward force to the bottom of the floor through the supported post-tensionedbeam. Retrofitting requires strengthening of a floor slab and beam, sometimes steel tendon are placed within the beam at precise locations. The tendons are then tensioned, and theyapply a vertical, upward force to the bottom of the floor through the supported post-tensionedbeam.

This study intends to integrate the behavior of concrete beams retrofitted with Basalt FRP(BFRP) and Aramid FRP (AFRP), using experiments and modelling**.**

4. LITERATURE REVIEW

Parameter Experimental Full-scale Test: The responses of the FEM model agree reasonably well with the results obtained from the experimental testing. The FEM model adopted further support that the FRP significantly increases the strength and stiffness of the RC beam. The behavior of the beam after steel yielding has been improved to a certain extent due to the FRP sheet. The crack patterns obtained from analysis indicate almost similar attribute to those resultingfrom experiments. The study indicates efficiency and accuracy of the developed finite element modeling for BFRP strengthened of RC beams such that elements were able to imitate prototypebehavior and the boundary conditions are consistent with existing actual condition. The deflectionwas measured at the center of each beam. The load deflection data obtained from finite element analysis was compared with experimental results shows the comparison of load deflection curvesfrom finite element analysis and experiments **G.N**. **Prajapati**

Parameter: Reverse cyclic loading*:* Two specimen are tested without wrapping and with GFRPand BFRP wrapping, total three number of specimens were tested with 2 layers, 4 layers and 6 layers of GFRP wrapping and other two specimens were tested with CFRP wrapping. Axial loadand reversed cyclic lateral loading were applied constantly on this specimen wrapped with FRP. Experimental results indicate a significant increase of ductility and increase in energy absorptioncapacity of RC beam-column when strengthened by both GFRP and CFRP Jacket. Increment in the load carrying capacity of column specimens is 8%, 28% and 32% wrapped with two layers, four layers and six layers of GFRP respectively compared to the control specimen without wrapping. The specimen jacketed with 6 layers of GFRP has the highest load carrying capacity and there is 32% increase in the strength compared with the specimen without GFRP wrapping. The specimens wrapped with CFRP had an about 98.3% increase in the load carrying capacity compared to the specimen without CFRP wrapping. **K. P. Jaya, Jessy Mathai**

Parameter: The finite element method*:* Author prove the finite element method is a useful tool for improving the understanding of the behavior of reinforced concrete beams retrofitted with CFRP. Experimental tests are needed to provide input data to the model and for the purpose of verification of simulation results. When the model has been validated it can be used for parameter studies to clarify the influence of various parameters This study showed that there is astress concentration at the end of the plate causing de-bonding failure. It would be interesting to study different approaches to avoid this phenomenon. Examples are tapering at end of plate and external CFRP wrapping (stirrup) for reducing the stress concentration at the end of the plate **Yasmeen taleb obaidat**

Parameter investigation of shear and flexural the behaviour*:* The results obtained from experimental analysis proves that investigation of shear and flexural the behavior can possible theresults are the maximum load in series RF1 was 166 kN, which is a more than 33 % increase compared to the control beam. The maximum load for series RF2 was 142 kN, 20 % higher thanfor the control beam. For series RF3 the maximum load was 128 kN which corresponds to a 7 %increase in maximum load. The maximum load carried by RS group of beam was 22kN.The cracking patterns consist of pure diagonal shear crack. The debonding mode is due to cracking ofthe concrete underneath the CFRP plate. The maximum load of the strengthened beam was 270 kN. It may be observed that strengthening increases the maximum load by over 23 %, when compared with the control beam **Abu-Farsakh, et al.**

Parameter: Testing of Basalt fiber reinforced polymer*:* Paper conclude that there was increasein ultimate load by 11.90% and 23.71% for fully wrapped 1 layer and 2 layers respectively. Increase in ultimate load by 9.75 % and 14.89% for partially wrapped 1 layer and 2 layer respectively. The compression failure mode is a brittle failure mode where type of failure occursmainly in ordinary reinforced concrete components. This type of failure was seen in control specimen. The failure of rupture of the laminates was seen in some specimens. The rupture of BFRP laminates with sudden failure was observed on specimens which were wrapped with one layer of laminates. Ductile failure was observed mainly due to corners. It was found that the specimens with partially wrapped BFRP specimens showed higher resistance compared with thefully wrapped specimens. Failure occurs as crushing of concrete and buckling for long column. **Krishna et al**

SUMMARIZED REMARK OF LITERATURE REVIWE:

Strengthening of RC beam-columns using Glass Fibre Reinforced Polymer (GFRP) and Carbon Fibre Reinforced Polymer (CFRP) subjected to reverse cyclic loading shows 50%- 60% increment in load carrying capacity. An experimental study carried out to investigate shear and flexural the behavior of structurally damaged full-scale reinforced concrete beamsretrofitted with CFRP laminates shows 30-35% increment in load carrying capacity. It is important to implant new materials in field of retrofittingTo evaluate enhancement in load carrying capacity and flexural strength of simply supported beam by Basalt Fiber Reinforced Polymer and Aramid Fiber Reinforced Polymer wrapping

5. CONCLUSION:

Considering through the inquire about, it is watched that, there is not any procedural information or standard code accessible in India for application of FRP. That's why the investigate and application is taken after by the writing accessible on the FRP. By consideringthe significance of past writing practical and explanatory consider is done on the FRP

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