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Use Of Glass Fiber Reinforced Polymer Composites To Protect Reinforced Concrete Beams

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Abstract-Based on necessities, the current characteristics of contemporary compounds in the concrete structure construction sector are expanding in terms of reinforcement and upkeep. owing to degradation caused by a number of issues, including inadequate maintenance, corrosion of the metal reinforcement, bad design, poor manufacture, use of inferior fabric, and higher design requirements owing to load, many reinforced concrete structures across the world are in severe need of repair and maintenance. Enhancing design guidance, public tolerance, exposure to dangerous conditions, and damage in the case of earthquakes. Fiber-reinforced polymer is now well acknowledged for its application in strengthening and restoring reinforced concrete components. Fiber Reinforced Polymer (FRP) is a very reliable method of reinforcing and restoring systems that have weakened because of design flaws and lifestyle choices. FRP repair solutions offer a cost-effective substitute for conventional tissue and medical equipment. Without pausing, it carried out experimental studies of the bending behavior of FRP-reinforced RC beams. A static loading device is used to test for failure of GFRP (Glass Fiber Reinforced Polymer) sheets glued to epoxy to externally reinforced concrete beams, with two identical variables being the emphasis.

Keywords- Glass, Reinforced Concrete, FRP, GFRP

1.INTRODUCTION

The rusting of steel reinforcement, bad design, poor manufacture, use of subpar materials, as well as aircraft carriers themselves are just a few of the numerous concrete structures that are still in existence, including buildings, bridge decks, girders, and offshore structures. Due to increased costs, hundreds of design criteria within have degraded.

Seismic activity, including earthquakes, damage to dangerous situations, and advancements in design indicators. There is an urgent need to fortify and restore dilapidated buildings. Deterioration of structures can be caused by a variety of factors, including the effects of the environment, poor planning and execution, the need for structural upgrades to comply with new earthquake protection design standards, corrosion in steel brought on by exposure to harsh environments and accidents like earthquakes, too much deflections, poor concrete quality, etc., or occasionally even to correct mistakes made during construction. To meet these strengthening needs, a variety of strengthening procedures have been created. An alternate design approach for the reinforcement of new or existing structures is provided by the development of FRP materials in a variety of configurations and forms, including non-woven, or loose fibers, woven, or braided fibers, textile or fabric, that is strongly braided, and a backing material, such as latex backing or natural rubber backing, among others. FRPs are appropriate materials for structural retrofitting because they give designers a great combination of qualities not found in other materials and could be a solution to the crisis in civil infrastructure. FRP composite materials also present an alluring substitute for any other retrofitting technique in the area of concrete element repair and strengthening. The enormous strength to weight ratio, unique excessive pulling power, adequate fatigue resistance, ease of installation and wear resistance features, simplicity of maintenance, and exceptional road resistance are just a few of the many benefits of FRP. They want a reduced density and superior durability compared to metal, etc. These are a few features that make FRP attractive for applications requiring reinforcement. but a significant amount of design advice and theoretical expertise. essential to guaranteeing the economic, dependable, and safe usage of FRP materials. The most often utilized devices in earlier research and retrofit applications are carbon fiber composites. Throughout time, hardening has emerged as a practical means of enhancing sporting items' performance and prolonging their wearer's life. Strong weight-to-electric ratio, enormous weight-to-stiffness ratio, design flexibility, non-corrosion, excessive-stress energy, and ease of application are some of the enhanced housing properties that FRPs display. The weight within the limb structure is no longer appreciably increased by the use of fiber composites. FRP materials are lightweight, therefore their transportation has minimal environmental effect. When these different elements come together, the process of strengthening is much simpler and quicker than with steel panels. According studies, FRP is a very effective way to strengthen weak concrete beams against bending, shearing, and torsion. There are currently no guidelines in India's considerable arrangement requiring enhancing the structural components' resistance to bending, shearing, and torsion using FRP materials. Carbon, glass, aramid synthetic fibers, and several other fibers are the most often utilized fibers that may be utilized as reinforcement in FRP for reinforcement of concrete systems. When paired with aramid fibers, carbon fiber is among the priciest materials ever. Its ability to increase structural capacity by several times is a plus, but the overall cost is significant. As a consequence, it is difficult to classify it as a product that primarily depends on superior outcomes. Even if the need for structural reinforcement is increasing daily due to the degradation of expanding urban infrastructure, the cost of these synthetic fibers rises in tandem with the many environmental requirements placed on their production. Despite being less expensive than carbon and aramide fiber, many persons who work with fiberglass packaging and goods have experienced dermatitis issues. Thus, innovative reinforcing techniques that use affordable and consumer-friendly fibers to create and manufacturing fiber-reinforced polymers are becoming more and more commonplace in order to extend the usable life of deteriorated urban infrastructure. Additionally, it should be considered that the materials chosen Functionality and an expansion or enhancement of the systems' numerous dwellings are examples of structural changes that must satisfy certain requirements for long-term viability and increased enjoyment. For instance, these substances must not harm biological resources or degrade the environment. They have to encourage self-sufficiency and be self-sufficient themselves. They must use their expertise to support regionally accessible materials. Paints for systems conditioning are therefore limited to the use of carbon fiber, glass, aramid, and a few other materials, and very few paintings are transferred to improve structures or utilize easily accessible materials or natural fibers. Instead of addressing the sustainability of these raw materials used for reinforcement, skeletal centers' composite efforts usually focus on employing synthetic fibers to boost hull strength. Because of the world's expanding population and rising purchasing power, there is a rapid increase in demand for the raw materials required for structural reinforcement that can meet global market needs.

2. LITERATURE REVIEW

Al-Rousan and associates [5] In addition to verifying the durability of nine exterior reinforced and concrete- reinforced beams with unique length and CFRP panel arrangement, the publication presents practical and statistical inspection results including static and increased stress. For stress stages 0.60 years to zero 80 years, zero 40 years to zero 80 years, zero 40 years to 0.60 years, and zero 30 years to zero 30 years, the firmness was evaluated. NLFEA was expanded to provide an enhanced comprehension of the impact of the breakdown pressure range, the CFRP layer by layer range, along with the distance of CFRP interaction with concrete on the durabiliTY (RC) beams after it was validated with the examination of the empirical findings.

The findings from field and computer-aided studies on the structural responses of mixed beams made from annealed glass panels and glass fiber reinforced polymer (GFRP) profiles are presented in Correia et al. [6]. Using GFRP reinforcing strips to boost the glass's residual strength and flexibility after fracture is the main objective of the precise structural reactions described here. The pilot project included two things: (1) substantial bending restrictions on glazing beams and combined glass beams, and (2) tension controls on double-lap junctions between glazing and GFRP laminates, coupled with novel patterns of structurally adhesives. -GFRP, using certain structural adhesives and stiffness geometry. The shape of the GFRP reinforcing detail and the stiffness of the construction adhesive utilized have a major impact on the combination of beams' structural response. For every tested beam, finite detail models were created, enabling a sufficiently accurate simulation of their service behavior (prior to glass breaking), particularly the classification of the shear reactivity at the connected interfaces.

Experimental study on reinforced concrete (RC) beams having external flexural along with bending strengthening using fiber-reinforced polymer (FRP) panels made of carbon FRP (CFRP) and fiber-reinforced polymer glass (GFRP) is presented in Jiangfeng et al. The panels demonstrated how the various reinforcement configurations of CFRP and GFRP panels influenced the behavior of the reinforced RC beams and investigated the bending, bending, and shear-strengthening capacities of modified RC beams. According to the research findings, the bending and shear-strengthening connection improves stiffness, electrical shutdown, and the rigidity behavior of RC beams more effectively compared to the bending bond.

Ghandour and associates. The strength during bending and shear efficiency of CFRP concrete girders are investigated in this research. Three changeable parameters were examined in relation to half-size girders, which have flexible proportions and a unique internal metal shear. U-caps or transversal panels constructed of reinforced plastic with carbon fiber are used to equip required bending or tearing beams. Shear or embedded structures supply critical shear and bending beams. The shear hardening efficacy at increased flexibility was found to be 38.3% lower in the case of good bending damage.

Yeong et al. Pilot investigations of reinforced concrete (RC) beams modified with a novel machine for mixed fiber-reinforced polymer (FRP), which consists of FRP glass (GFRP) and FRP carbon (CFRP), are reported in this study. The purpose of this article is to examine how hybrid FRPs affect the structural conduct of seasoned RC beams and to confirm if the CFRP & GFRP panel properties of hybrid

FRPs contribute to better RC beam reinforcing. In order to do this, 14 RC beams are produced and modified using mixed FRPs, which include special CFRP and GFRP component combinations. During retrofitting, the beams undergo loads in various diameters to examine how the initial load affects the bending conduction of the redesigned shaft. The connecting order of the FRP hybrid layers and the preload sizes are crucial factors to consider when examining the variations.

3. MATERIAL

The parameters and the qualities of products used for molding and strengthening of samples are: OPC Grade 53, which complies with IS: 12269-1987, was utilized for specimen casting in the test. The table below displays the characteristics of the cement that was utilized.

4. FINE AGGREGATES

Sand that has been treated was transformed for the test. They are commonly graded and cleaned to replace riversand and are milled aggregates made from solid cubic granite stone with ground edges. The desktop shows the characteristics of the rough texture used for look.

Coarse mixture used are 2 sorts, 20mm and 10 mm.The residences of coarse aggregates are given inside the table.

Table-01 fine aggregates properties

Sl. No.	Properties	Test results
1	Specific gravity	2.74
2	Water absorption	2.47%
3	Fineness modulus	3.07
4	Grading zone	Zone II

Table-02 coarse aggregates properties

Sl. No.	Properties	Test results
1	Specific gravity	2.75
2	Water absorption	1.11%
3	Aggregate crushing value	29.82

There are two types of coarse combination used: 20mm and 12mm. Within the matrix are the dwellings of coarse particles.

5. EXPERIMENTAL

Three sets of programs were offered in the beta testing. Because FRP was not used, the products in SETII were made to confirm the impact of complete immersion technology, whereas the products in SET I were made as a regulated sample (CB1, CB2). 90° (three-sided U wrap), only one layer of FRP glass (SB1, SB2) was used to strengthen the radius, and SETIII was a double layer encased beam (SB3, SB4). The specifics of the reinforcements used for the 3 sets of beams are presented below. Plywood was cast into beams. The specimens were left to d for dry 28 days following the removal of the mould. In order to reinforce the three features of the package that a FRP program might do, the beams were assembled by machining three side faces. The beams' three faces were washed to get rid of any last bits of dust after cleaning. The periphery area was set up similarly for the columns. The seller's handbook states that Araldite AW106, the resin along with the hardener combination, should have 100 components by weight and hardener.Additionally, HV953-80 components by weight were identified. The application of epoxy resin is done to the hard surface, and the fiber sheeting was wrapped beneath the neutral orientation of the beams on the wood fibers that had been cut to the desired size. Pieces were used to wrap fiberglass sheets. Additionally, air bubbles that were stuck at the interface have been eliminated.Prior to testing, every reinforced concrete beam was treated for a full day at ambient temperature.

6.RESULT

Together with the failure's type, the usual wear possibility rate of the beam preparation's closing load is explained.Similar to single and multiple-layered coiled samples, the drive beam exhibits a quicker deformation fluctuation with load. In comparison with single-layer looped samples, double-layer wrapped packages exhibit a progressive release of deflection under load. Regarding the increase in charge cost, the single-layer sample and double-layer pattern show a greater variance in specimen handling. Compared to drive girders, reinforced frameworks have a greater bearing capacity. The maximum load-carrying capacities of control supports, single-layer FRP looped beams, and double-layer FRP looped beams are 50 KN, 78 KN, 5 KN, and 84 KN.

7. CONCLUSION

Compared to the control beams, the single layer glass fiber coated beams can support 46% more weight.Compared to control beams, the double layer glass fiber wrapped beams can support 62% more weight. When exposed to a certain load, single layer fiber-glass wrapped beams bend less than regulate beams. At a given load, double-layer glass fiber-wrapped beams bend fewer than single-layer glass fiber-wrapped beams. The two main ways that FRP fails are by debonding and rupture. Even when the steel yields, a significant amount of reserve capacity remains in the beam.

8. REFRENCES

[1] Al-Amery, Riyadh, Al-Mahaidi, Riadh,2006. Coupled flexural–shear retrofitting of RC beams using CFRP straps. Compos. Struct. 75, 457– 464.

[2] Almusallam, Tarek H., 2006. Load–deflection behavior of RC beams strengthened with GFRP sheets subjected to different environmental conditions. Cem.Concr. ompos. 28, 879–889.

[3] Al-Rousan, R., Issa, M., 2011. Fatigue performance of reinforced concrete beams strengthened with CFRP sheets. Constr. Build. Mater. 25, 3520–3529.

[4] Barros, J.A.O., Dias, S.J.E., Lima, J.L.T., 2007. Efficacy of CFRP-based techniques for the flexural and shear strengthening of concrete beams. Cem. Concr. Compos. 29, 203–217.

[5] Al-Rousan, R., Issa, M., 2011. Fatigue performance of reinforced concrete beams strengthened with CFRP sheets. Constr. Build. Mater. 25, 3520–3529.

[6] Correia, Joa˜o R., Valarinho, Luı´s, Branco, Fernando A., 2011. Post cracking strength and ductility of glass–GFRP composite beams. Compos. Struct. 93, 2299–2309.

[7] Dong, Jiangfeng, Wang, Qingyuan, Guan, Zhongwei, 2013. Structural behaviour of RC beams with external flexural and flexural–shear strengthening by FRP sheets.Composites Part B 44, 604–612

[8] El-Ghandour, A.A., 2011 .Experimental and analytical investigation of CFRP flexural and shear strengthening efficiencies of RC beams. Constr. Build. Mater. 25, 1419–1429

[9] Kim, Hee Sun, Shin, Yeong Soo, 2011. Flexural behavior of reinforced concrete (RC) beams retrofitted with hybrid fiber reinforced polymers (FRPs) under sustaining loads. Compos. Struct. 93, 802–811.

[10] Ceroni, F., 2010. Experimental performances of RC beams strengthened with FRP materials. Constr. Build. Mater. 24, 1547–155