EXPERIMENTAL AND ANALYTICAL INVESTIGATION ON CONVENSIONAL CONCRETE REINFORCED BEAM AND COLUMN WRAPPED WITH GLASS FIBRE REINFORCED POLYMERS SHEETS.

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Abstract: *Maintenance, repair and strengthening of structures are important problems in the construction site. Wrapping RC beams and column with fiberglass-reinforced polymer sheets increases strength. Finite element reinforced concrete models of unreinforced and reinforced concrete beams and column were analyzed using the ETABS finite element program. In the analytical study, beams and column were analyzed in software. In the study, beams and column were cast and analyzed in ETABS software. The reinforcement was done by gluing GFRP panels to the entire volume of the beam and column. This article models a beam and column based on the three weak points of beam and column, parallel beam and extreme beam. Ultimate damage load, deflection, crack morphology and strength development percentage As a result of software analysis and experimental studies, it has been determined that the ultimate bearing capacity of reinforced concrete beams wrapped with GFRP panels is higher than uncoated beams.*

Keywords: **GFRP sheet-Glass fibre reinforced polymer sheet, ETABS analysis, Model analysis.**

1. INTRODUCTION

Fiber reinforced concrete (FRC) is a composite material made from fiber materials that add structural strength and integrity. ACI defines the term FRC as composite concrete consisting of dispersed, randomly oriented fibers. Because concrete is a hard material, it has poor tensile strength and is susceptible to cracking, freeze-thaw damage, flaking, discoloration and steel corrosion. Therefore, to solve these problems, fibers are added to the concrete to control cracks and ruptures. In general, many synthetic and natural fibers are used to control cracks in concrete and the propagation of cracks through plastic and drying shrinkage. Papers published by Romualdi and Batson in the early 1960s brought the FRC to the attention of economists and economists worldwide. Since then, researchers have conducted many studies on the development of FRC by combining various fibers such as glass, polypropylene, plastic, bamboo, carbon, sisal and jute fibers. The purpose of this article is to describe the effects of adding different types of fibers to concrete glass fiber reinforced polymer (GFRP) materials, which are widely used in the construction of composites. The matrix includes organic resin, polyester resin, heat-resistant resin, vinyl ester resin, phenolic resin and epoxy resin. Polyester resin is divided into bisphenol type and ortho or meta type. The properties of fiber-reinforced materials depend on fiber strength and modulus, chemical stability, matrix strength, and interfacial bonding resulting in stress transfer between fibers/matrix. Proper fiber composition and orientation enable GFRP composites to achieve the required strength and performance characteristics compared to steel, to be stronger than aluminum and to have a specific absorbency that is a quarter of that of steel.

2. Methodology

- Referring all the relative research papers to choose the sizes of column and beam. Select the M30 Grade of concrete mix proportion ratio for casting according to the IS-codes IS-10262:2009 and IS-456:2000. Selection of the basic parameters of ingredient and proper method to be used.
- Longitudinal reinforcement placement and placement of steel stirrups. While the concrete and the steel properties were determined according to IS-codes.
- After Formwork, reinforcements and oil application beam and column casts by concrete reinforcements also making the T section of beam and column joint and

applying epoxy chemicals on column and beam specimens then they are wrapped with Glass fiber sheets.

- Transforming the beam and column to storage it. Taking a various tests and apply the loads as per IS code IS-875 (part1&2).
- Collecting the result of water absorption tests, flexural strength test and compression test, torsional twisting moment and loads applied on conventional concrete reinforcements and GFRP specimen. Design and Analysis it on ETABS software.
- Results of all Experimental and analytical comparisons were tabulated and discussed.

2. Literature Review

Shaikh Zahoor Khalid.(2022)[1] In this paper author summarizes the ongoing research on use of Fiber Reinforced Polymer (FRP) in structural strengthening. Strengthening is required when the structural members are damaged under excessive external loading or when there is change of Structural use of the Structure. Since Fiber Reinforced Polymer have been the source of an increasing interest in the field of rehabilitation, the main focus of author in this paper is to study the work done by various researchers on the application of Fiber Reinforced Polymer (FRP) in rehabilitation of Structures. The main findings obtained in the previous studies are mentioned and the issues that are not yet well understood.

Muhammad Anas , Majid Khan , Hazrat Bilal, Shantul Jadoon and Muhammad Nadeem Khan. (22 sepember 2022) [2] The author says that the Concrete is the most widely used constituent in the construction industry as a construction material due to its wide range of applications to civil infrastructure works. However, the use of concrete has been limited due to its certain deficiencies such as brittleness, low tensile strength, proneness to crack opening and propagation and low durability. To subdue these drawbacks, researchers have modified concrete by adding various synthetic and natural fibers to upgrade the nature of concrete. The demand for high strength and cracks resistant concrete led to the development of fiber-reinforced concrete. This paper and authors reviews the effects of fibers inclusion on the performance of concrete. Generally, the addition of fibers improves tensile strength, flexural strength, and durability performance. Moreover, incorporating fibers reduces the shrinkage cracks of concrete. However,incorporating fibers in concrete has some negative effects like low workability.

Jawed Qureshi (8 March 2022) [3] In this paper authors reviews the Fibre Reinforced Polymer (FRP) composites in Civil Engineering applications. Three FRP types are used in Structural Engineering: FRP profiles for new construction, FRP rebars and FRP strengthening systems. Basic materials (fibres and resins), manufacturing processes and material properties are discussed. The focus of the paper is on all-FRP new-build structures and their joints. All-FRP structures use pultruded FRP profiles. Their connections and joints use bolting, bonding or a combination of both. For plate-to-pate connections, effects of geometry, fibre direction, type and rate of loading, bolt torque and bolt hole clearance, and washers on failure modes and strength are reviewed. FRP beam-columns joints are also reviewed. He investigated that The joints are divided into five categories: web cleated, web and flange cleated, high strength, plate bolted and box profile joints. The effect of both static and cyclic loading on joints is studied. The joints' failure modes are also discussed.

Ahima Ashokan . Dona Chacko(2019) [4] They has investigated that the grade Strengthening of RC beams is necessary to obtain the expected life span of structures.

Life span of RC beam may reduce because of improper beam design, ingression of chemical agents etc. Strengthening of RC beams using steel plates and FRP composites are most common globally. In order to minimize the disadvantages of steel such as corrosion, high unit weight, connection difficulties, many researchers have tried various FRP composites such as Aramid, Glass and Carbon. Advantages given by this material is such as resistance against corrosion, high tensile strength, superior ductility, light weight, and absence of heavy additional equipment in application. As their observation the strengthening of the beams is done with different amount and configuration of GFRP sheets. Four beams are casted and preloaded before wrapping with GFRP and then they are tested to determine their ultimate load and flexural strength. Study is carried out to get the effect on ultimate load carrying capacity and failure mode of the beams using externally bonded GFRP fibre sheets.

Pranoy Roy(July 2018) [5] Attempt is made in this paper to study the effect of Glass Fiber Reinforced Polymer (GFRP) in exterior beamcolumn joints subjected ultimate loads. Specimens with adequate reinforcement of M20 grade of concrete are prepared and woven GFRP is wrapped at the corners upto 1/3rd length. Specimens are wrapped with one layer, two layer and three layer of GFRP and compared with control specimens.

S.Bharathi(2017) [6] In this project, experimental study as well as analytical study has been done. In this project, two beam column joint specimens have been casted. The first specimen is considered as control specimen who is casted without GFRP wrapping. In the second specimen, before concreting, GFRP sheets pasted by epoxy adhesive are wrapped initially with reinforcement. The two specimens are checked for its load carrying capacity, load-deflection behaviour and cracking pattern. The comparison of results shows that GFRP sheets are very effective in improving shear resistance and deformation capacity of the corner beam-column joints and delaying their stiffness degradation. The corner as well as exterior beam-column joint is analyzed by using Ansys software with varying stiffness of beam-column joint. The behavior of exterior and corner beam-column joint subjected to cyclic loading is different. The results which will be obtained from the experiment and by software analysis will be characterized by plotting various graphs like load vs. deflection (deformations), Maximum stress and Stiffness variations. The failure modes and crack patterns are noted to get better understanding on the performance of beam column joints strengthened with GFRP sheets.

Nimesh Mohan M (2015) [7] Fibre Reinforced Polymer (FRP) composites are widely used for strengthening concrete structures because they have many advantages over conventional strengthening methods. Much research has been carried out over the past decade into the performance of concrete beams strengthened in shear with externally bonded FRP composites. Previous experimental studies have shown FRP composites are effective in increasing the shear capacity of Reinforced Concrete (RC) beams. Despite numerous interesting studies, the shear behaviour of RC beams strengthened with FRP is not well understood. The majority of tests have been carried out on simply supported beams without steel stirrups strengthened with complete side wrap, U-wrap or full wrapping of the section with Glass Fibre Reinforced polymer (GFRP) sheet.

6. Conclusion

[1] Lack of data arrangement that is record by using manual system and using a lot of paper to record the student information, student result and performance

[2] The manual system is hard to search and update about the student information, result and performance.

[3] The software analysis providing the more accuracy to find out shear failure, bending moments and defection.
[4] Find out best effect of GFRP sheet cover in column and beam.

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