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Analysis of Strengthening RC Beams Using Stainless Steel Continuous Reinforcement Embedded at Ends Using ANSYS

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Abstract: An innovative system for the flexural strengthening of RC structures designated continuous reinforcement embedded at ends (CREatE) is presented in this research work. The main charateristics and procedures for the application of this new strengthening techniques were described. To evaluate the performance and efficiency of this technique, a set of RC T-beams was subjected to a four pointed bending test setup. Different application arrangements and different amount of reinforcement were considered, and the CREatE technique was tested under monotonic and cyclic loading histories. The tests were modeled using the nonlinear finite element method (FEM) to predict the performance of the RC T beam, which allowed analysing, in detail and with good agreement with the experiments, the influence of the CREatE technique on the (1) strains developed in the concrete, (2) cracking patterns, and (3) strains developed in the stirrups. Apart from the expected increases in the flexural stiffness and load bearing capacity of the T beam, the result showed that the use of the CREatE technique led to higher ductility indexes in the displacement compared with traditional techniques. Moreover, with the CREatE technique, premature debonding of the reinforcement material from the concrete tensioned surface commonly observed in externally bonded reinforcement (EBR) strengthening system was eliminate.
Keywords: CREatE, Finite Element Method, Monotonic, Cyclic Loading, Ductility Indexes.

I. INTRODUCTION

This Building and bridge structural repair is a crucial step in extending their life span and promoting the sustainable growth of our society as a whole. Due to the strength to weight ratio or low susceptibility to corrosion when exposed to external conditions, using composite materials based on either polymeric or cement matrices appears to be a good substitute for conventional materials and procedures. T beams are a type of beam that is frequently employed in construction because of their higher moment of inertia, flanges that resist bending, and ductility. Examining the usage of glass fiber reinforced polymer (GFRP) rebar with fiber reinforced polymer (FBR) U wrap for T beams. T beams are frequently flanges that prevent bending, and ductility. A set of RC T-beams were put under a four point bending test configuration to assess the effectiveness and performance of this method. With stronger strength to weight ratios, higher stiffness to weight ratios, flexibility in designs, non corrosiveness and reduced density, GFRP tubes are used. Instead of steel reinforcement, GFRP tubes in various designs are used. U wraps are employed because they have a strong anchoring and high shear impact. The difference is examined after the GFRP sheets provide and retrofit the cracks. The externally bonded FRP reinforced elements debonding failure will be delayed by the confinement stress and frictional slide generated by U wrap between the two deboned surfaces. Utilizing U wraps increases flexural strength by 33%.

A. Objective

1) To evaluate the performance of GFRP rebar in T beams and different configurations.
2) To investigate how the large-scale FRP-enhanced T-beams with U-wraps respond to the frictional bond-slip model.
3) To determine the most effective method for retrofitting to prevent the spread of a crack.

B. Scope

1) The work is limited to modelling and analysis of T beams using GFRP sheets using ANSYS.
2) The work is focused only on GFRP sheets and the cracks provied on the T beam

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II. RESULTS AND REVIEW

ANSYS is used to draw the beam's geometry. Modeled is a T Beam with dimensions of 305X405X105X150. 3 12mm diameter At the bottom of the website are bars. 6 8 mm diameter At the flange, bars are offered. 6 mm wide by 6 mm long. There are stirrups available with a 150 mm spacing.

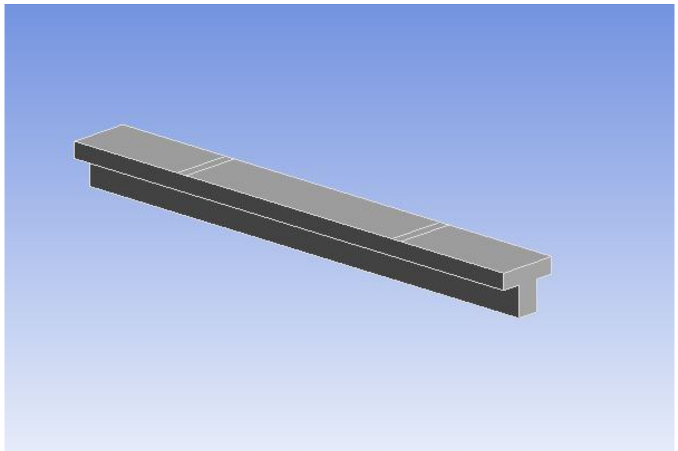

Fig.1: T beam geometry

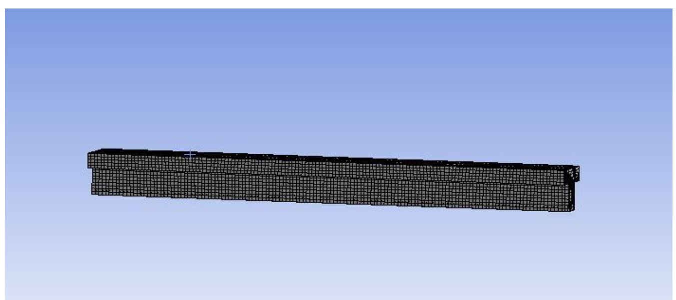

Fig 2: mesh diagram

1) hexahedral meshing
2) 4 ,20noded 3D element
3) Number of nodes :108669
4) Number of elements :24639
5) Element size :10mm

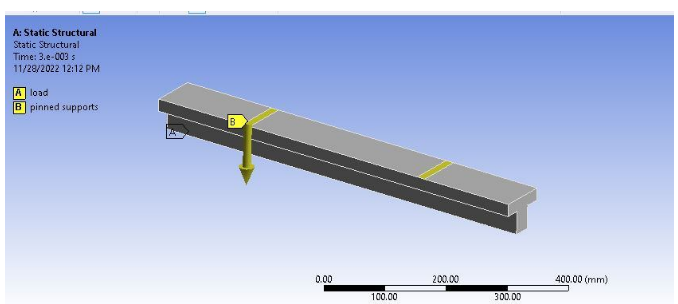

Fig 3: Boundary condition

a) Load on plates of the along y direction
b) Pinned support along bottom (face partition)
c) Non-linear analysis is carried out in the renovated RC frame under cyclic loading.
d) The load deflection values were obtained for the 12mm, 8mm and 6mm diameter GFRP reinforcement and compared
e) The total deformation and equivalent stress diagrams were also obtained.

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III. ANALYSIS RESULTS

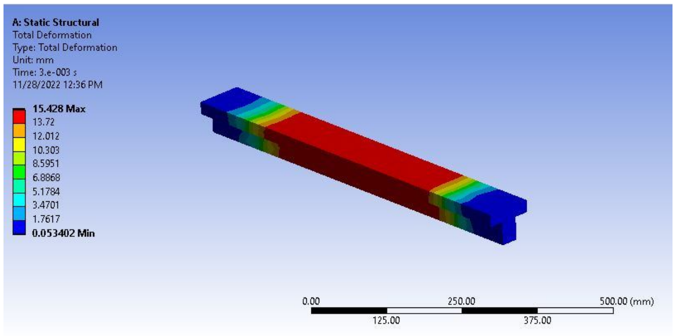

Fig 4: Total deformation

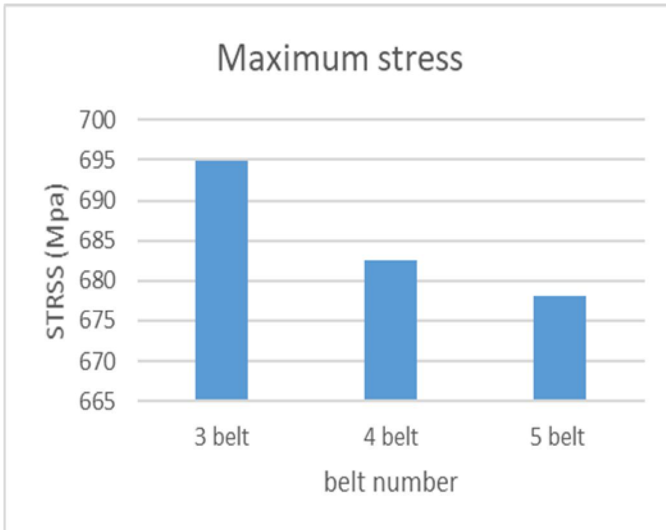

Chart -1: Maximum Stress Chart

The ultimate flexural capacities of T beam high-strength concreate beams with and without GFRP reinforcement were compared. As expected, circular openings reduced the ultimate flexural capacities of T beam high-strength steel beams. This reduction in flexural capacity was due to the stress concentrations, which occurred near the beam centre. When the GFRP rebar were 6mm , 8mm and 12 mm diameter , they had little influence on The ultimate force capacities. For the narrow depth of beam high-strength GFRP rebar with a 12mm bar, a reduction of about 10% in flexural capacity was observed, when compared to the flexural capacities of T beam with GFRP bar. For the with rebar, which had diameters of 12mm, the failure modes, and location of failures were changed from local buckling of the T beam centre loading position to the local buck.

IV. CONCLUSION

1) From the results in load deflection obtained from analysis using ANSYS, it was observed that 6 mm dia. Bracings have higher value .
2) 8 mm dia. Bracings have lowest load-deflection value.
3) Hence 6mm dia. Bracings will give higher load carriying capacity.
4) Better results were obtained in load carrying and stress distribution thanks to the T beam FRP belt layout.
5) Compared to other belt layouts, the fifth belt offers the best performance.
6) According to the load deflection results from the ANSYS analysis, 6 mm dia. bracings have a greater value
7) The T beam FRP belt configuration led to better outcomes in load carrying and stress distribution. Increase the belt configuration for the most stability possible.
8) FRP attachment is an effective way to stop fracture spread.

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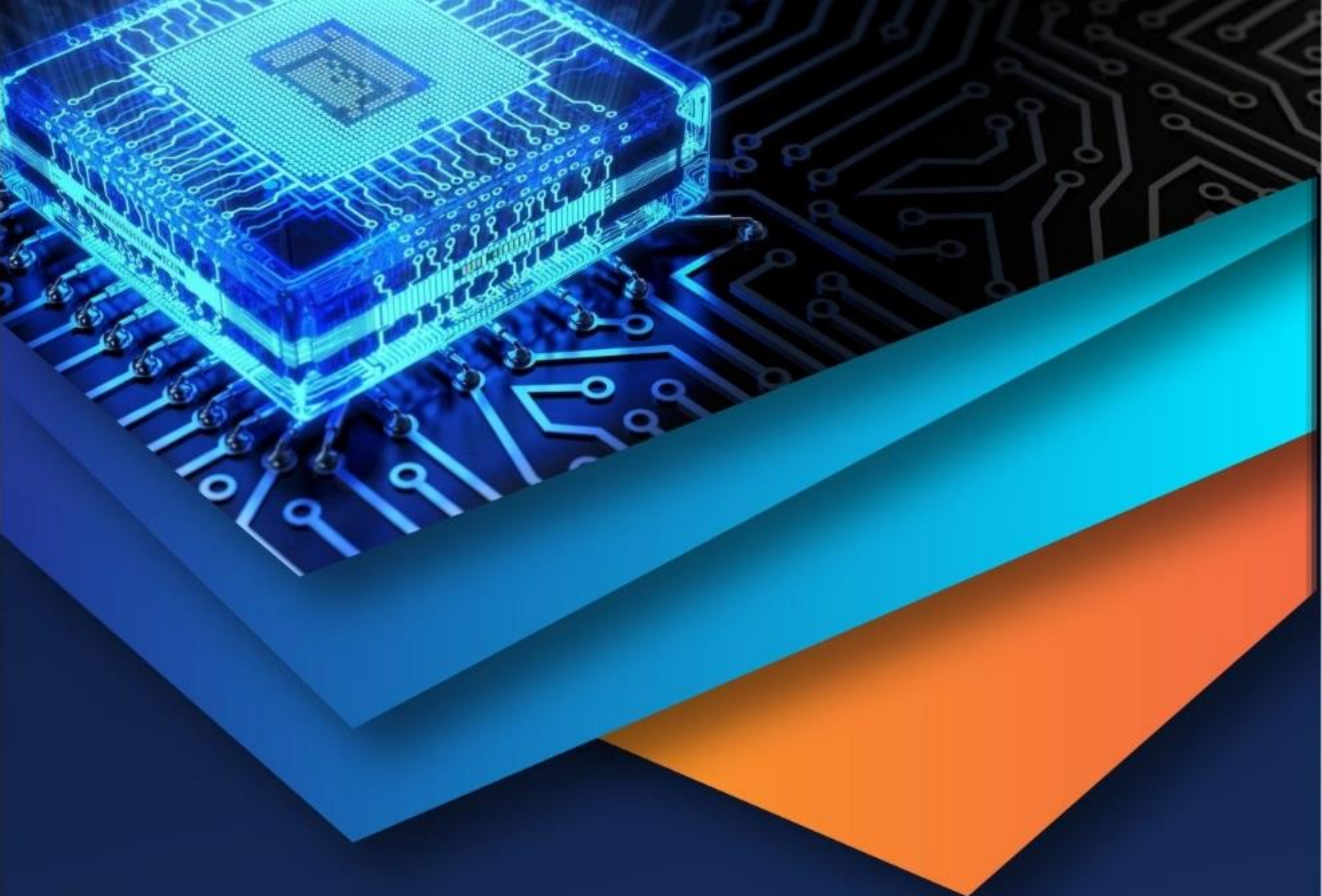

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