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Comparative Study of with and without Crack Propagation on Double Edged Beam using Different Retrofitting Conditions

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Abstract - *Externally bonded fiber reinforced polymer (FRP) plates, rib and corrugated plates can significantly improve the fatigue behavior of cracked steel members. This increases the transverse direction load transfer capacity by using corrugated plates. The modification of steel beam using rib alternative arrangement can also increase load carrying capacity. Steel beams are evaluated based on the fracture mechanics theory and finite element (FE) modeling to predict the crack growth behavior .This method was verified by comparing the different retrofitted models results. The comparative results indicate that the crack growth life of the strengthened double-edged cracked steel beam can be improved.*

Keywords: Crack, Fatigue Behavior, FRP Plates, Rib, Steel Plate

1. INTRODUCTION

The use of Fibre Reinforced Polymer increases the strength and repair steel beam. This technique benefits from the light weight and extra strong beam and pre crack beam to enhance the flexural capacity of different loading cases. The behavior of steel beams strengthened with FRP plates, rib and steel plate in flexure has been subjected to several studies. This study focused on investigating the effect of development load carrying capacity and determining the stress & strain capacity under non-linear loading condition. Comparing with other strengthening methods, FRP plates, rib, steel plates are recommended in this study. FRP plates are corrosion resistant material and increases durability. To increase the strength of steel beam, steel plate is attached by welding or bolted. The plates are provided with thickness of 2mm. Ribs are arranged alternatively to improve the strength and load carrying capacity.

1.1 Objective

- To study FRP plate on double –edged area, and finding crack propagation
- To study the steel plate for transverse load transfer
- To compare without crack and with crack beam condition

1.2 Scope

- To increase the load carrying capacity of double- edged beam
- To improve the fatigue behavior of cracked steel members.
- This method is more effective than the traditional welding method
- Increasing the strength of beam using retrofits operation by plates and ribs.

2. METHODOLOGY

- Literature review: To cover the past studies and understand the enhancement that can be provided for the present work.
- To create different type of model using ANSYS software.
- To apply the different types of boundary conditions.
- Analysis of the structure: Different types of analysis using ANSYS software.
- Analysis of results: The result will be analyzed and compared the all the types of models.

Table -1:

GEOMETRY				
MEMBER	DEPTH d (mm)	WEB THICKNESS (mm)	FLANGE WIDTH (mm)	FLANGE THICKNESS (mm)
BEAM	150	4.8	80	6.8

3. DIFFERENT TYPES OF MODELS

FIG -1: Central Loading

FIG- 2: Crack In Central Loading

FIG- 3: FRP In Central Loading

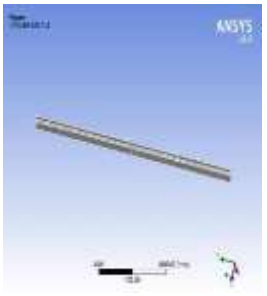
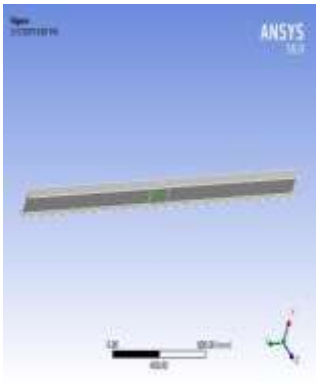


FIG- 4: Rib In Central Load



FIG–5: Steel plate in central loading

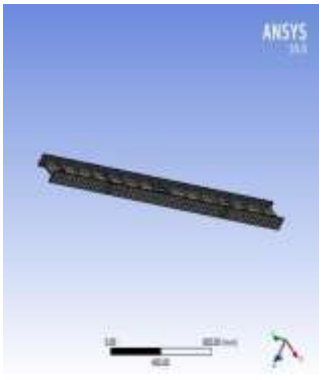


FIG- 6: Mesh

3.1 BOUNDARYCONDITION

FIG-7: Normal beam

FIG-8: Double edged beam

4. RESULT AND REVIEW

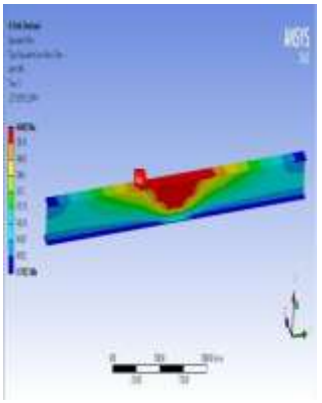


FIG-9: Stress Central

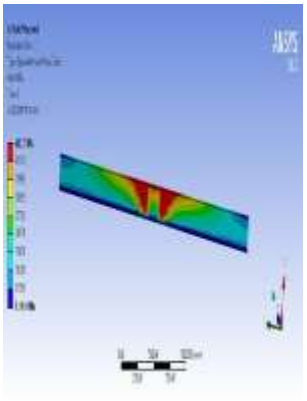


FIG-10: Stress Frp

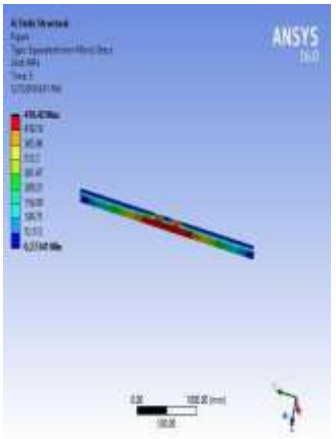


FIG-11: Stress Rib

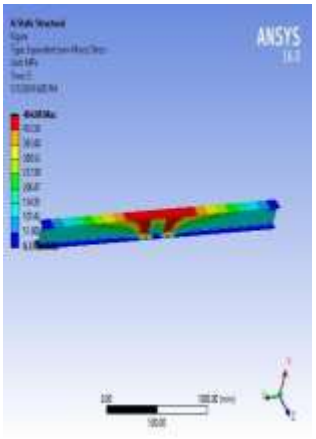


FIG-12: Stress Steel

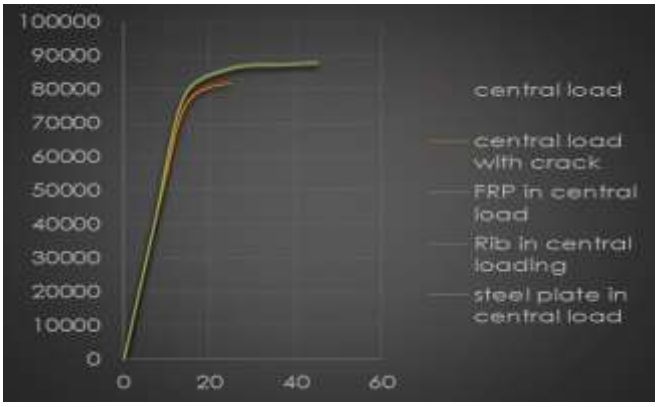


CHART 1- Force v/s displacement graph – central loading with crack

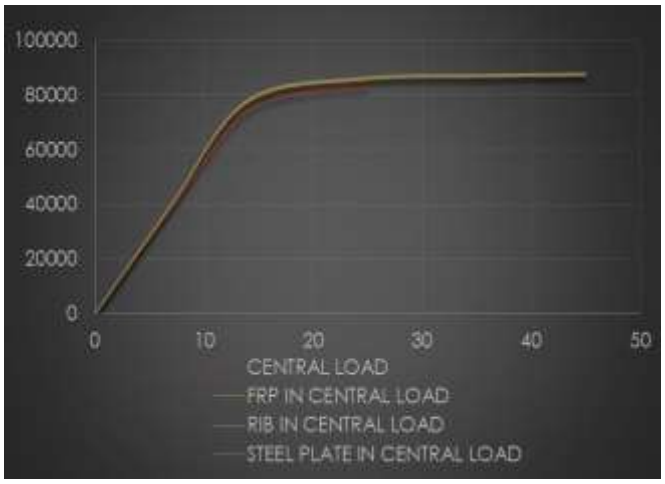


CHART 2- Force v/s displacement graph – central loading without crack

5. CONCLUSION

This paper focused on various strengthening technique by retrofitting steel beam using FRP plates, rib, and steel plates. From this study, strength of steel beam with and without crack retrofitted by Rib gives better result in central loading condition and for 2 point loading condition with and without crack , steel plate gives better result and for 3 point loading condition with and without crack, FRP gives better results.

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