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Finite Element Analysis of prefabricated Steel Frames Under End Plate Boundary Condition

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Abstract - *In prefabricated buildings, the members are fabricated in factories and assembled together on site. Have relatively better construction quality and faster construction speed. The beams and columns are bolt connected, slabs are connected with frame using stud shear connectors and braces are connected with frame using fillet welds. The aim of the study is to evaluate the strength of single reduced beam. Reduced beam section is cut from flange of the beam at a particular radius. Radius of cut depends on the geometrical shape of the section. Reduced beam section is useful to achieve higher ductility of seismic system. Also improve the performance of structure under earthquake. To determine the best retrofitting method in reduced beam concept using ANSYS software.*

1. INTRODUCTION

During Northridge earthquake, the steel frames of bolted and web connections have undergoes lot of damages. Loss of life of peoples and other material damages was also occurred in this earthquake. The prefabricated steel structure is a modern type of steel structure and nowadays it will also use in some countries. Compared with old type of reinforced concrete structures, the prefabricated structures have many advantages in modern year. The main advantages are, construction speed increases and also reduces the construction period. The main problem occurs in steel structure system is that, the problem occur in steel bolted connections. In this study, a beam to column end plate was analyzed using ANSYS by the use of FE modeling. The results are compared by experimental and validation values. Reduced beam section (RBS) is one of the most important for several types of models. It is very economical for modern steel moment frame structures in seismic areas. To form RBS, some radius of the beam cut at a certain distance. Thus plastic hinge point and yield point occurs in this area.

1.1 Objective

- To study the single reduced beam.
- Optimize single reduced beam by placing plates in major stress concentration area.
- Changing the material of plates and change the pattern of bolt.
- To place the web or rib in suitable area to protect the entire beam.
- Checking different load conditions.
- Rotation, Displacement, Axial loading, Lateral loading, cyclic loading etc.

1.2 Scope

- To develop a finite element model with high accuracy, good stabilization and acceptable computational costs.
- Flexible building creations.
- Reducing the frictional loss in plates.
- 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)
COLUMN	162	8	154	11.5
BEAM	200	5.6	100	8.5

3. DIFFERENT TYPES OF MODELS

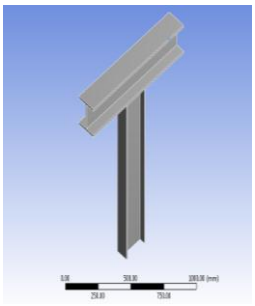


FIG -1: Normal beam section

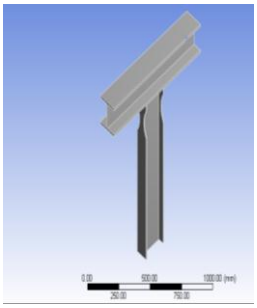


FIG- 2: RBS of Radius Cut 2.27 Radian.

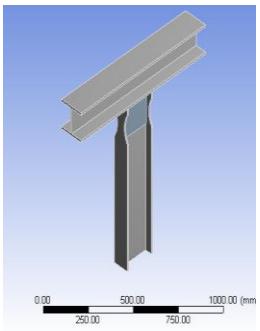


FIG- 3: RBS using Plate

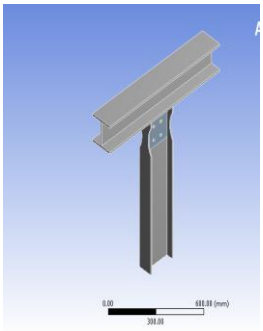
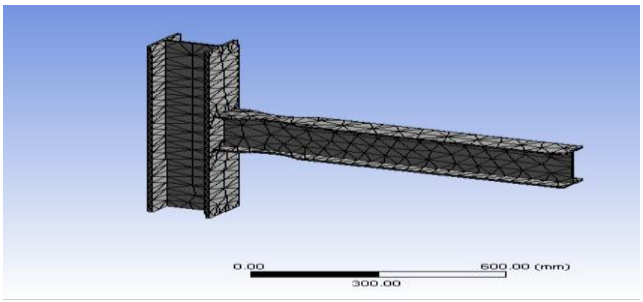


FIG- 4: RBS using bolt



FIG–3: Finite element model mesh

3.1 Boundary Condition

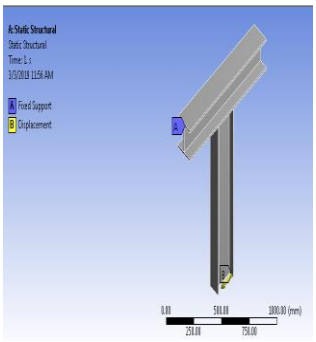


FIG -1: Normal beam section

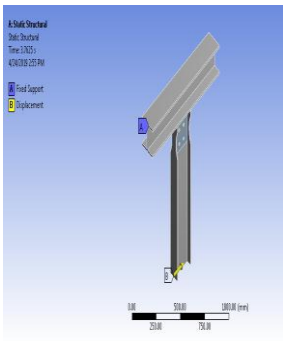


FIG- 4: RBS using bolt

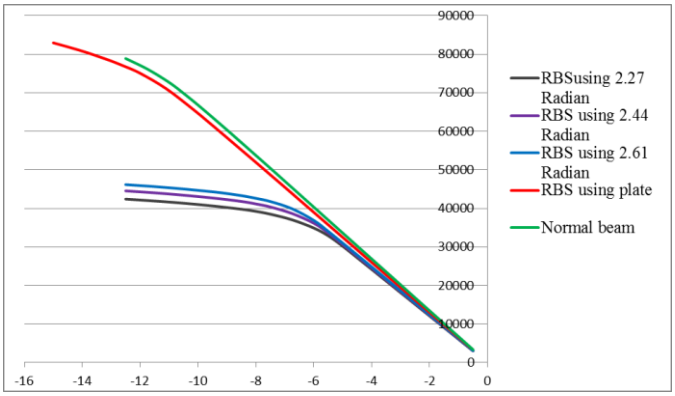


Chart 1- Force versus Displacement graph

4. RESULTS AND REVIEW

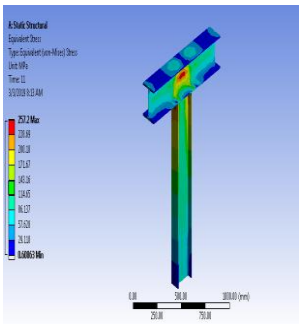


FIG-1: Normal beam section

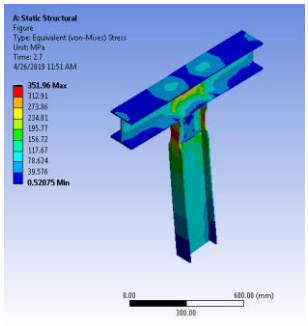


FIG2: RBS using bolt

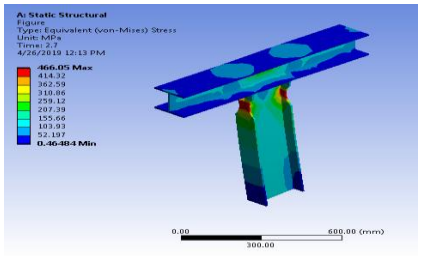


FIG- 3: RBS using Web

Table- 2:

MODEL	EQUIVALENT STRESS
Normal beam section	257.2
RBS using bolt	351.96
RBS using web	466.05

CONCLUSION

The reduced beam shows better stress distribution than normal beam. To improve the strength of reduced beam by some retrofitting methods such as placing plates. It includes web plates, plate with bolt arrangement. Finally, the strength

and force distribution of frame structure of reduced beam with plate and bolt arrangement give better results than normal beam. To observe the cyclic performance of normal beam and reduced beam, there must be stress distribution variation. Normal beam have stress concentration point. In reduced beam, stress is distributed in overall structure. The retrofitting method of web arrangement in reduced beam, the web carrying the maximum stress. So the reduced area will be safe.

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