IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

REDUCE WEB SECTION IN BOLT EXTENDED ENDPLATE MOMENT CONNECTION: A NEW STUDY

[1]Arun p k, [2]Dr.Sunilaa George,

[1,] ME Student, [2] Professor and Head of the Department

[1]ME Structural Engineering,

[1] EASA College of Engineering and Technology,Coimbatore,Tamil Nadu, India.

Abstract: The goal of this study is to determine the reduced web section's (RWS) moment carrying capacity in steel beam column joints with extended endplate moment connections. ANSYS 16.0 is used to assess a reduced web section (RWS) with five numbers of both vertical and horizontal slots. In order to enhance the cyclic performance of moment connections with lower beam section, extensive research has been conducted on steel moment frames (RBS). In addition to the hole cutting of the beam flange and radial reduction, some researchers have proposed reduced web section (RWS) connections as an alternative to RBS connections. The focus of the current study is on RWS connections with horizontal and vertical slits as a cost-effective alternative with a variety of design criteria**.** The purpose of this study is to determine appropriate ranges for the geometric design characteristics of the VS-RWS and HS-RWS connections. To evaluate the performance of the connections, two full-scale specimens of the bolted extended end-plate VS-RWS, HS-RWS connection were tested under cyclic stress in this order. Next, a parametric investigation was conducted using the validated numerical models.

Index Terms – **Reduced beam section, Reduced web section, connection, slits, moment**.

1. INTRODUCTION

In seismic zones, such as earthquake-prone locations, the moment resisting frame technology had been widely used in the construction sector. Many conventional moment connections failed to provide the desired ductility as a result of the Northridge earthquakes in 1994, and the connections were vulnerable to brittle fracture. Reducing the beam section, based on the strong column-weak beam principle, and forming a plastic hinge relocation in the reduced region are two methods for enhancing the performance of these connections. This section, which serves as a stress distribution area, generates some suitable ductility to stop the connection from becoming brittle. Given that the web of the beam only contributes marginally

2. OBJECTIVE OF PROJECT

- RBS and RWS comparison
- RBS and RWS comparison on ductility for all types of connections
- To compare the stiffness of RBS and RWS.

3. DECREASED BEAM SECTION AND DECREASED WEB SECTION

Slits are used to introduce reduced web section. Examples of condensed web parts include:

- Vertical slits in the reduced web section
- Reduced web section with slots running horizontally

Reduced web section types include radial circular cuts with holes of the same radius. Reduced web section types include radial circular cuts with holes of the same radius.

In the overall modelling, the reduced web section with horizontal slits outperforms the reduced beam section and reduced web section in terms of moment carrying.

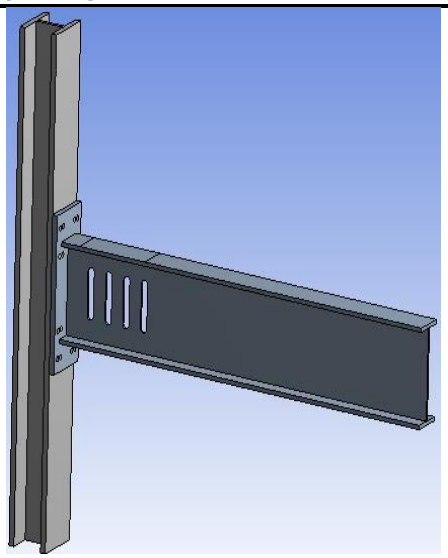

Fig 1: HS-RWS

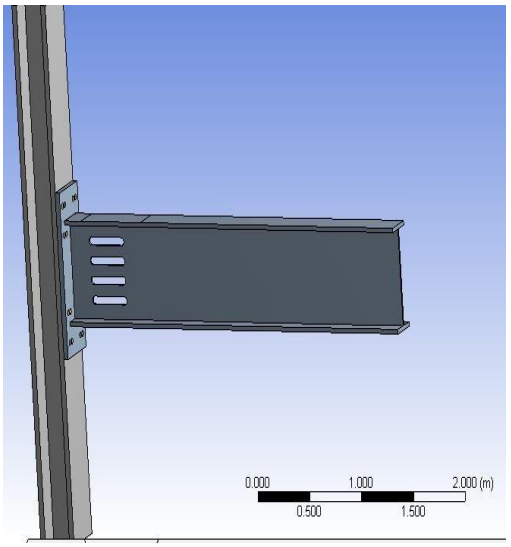

Fig 2: VS-RWS

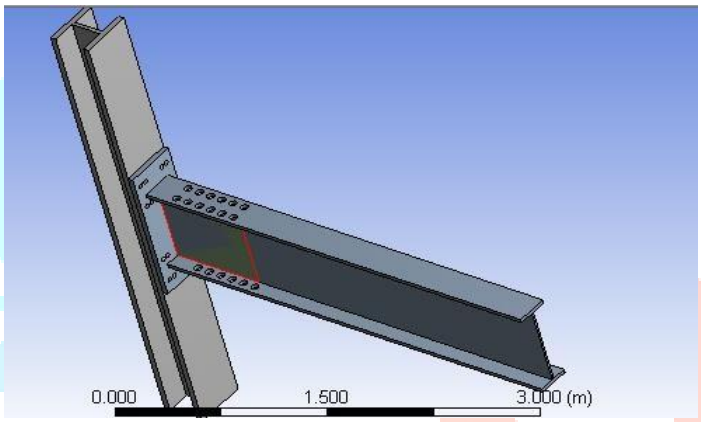

Fig 3: RBS-SH

4. MODELING AND ANALYSIS

4.1. Details of Models

a = 0.5-75% of flange width
b = 0.65-0.85% of depth of beam c′ = 0.1-0.25 % of flange width g/4 = % of b

a=200	b= 562	2c′ = 312	g/4=56

It is investigated the decreased web section with slits. Figure 4 shows a beam web with five equal-sized slits. Figures 6 and 7 depict the hysteresis behaviour of RWS with vertical and horizontal slits. RWS's equivalent stress is depicted in Figures 8, 9. When compared to RBS, the RWS section with both vertical and horizontal slits exhibits an equal moment bearing capability. Fig. 5 depicts the reduced beam section with circular cutting. At the beam flange, there is a circular cutting with a 60mm diameter that has 6 numbers of holes in 2 rows. Figure 9 depicts the corresponding stress distribution.

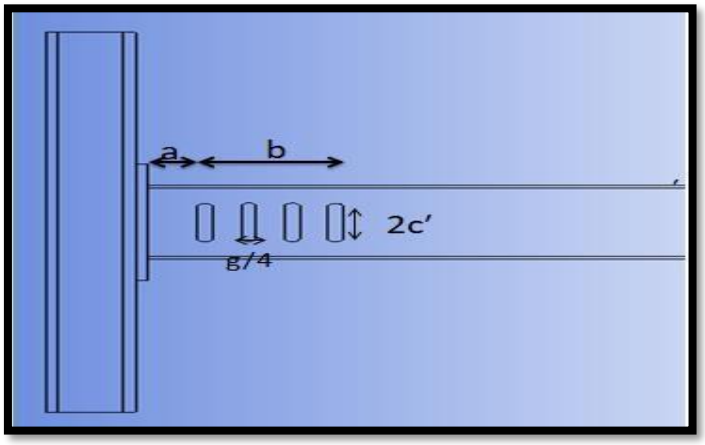

Fig 4: Details of Reduced web section

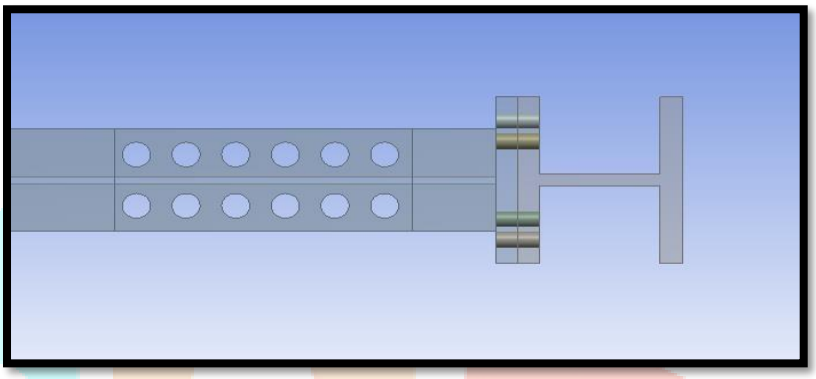

Fig 5: Details of Reduced beam section with same holes

5. Material properties

Table1: Material properties

Properties	Steel	Bolt
Young's modulus (KPa)	2×10^{11}	2×10^{11}
Yield strength (MPa)	599	490
Poisson's ratio	0.3	0.3

6. DETAILS OF COMPARISON STUDY

According to the investigation, reduced web section and reduced beam section on bolt extended ending plates perform better under cyclic loading than reduced web section and reduced beam section.

Models for analysis using RWS and RBS

One model of a reduced beam section with circular cutting and two models of a reduced web section with slits are offered in this study. They were offered in a beam column junction with a beam section of W760X 220 and a column section of W360 X382.

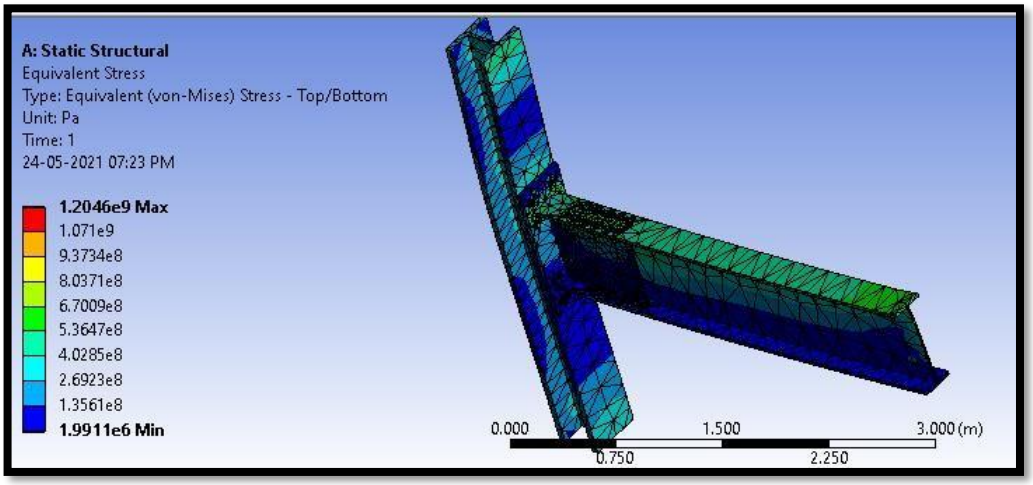

Fig 6: Stress distribution of RBS-SH

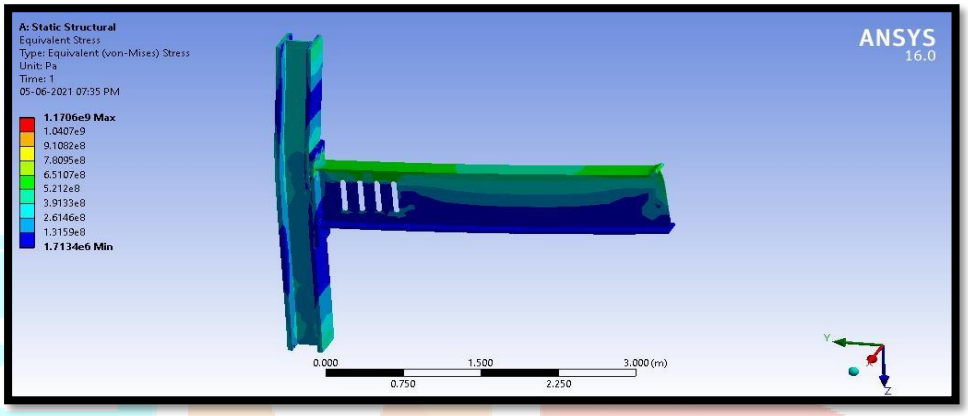

Fig 7: Equivalent stress distribution of beam web with vertical slits

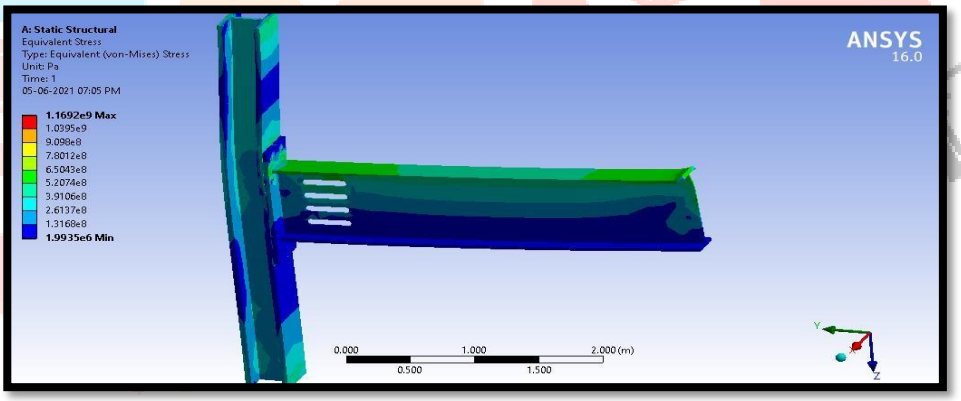

Fig 8: Equivalent stress distribution of beam web with horizontal slits

RESULT AND DISCUSSION

It was noticed the maximal moment and its associated rotation. Below is a result of an analysis performed using ANSYS 16.0. It is investigated the decreased web section with slits. The stress distribution of a beam web with five equal-sized apertures is shown in Figures 7 and 8. Fig. 6 depicts the shortened section with the round hole. Figures 9, 10, and 11 depict the hysteresis behaviour of RWS with vertical and horizontal slits. When compared to RBS, the RWS section with both vertical and horizontal slits exhibits an equal moment bearing capability.

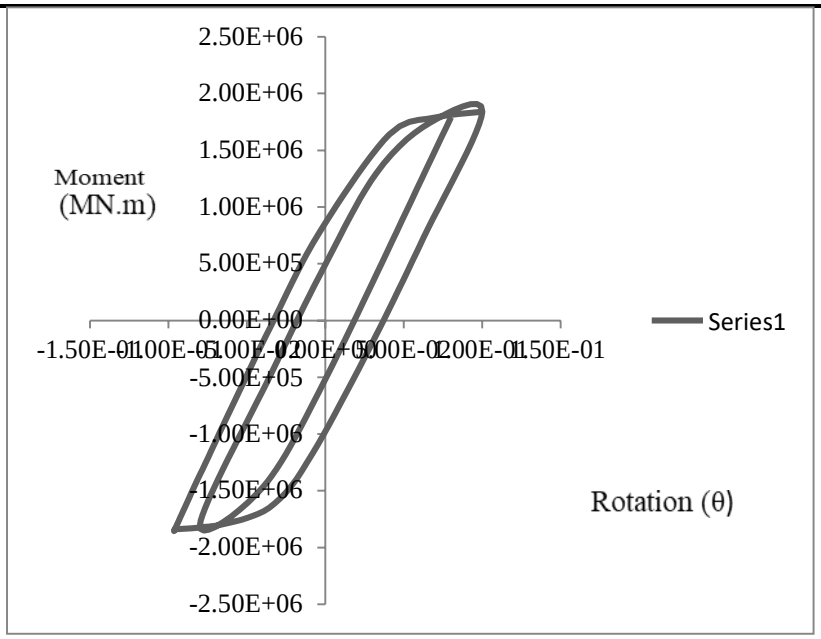

Fig 9: Moment Rotation graph of beam flange with RBS having same holes

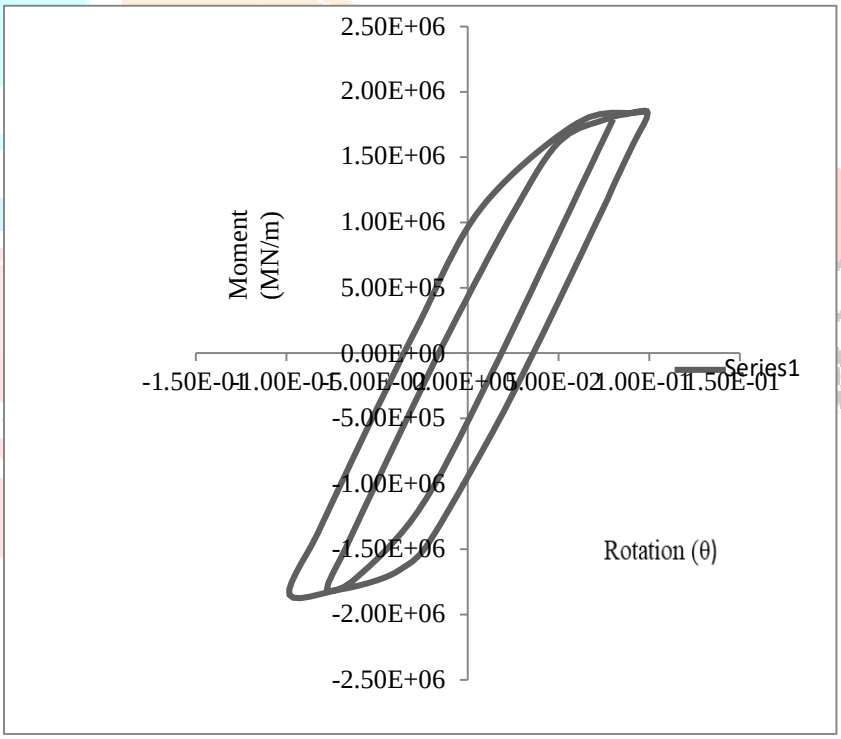

Fig 10: Moment Rotation graph of beam flange with RWS having Vertical slits

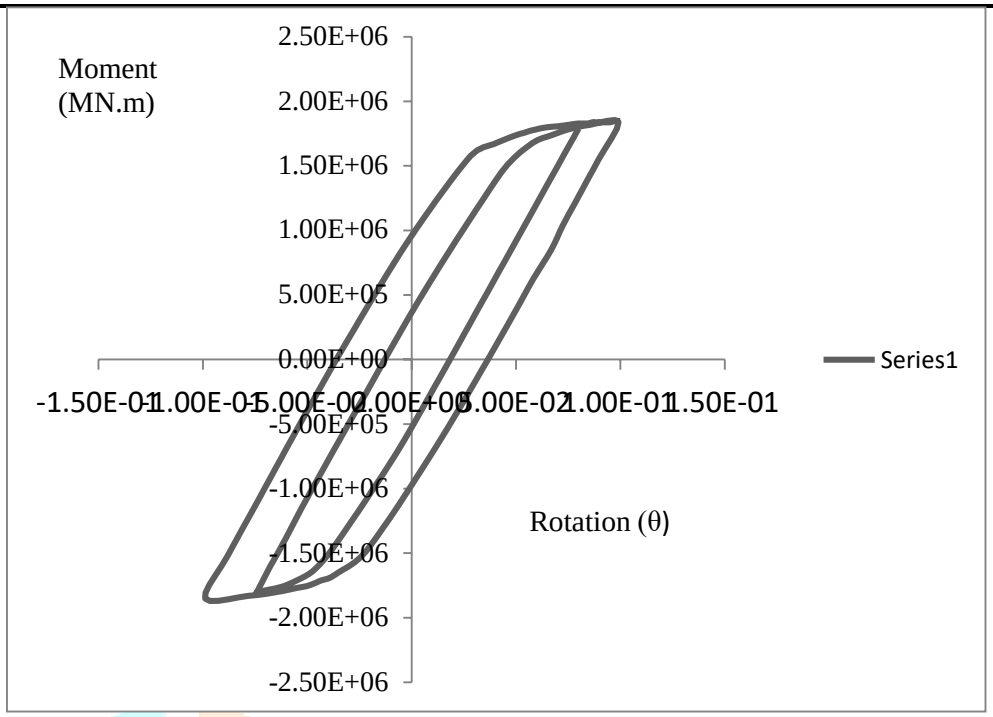

Fig 11: Moment Rotation graph of beam flange with RWS having Horizontal slits

Table 2: Analytical results of models

Models	Moment	Rotation	Stiffness	Ductility
RBS-SH	1.84	0.07	2051	3.4
VS-RWS	1.85	0.09	2055	3.9
HS-RWS	1.86	0.09	2066	3.7

7. CONCLUSIONS

Based on an analysis of a beam-column joint with a reduced web section and a reduced beam section and a moment connection with an extended endplate. According to the table, the decreased web section with horizontal slits is more capable of carrying moment than any other model. The HS-RWS model has better rigidity. Two connections, in comparison to the RBS and RWS, were able to detach the plastic hinge region from the column face and display good hysteresis behaviour. The outcomes also demonstrated that the RWS connection's moment carrying capacity is 10% greater than the RBS connection's. The connections between RWS and RBS both displayed high ductility and stiffness. Additionally, as demonstrated in table 2, the ductility is greater for reduced web sections with vertical slits.

REFERENCES

[1] AISC358-16/ANSI Prequalified connections for special and intermediate steel moment frames for seismic applications, including supplement No.1

[2] **Hamidreza Nazaralizadeh a , Hamid Ronagh, Parham Memarzadeh , Farhad Behnamfar** (2020) "Cyclic performance of bolted end-plate RWS connection with vertical-slits" *Journal of Constructional Steel Research*© 2020 Elsevier Ltd

[3] **Antonella B. Francavilla, Massimo LatourVincenzo Piluso, Gianvittorio Rizzano** (2018) "Design of Full Strength Full-Ductility Extended End-plate beam-to-column joints"*Journal of Constructional Steel Research* © 2017 Elsevier Ltd

[4] **Xiaofeng Zhang and James M. Ricles** (2006) "Experimental Evaluation of Reduced Beam Section Connections to Deep Columns" *Journal of Structural Engineering*

[5] **Sana N. El Kalash, et. al** (2019) ‑Prying effect in unstiffened extended endplate connection with circular bolts configuration‖, *Journal of Constructional Steel Research* Vol 160, pp.106-213

*[6]***Robert Tartagila, et,al** (2018) ― Full Strength Extended Endplate Joints AISC vs Recent design Criteria‖, *Journal of Engineering structures* Vol 105, pp.156-171