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FEA OF DIFFERENT CONFIGURATIONS OF RECTANGULAR HOLLOW FLANGE CHANNEL BEAM (RHFCB) WITH AND WITHOUT WEB OPENING

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Abstract - *The use of members of steel made from the cold process in building structures is increased. 70 percent of steel buildings will be built using cold-shaped steel. The main advantages are ease of transportation, low construction costs, lightweight weight, and so on. Rivet-fastened RHFCB can be easily manufactured using a cooling-forming and rivet binding process. The independent method of adding flange plate elements of the web and section allows for further optimization by selecting the appropriate combinations of web and flange plate thickness. RHFCB also has extra lips, which probably contribute to tightness and an increase in strength. For this purpose, we will achieve the optimal design capability of a sample with a better height. Opening the web with proper diameter found a better stress value. In this study, both the lipped channel beam and the rectangular hollow flange were made and validated. A better stress value was obtained from a rectangular hollow flange. This study discusses the various parameters affecting web crippling. Here we consider both the bending radius and the bearing length. The use of web openings in cold-formed steel beams such as lipped channel beams significantly reduces their shear capabilities due to the low web area. Several parameters affect the shear capacity of the cold-formed steel beam containing the web opening. They are also the size, shape, and location of the web opening and the thinness of the web element.*

***Key Words*: Web crippling, web opening, RHFCB, ANSYS 2021 R2**

1. INTRODUCTION

The hollow flanges of the beam are tied to the trap using a self-pierced rivet binding on the lips. Rivet-fastened RHFCB can be easily manufactured using a cooling-forming and rivet binding process. The method of adding web and flange plate elements to the section allows for further optimization by choosing suitable combinations of web and flange plate thickness. The use of thick web plate elements increases the web buckling capacity.

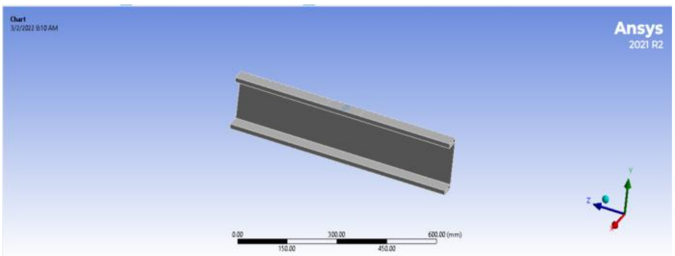

Fig -1: Model of RHFCB

The crippling capacity equation is composed of the following parameters: web section thickness (tw), material capacity (fy), clear web height to web section thickness and web section thickness ratio (d1/tw), bearing length ratio to web section thickness (lb/tw), web section thickness (ri/tw), inner folded radius ratio (ri/t π w) the angle between Cr, Cl and Cw).

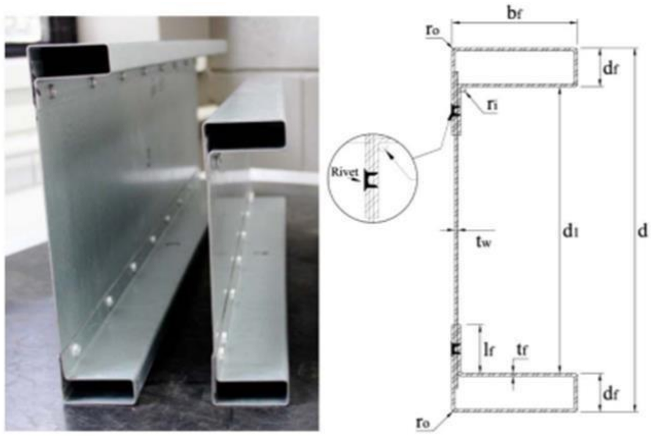

Fig -2: Dimensions of the cross-section

Web openings in cold-form steel beams, such as lipped channel beams, significantly reduce their cutting capacity due to the low web area. Several parameters affect the shear strength of a cold-form steel beam with a web opening. The carrier is an existing industry practice in a typical floor beam to facilitate early construction services in the web segment.

2. OBJECTIVES

The main objectives are,

1. Evaluating different combinations of web and flange element size to achieve appropriate design capabilities.

2. To understand the performance with and without web openings.

3. To investigate the web disabling behavior of a rivet-tied rectangular hollow flange channel beam.

4. Maintaining web weakening parameters such as yield pressure, bearing length, and web weakening capacity over the curved radius within.

High-capacity steel increased the level of cold-formed steel formation using a series of thin-walled steel sections. The commonly used unlipped channel sections are ambiguous against different types of loading and thus are prone to web weakening failures. A rivet-built rectangular hollow flange channel beam is structurally more efficient and profitable than hot spiral steel sections.

2.1 To evaluate different combinations of web and flange element size to achieve suitable design capabilities.

Bucking the web as a passive motion caused by the rotation of the web-flange intersection. In this target, the web size is changed under 100, 121,135,145, and 182, which gets the maximum force on displacement at 8 mm deformation.

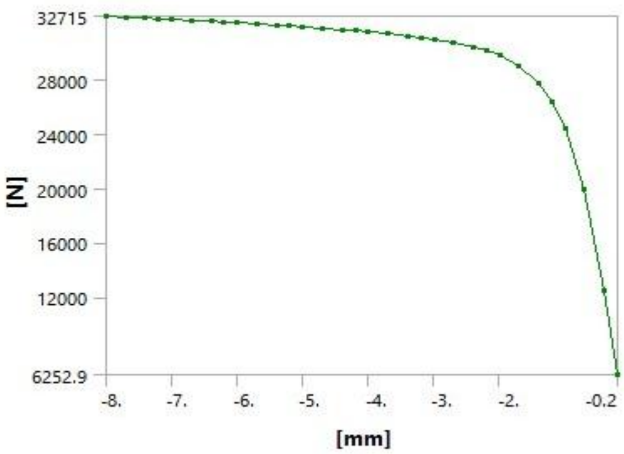

Chart -1: Stress vs Displacement graph

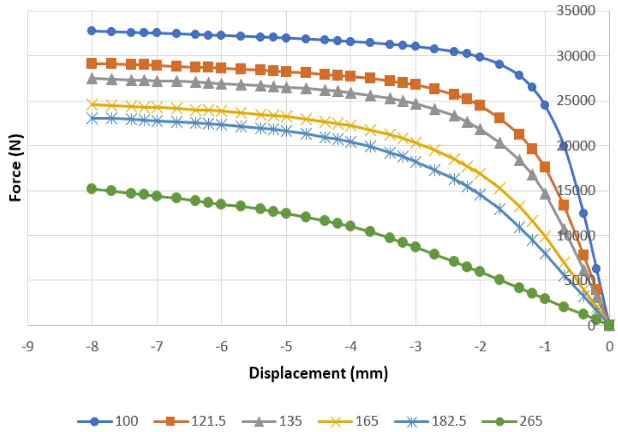

Chart -2: Force vs Displacement graph (Combination)

2.2 To understand the performance of with and without web openings.

To determine the model which has less stress contribution. Two types of models have been created (with and without holes). From the validation results, we can conclude that the specimen with web opening has the least stress values.

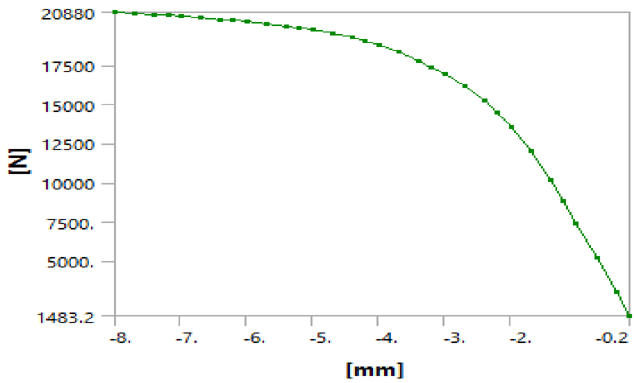

Chart -3: Force vs Displacement graph

2.3 To Investigate Web Crippling Behavior of Lipped Channel Beams Rectangular Hollow Flange.

To determine which of these two samples has the best strain value. Both lipped and made rectangular patterns. The best pressure value is obtained from a rectangular hollow flange.

The rectangular hollow flange has got a stress value of 452 MPa.

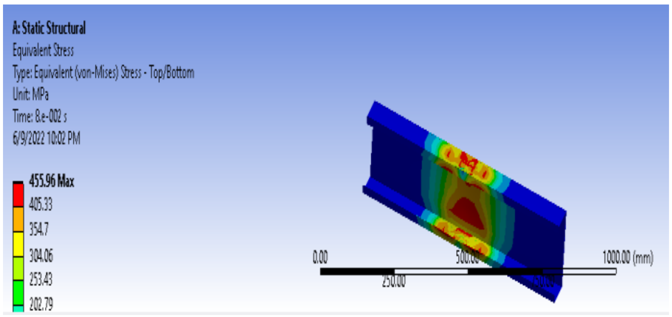

Fig -3: Von mises stress along RHFCB

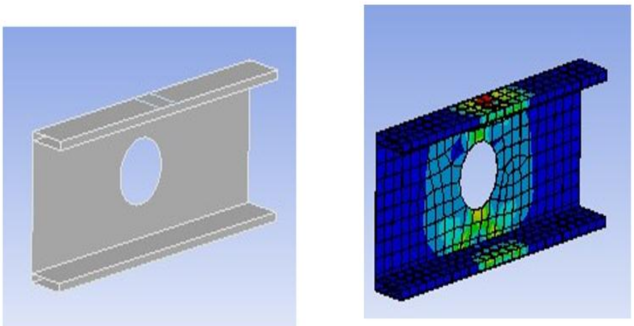

Fig -3: Web opening on RHFCB

2.4 To Perform Web Crippling Parameters Such as Inside Bent Radius and Bearing Length.

Both inside bent radius and bearing length affect the stress concentration along the beam and flanges.

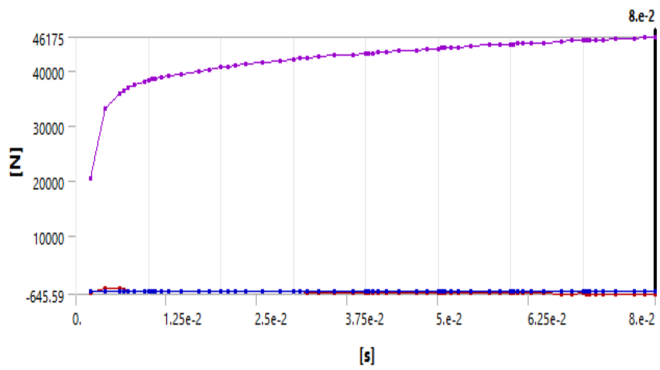

Chart -4: Force vs Displacement graph (Combination)

3. CONCLUSIONS

From this objective, we will get an optimum design capacity of a specimen with 135 mm web height. Created specimens with different web openings. Web opening with 67.5 mm diameter got a better stress value. In this study, both lipped channel beam and rectangular hollow flange were created and validated. A better stress value was obtained from a rectangular hollow flange. This study discusses the various parameters affecting the web crippling. Here we consider both bending radius and bearing length. Various stress values were obtained.

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