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EXPERIMENTAL INVESTIGATION ON BUCKLING ANALYSIS OF CASTELLATED COLUMN WITH SOFTWARE

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ABSTRACT

Perforated-web steel sections have been used as structural members since the Second World War in an attempt to enhance the flexural behavior without increasing the cost of the material. Nowadays, such sections are widely used in a variety of geometries suitable for various loading conditions. The study considers a wide range of practical geometric dimensions, as well as, various columns' end conditions. Due to the increase in width of column the radius of gyration of column increase and the slenderness ratio of column get reduce. Due to this effect the buckling load carrying capacity of column increase.

KEYWORDS: Castellated Column, Effective Length, Slenderness Ratio.

INTRODUCTION

Castellated column is defined as the column in which increasing width of column without increasing the self-weight of column. Now a day castellated column is a new technique. A castellated column is fabricated from a standard steel I-shape by cutting the web on a half hexagonal line down the center of the beam. The two halves are moved across by one spacing and then rejoined by welding. This process increases the width of the column and hence the major axis bending strength and stiffness without adding additional materials. Due to the opening in the web, castellated column are more susceptible to lateral-torsional buckling. The main benefit of using a castellated column is to increase its buckling resistance about the major axis. However, because of the openings in the web, castellated columns have complicated sectional properties, which make it extremely difficult to predict their buckling resistance analytically.

TYPE OF CASTELLATED COLUMN

Hexagonal castellated column

In the hexagonal castellated column the opening is provided 45' or 60' angle. Hexagonal castellated column give greater resistance to buckling.

Cellular column

The use of cellular column, with regularly spaced circular openings, increases in steel construction. Those columns are made from hot rolled profiles and provide for an equivalent weight of steel higher mechanical performances compared to the parent standard profile.

Diamond shape castellated column

The Diamond shape castellated column is a new version of castellated column which achieve by the diamond cutting pattern. The failure chances of this type of column are less as compare to square castellated column.

Square shape castellated column

In square type of castellated column due to the number of corner the failure chances are more as compare to other type of castellated column.

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OBJECTIVE

- To learn different type of castellated column.
- Analysis and design of castellated column.
- To know about the design philosophy for the safe and economical design of castellated column.
- Comparison between manually design and software design result.
- To find out buckling load and deflection of section.

LITERATURE REVIEW

Wei-bin Yuan **etal**The majority of the existing literature on castellated members is focused on beams. Very little work has been done on the stability of castellated columns although they have been increasingly used in buildings in recent years.

Khaled M. El-Sway **etal** Perforated-web steel sections have been used as structural members since the Second World War in an attempt to enhance the flexural behavior without increasing the cost of the material.

SaeedGholizadeh[etal]In this paper, load carrying capacity of simply supported castellated steel beams, susceptible to web post buckling, is studied.

DelphineSonck[etal] Cellular and castellated members are usually produced by performing cutting and rewelding operations on a hot rolled I-section member.

METHODOLOGY

Assembly for various end condition
There are four end condition given below

- Column with both the ends fixed
- Column with both the ends pin
- Column with one end is fixed and other end is pin
- Column with one end is fixed and other end is free

Assembly for testing of column is prepared from steel material. This is a plate and nut combination assembly which can achieve four end condition of testing. As shown in below figure

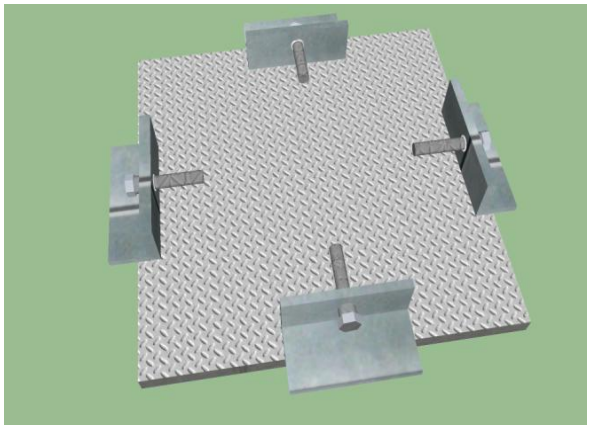

Fig.1 Assembly for testing

Critical buckling load N_{cr}
For a doubly symmetric column subjected to a central normal load there are three failure possibilities: flexural buckling about the weak axis, flexural buckling about the strong axis and torsional buckling. The critical buckling load N_{cr} is hence the smallest of the corresponding normal loads: flexural buckling will occur about the weak axis. Yet, in reality buckling about the weak axis is mostly obstructed to obtain a higher design load,

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hence buckling about the strong-axis becomes the governing design criterion. Thus, this thesis investigates the strong-axis flexural buckling which implies that several boundary conditions will have to be added to the model to prevent weak-axis buckling.

$$N_{cr,z}=\frac{n\Pi^2EI}{L^2}$$

$$N_{cr,y}=\frac{n\Pi^2EI}{L^2}$$

Geometry of a typical castellated column.

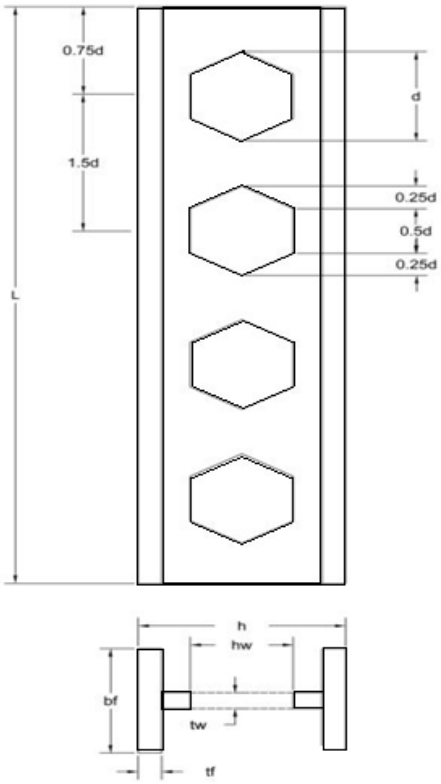

Fig.3 Geometry of a typical castellated column

Typical geometry of modeled castellated columns is presented in Fig. 3.8. According to this illustration, the typical spacing between castellation is 1.5d, centre-to-centre, where d represents the diameter of the circle enclosing the hexagonal perforation. The gain in the depth of the expanded section, relative to the original depth, is estimated as 0.433h.

CONCLUSION

The current study presents a simplified approach for the assessment of the effect of shear deformations on axially loaded castellated columns and evaluation of the associated buckling load capacity. The influence ofweb shear deformations on the critical buckling loads of castellated columns increases with the cross-sectional area of a tee section. We can achieve four end condition of column by plate and bolt assembly. Theoretically we understood that if section width increase at the same time radius of gyration also increases. Due to this the buckling capacity of column also increases.

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