iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 5 **Issue:** IV **Month of publication:** April 2017

DOI: http://doi.org/10.22214/ijraset.2017.4136

Volume 5 Issue IV, April 2017
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

A Study on the Peculiar Problems of Cold-Formed Steel Design

Ramanand Tiwari[1], Mr. V. S. Parihar[2]
[1]Scholar M. Tech (Construction Technology and Management), [2]Asst. Professor, Department of Civil Engineering
Acropolis Institute of Technology & Research, Bhopal (M.P.)

Abstract: The steel construction is the increasingly an important technology for the civil building and actually, the Steel industry is constantly in search of more and better uses for steel. The uses of hot-rolled welded and cold-formed steel elements in the construction of the buildings are ones of the solutions that can easily replace the traditional technology of construction. Indeed, cold-formed steel is one of which are the becoming a very popular material in the construction because they provide a high strength to weight of ratio are easy to produce, transport and assembly when compared to thicker hot-rolled steel members. Another advantage is the great variety of profiles available on the market which allow the building of the different member cross-sections. However, they may behave poorly under the fire conditions, especially when they are unprotected in fire case due to the combination of the high thermal conductivity of the steel and section factor of these structural members (small wall thickness) both of which lead to a rapid rise of the temperature in steel in fire situation in the addition cold-formed steel members usually have the complex buckling of behavior, involving local, distortional, global buckling and their interactions. This paper is a study on the peculiar problems of cold-formed steel design of the construction technologies.
Keywords: Cold-Formed, Problems, Increasingly, Buildings, Solutions.

I. INTRODUCTION

Cold-formed steel products are found in all aspects of modern life and the use of these products are multiple and varied ranging from tin cans to structural piling from keyboard switches to mainframe building members and nowadays a multiplicity of the widely different products with a tremendous in diversity of shapes sizes and applications are produced in steel using the cold-forming process. In Steel structures two primary structural steel member types are used hot-rolled steel members and cold-formed steel members and hot-rolled steel members are formed at elevated temperatures, whereas cold-formed steel members are formed at room temperatures. Until recently, the hot-rolled steel members have been recognized as the most popular and are widely used the steel group, but since then the use of cold-formed high strength steel structural members has rapidly increased. However, the structural behaviour of these light gauge high strength steel members characterized by various buckling modes such as local buckling and distortional buckling, and flexural-torsional buckling is not yet fully understood the Open Cold -Formed Steel sections such as C-,Z-, hat and rack sections are relatively common because of their simple forming procedures and easy connections, but they suffer from the certain buckling modes due to their mono-symmetric or point symmetric nature, high plate slenderness, eccentricity of shear center and low torsional rigidity.

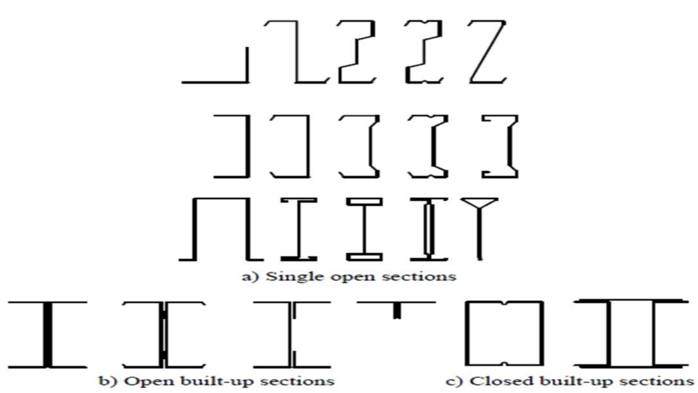


Figure-1. Different types of built-up section

Volume 5 Issue IV, April 2017
ISSN: 2321-9653
International Journal for Research in Applied Science & Engineering Technology (IJRASET)

II. PROPERTIES OF BUILT–UP COLD FORMED STEEL SECTIONS

There is great flexibility in the design using Cold-formed steel. The low cost, ease of manufacture and controlled quality can encourage the development of innovative uses. In spite of the benefits, the range of application is restricted in Latvia, especially for load bearing structures. The resistance of thin-walled Coldformed steel sections should be calculated according to EN 1993-1-3 (2006) and 1993-1-5 (2006) by the method of effective width. As a I step, in this thesis work the resistance to buckling of Cold-formed steel sections in compression and bending is analyzed taking into consideration geometrical proportions, influence of stiffeners and circular corners. By numerical analysis there is given the estimation of effective C and U –section properties in the range of width-to-height (b/h) and width-tothickness (b/t) in concordance with EN 1993-1-3, Section 5. In addition to the numerical analysis there are presented and determined results of experimental research with natural beams in bending. Estimation of correct CFSS properties is of essential importance. The section modulus with increasing of the internal radius reduces under 3.0%. For calculation of the stiffness properties the influence should always be taken into consideration. On the other side, there are well-known changes in the mechanical properties of steel by virtue of cold forming. It is assumed, that the yield strength is increased in the bends of the section up to 15.0%.

III. PECULIAR PROBLEMS OF COLD-FORMED STEEL DESIGN

The use of thin-walled sections and cold-forming manufacturing effects can results in special design problems not normally encountered when tick hot-rolled sections are used a brief summary of some special problems in the cold-formed steel of the design are reviewed in the following.

A. Buckling Strength

The steel sections may be subject to one of four generic types of buckling, namely local, global and distortional and shear local buckling is particularly prevalent in cold-formed steel sections and is characterised by the relatively short wavelength buckling of individual plate element of the term global buckling embraces euler (flexural) and the flexural-torsional buckling of columns and lateral-torsional buckling of beams. It is sometimes termed rigid-body buckling because any given cross section moves as a rigid body without any distortion of the cross section and distortional buckling, as the term suggests is a buckling which takes place as a consequence of distortion of the cross-section in cold-formed sections it is characterised by the relative movement of the fold-lines the wavelength of distortional buckling is generally intermediate between that of local buckling and global buckling.

B. Web Crippling

Web crippling at points of concentrated load and supports can be a critical problem in cold-formed steel structural members and sheeting for several reasons these are in cold-formed steel design it is often not practical to provide load bearing and end bearing stiffeners this is always the case in continuous sheeting and decking spanning several support points the depth to-thickness ratios of the webs of cold-formed members are usually larger than for hot-rolled structural members in many cases the webs are inclined rather than vertical the intermediate element between the flange, onto which the load is applied and the web of a cold-formed member usually consists of a bend of finite radius. Hence the load is applied eccentrically from the web. Special provisions are included in design codes to guard against failure by web crippling.

C. Ductility and Plastic Design

Due to sectional buckling mainly (cold-formed sections are of class 4 or class 3, at the most), but also due to the effect of cold-forming by the strain hardening and cold-formed steel sections possess low ductility and are not generally allowed for plastic design the previous discussion related to revealed the low inelastic capacity reserve for these sections after yielding the initiated however for the members in bending design codes allow to a use the inelastic capacity reserve in the part of the cross section working in tension. Because of their reduced ductility of cold-formed steel sections cannot dissipate energy in the seismic resistant structures. However cold-formed sections can be used in seismic resistant structures because there are structural benefits to be derived from their reduced weight but only elastic design is allowed and no reduction of the shear seismic force is a possible hence in seismic design a reduction factor $q = 1$ has to be assumed as stated in EN1998.

D. Connections

Conventional methods for connections used in steel construction, such as bolting and arc-welding are available for cold-formed steel sections but are generally less appropriate because of the wall thinness and special techniques more suited to thin materials are often employed and long-standing methods for connecting two thin elements are blind rivets and self drilling, self tapping screws. Fired pins are often used to connect thin materials to a ticker supporting member of more recently press-joining or clinching technologies (Predeschi *et al*, 1997) have been developed which require no additional components and cause no damage to the galvanising or other metallic coating. This technology has been adopted from the automotive industry and is successfully used in building construction and rosette system is another innovative connecting technology (Makelainen & Kesti, 1999), applicable to cold-formed steel structures. Therefore the connection design is more complex and challenging to the engineers.

E. Fire Resistance

Due to the small values of section factor of (i.e. the ratio of the heated volume to the cross sectional area of the member) the fire resistance of the unprotected cold-formed steel sections is reduced for the same reason fire protection with intumescent coating is not efficient.

F. Corrosion

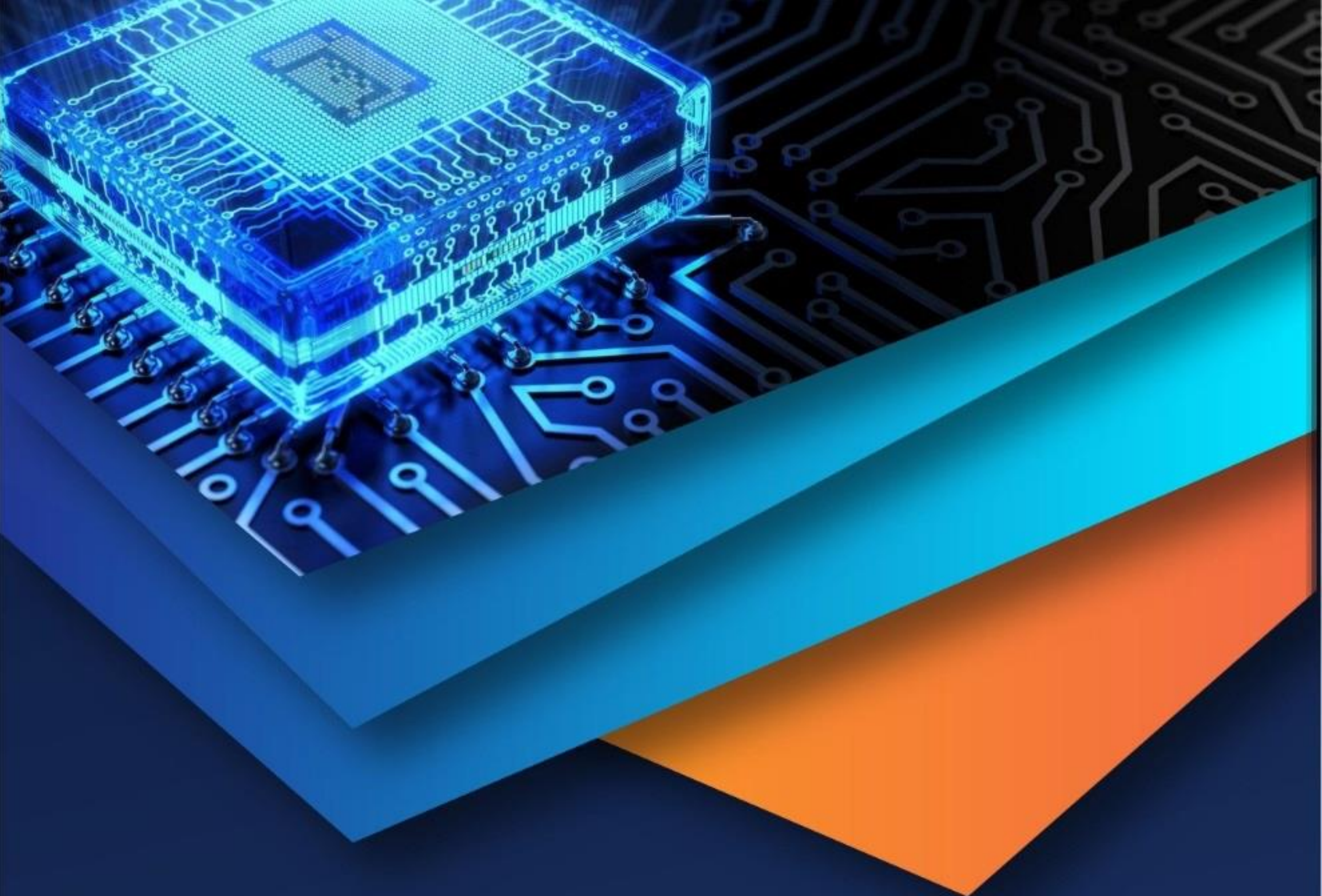
The main factor governing the corrosion resistance of cold-formed steel sections is the type and thickness of the protective treatment applied to the steel rather than the base metal thickness and cold-formed steel has the advantage that the protective coatings can be applied to the strip during manufacture and before roll forming. Consequently the galvanised strip can be passed through the rolls and requires no further treatment.

IV. CONCLUSON

This paper is a study on the peculiar problems of cold-formed steel design of the construction technologies and the study on buckling strength; web crippling, ductility and plastic design, connections, fire resistance and corrosion. The construction technologies world the paper describes the circumstances leading to their development. The purpose of this research paper is how to study the peculiar problems of cold-formed steel design.

REFERENCES

[1] IS 1608:2005 (Part –I) Metallic metals- tensile testing at ambient temperature.
[2] IS: 801 – 1975,"Code of practice for use of cold-formed light gauge steel structural member in general building construction.
[3] Rhodes, J.: Design of Cold–Formed Steel Members, Elsevier Applied Science, England, ISBN 1 85166 595, 1, 1991
[4] Yu, W. W.: Cold–Formed Steel Design, John Wiley & Sons, Canada, 3rd Edition, ISBN 0-471-34809-0, 2000
[5] ENV 1993-1-3:2006, Eurocode: Design of Steel Structures; Part 1.3: General Rule Supplementary Rules for Cold Formed Thin Gauge Members and Sheeting, 2009.
[6] British Standards Institution, British standards for structural use of steel wor in buildings { Part 5: Code of practice for design of cold formed thin gauge sections, BS5950, 1998.
[7] American Iron and Steel Institute, Speci_cation for the Design of Cold Forme Steel Structural Members, AISI–S100–07, 2007.
[8] AS/NZS4600, Cold {Formed Steel Structures, Standards Australia, Sydney, 2005.
[9] Search engine: Google .com
[10] Wikipedia.com



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY