Analysis of Cold Formed Steel Sections : Review Paper

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***Abstract* - This paper summarizes the behavior of various cold formed or light gauge steel sections using nonlinear FEA (Finite element analysis). Based on the literature reviews we can investigate the analytical and theoretical behavior of CFS sections under the different loading conditions using the software package ABAQUS and ANSYS. In this paper the objective is to provide guidance for performance of cold formed steel in the construction industry field.**

Keywords - Cold formed steel sections; failure modes; nonlinear; Finite element analysis; ABAQUS; ANSYS.

I. INTRODUCTION

Cold-formed steel (CFS) sections or thin walled sections are the light in weight building materials and hence they are suitable for the building construction owing to versatility in various applications and ease of installation and fabrication. Generally C sections and Z sections are used in the building construction and their section depths range from 0.1m to 0.35m while the thickness of the section range from 1.2 - 3.0 mm. CFS sections are developing at a rapid rate such that they are used as a method of constructing the light-weight floors and framed structures. Light gauge steel construction is now being one of the highly competitive alternative to the traditional structural system. Some of the advantages of CFS framings are that it is lighter in weight, reduces the transportation and handling costs, ease of installation and prefabrication etc.

II. LITERATURE REVIEW

Abhishek Dangi (2017), In this paper the numerical study on the performance of CFS Z purlins under the bending when subjected to UDL applied at the shear center of the proposed section. The results that is obtained by nonlinear analysis showed variation between the nonlinear FEA solutions and classical linear solution in displacement. In this paper FEA observations and the results obtained from this study can be used for developing finite element models and there in to notify design codes and the analytical investigations such that it can provide a better way to assess wherein serviceability and large deformation effects for CFS members.

G.Beulah Gnana Ananthi (2016), in this current paper the non-linear (FEA) finite element analysis has been done by using the ABAQUS software to predict the structural nature of built-up CFS sections under the axial loading. This paper shows about theoretical, experimental and numerical investigations on the behavior of the CFS box double angle columns tested with axial compression with pinned-end condition. An analytical model was used in order to calculate the maximum load carrying capability on the built-up box angle column based the on Direct Strength Method. The numerical outcomes of the parameter analysis has been compared with the proposed method and also with the current DSM equation.

Krishanu ROY (2019), This paper has proposed the improved version design rules and its accuracy by FEA using ABAQUS and ANSYS software's and the test results for the back-to-back CFS built-up channel sections which is subjected to the axial compression. The FE model will include the modeling of the material non-linearity, web fasteners and geometric imperfections. The obtained deformed shapes of the sections and the failure modes during failure are being discussed. The AISI (American) and AS/NZS (Australian/New Zealand) codal standards are shown to be conservative to the FE results and has been compared between the obtained experimental test results showing good agreement.

Jothilakshmi.M (2016), this paper presents the numerical investigation which is made by using the ANSYS 14.0 software, here the behavior of CFS double channel beam section have been studied. The Specimens are first modelled and then analyzed in S-S condition for varying Depth to thickness ratio. The Von-Misses stress, load-strain behavior, displacement, strain variations has been found. This has been followed by the determination of the load carrying capacity. The light gauge steel double channel beam sections are analyzed in the transverse one point loading with simply supported condition using ANSYS 14.0. The Deflection curves and the strain were obtained in numerical investigation and analysis and the graphs plotted.

Sreedhar Kalavagunta (2013), this paper studies the finite element analysis and investigation on light gauge steel sections to determine load carrying capacity and the critical stresses. To

validate these obtained results, the cold formed steel CFS C sections are designed using the STAAD.Pro design and structural analysis software per the AISI codal specifications. The analysis results has been found to be approximately nearer to American design results.

Jia-Lin Maa (2017), in this article an comprehensive numerical modelling for the thin walled high strength tubular steel beams has been performed. Upon the concerned validation of the FEM methodology, a parametric study was being conducted to generate the additional numerical data that has covered a vast range of the cross-section and its slenderness. The design method for CHS has been shown more reliable, effective and accurate than the present design method. Hence, from studies we conclude that the two most proposed design methods are being suggested to be utilized for the design of thin walled high strength steel beams.

Marsel Garifullina (2018), the paper provides the nonlinear buckling analyses results of light gauge C-shaped compressed columns and then calculates the load-bearing capacity of the column members and its influence of the imperfections on the columns. The modified Rik's analysis realized in the software ABAQUS has been employed for buckling analysis to investigate the buckling loads of the C-sectioned compressed Light gauge steel members. For validation of the results each column was calculated manually according to the Russian codal recommendations.

Feng Zhou (2018), this paper investigates the numerical structural performance of thin walled stainless steel sections which is subjected to combined effect of compression and bending. A finite element model (FEM) which is taking the imperfections in the geometry and the non-linear material and its properties into the consideration has been developed in the beginning. The property of the material has been carefully incorporated in the model. The interactions of the constituent plate elements have been studied thoroughly in this paper.

James B.P. Lim (2019), this paper presents the investigation of the back-to-back light gauge stainless-steel channels numerically. Duplex, ferric and austenitic are three different grades which has been considered in this paper. The Load was applied axially to the specimens using a 600kN weight capacity of GOTECH, GT-7001-LC60174 Universal Testing Machine (UTM). The Numerical models were being developed using the ABAQUS software. Finally the results obtained it has been found that for the slender and stub columns of stainless-steel including all three grades has been found to be negligible on showing its effect on the axial strength.

Nagesh.R.Iyer (2015), this paper presents the theoretical and analytical investigations on the maximum load carrying capacity and the behavior of light gauge un-lipped channel sections with ends being fixed then subjected to axial compression. The comparison is being done with the design strengths as predicted by using the North American Standards for light gauge structures. The FEA predictions provides good agreement with the obtained test results. For the un-lipped channels sections, the proposed equation gives a lower and high bound values for short and long columns members.

III. CONCLUSION

From the above literatures, the behavior of CFS sections like angle section (Z section), build up sections, double channel beam section section with stiffeners have been investigated. The American standard (AISI) and AZ/NZ codal provisions has been used. The Numerical modelling of the various CFS section is being carried out by using the FEA software's, ANSYS and ABAQUS. For validation the results obtained from Numerical and theoretical methods has been evaluated and compared. The behavior of the sections and the Failure patterns obtained under various types of loading conditions has been investigated.

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