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An Examination of Industrial Roof Truss with Or Without Cold Formed Steel Section

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ABSTRACT

The elements connected by joints are called trusses. The legs of the skeleton are very high. It consists of completely different organizations for spans, slopes, different types, and overall variations of the section. Steel framing is increasingly being used in commercial building construction. As the number of steel-framed chassis increases, there is a demand for lighter-weight frames. In recent years, structural adjustment has become an invaluable tool for engineers and screeners. Technical improvements have been implemented for more than 40 years, but it wasn't until the large-scale development of high-performance systems that they became common tools. As the company continues to improve, the structures will get lighter, bigger, and cheaper. This kind of quality enhancement and defect detection has become a significant component of mechanical engineering planning. Two definitions are required in order to comprehend structural improvement and the subject matter of this study. The first definition is a structural definition that includes all the semantics and traits associated with this kind of systemic static analysis. The second purpose is concerned with improving structure, particularly in terms of size and shape. In this research work we use 4 different type of industrial roof truss for analysis. Different type of members with different cross section applied on them and gets optimum I-shape for truss member. Two different materials made with steel and cold formed steel sections use in ETABS 2016. Some parameters like joint displacement, base shear, bending moment and storey drift compare for all cases.

Keyword:Cold formed Steel, Hot Rolled Steel, Industrial Roof Truss, Deformed Shape etc.

I. INTRODUCTION

The major steel structure is a single-story industrial structure. The subsidiary structural components of the metal construction system span the distance between the primary building frames. Beyond merely supporting roof and wall panels or bearing external loads on the main structure, they perform intricate duties. These components, often referred to as secondary structures, serve as wing supports for the primary frame and are part of the system for bearing lateral loads in the building. The horizontal roof membrane frequently includes secondary roof components (also known as purlins) as a significant component. The supporting assembly of the wall often contains the secondary wall components, also known as studs. The majority of the steel structures that will be constructed are single-story, low-rise structures.

Figure 1Structure frame of steel truss

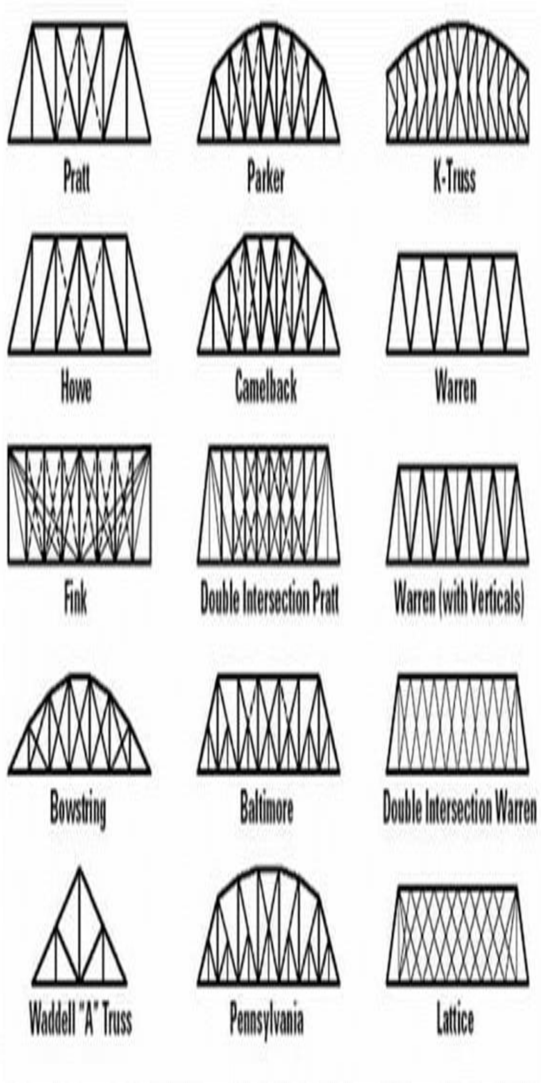

Figure 2Diagrams of different type trusses

Cold formed steel

Cold-formed steel is a generic term for products obtained by rolling or stamping steel to produce semi-finished or finished products at relatively low temperatures (cold forming). Cold-formed steel products are manufactured from billets, bars, or plates into products that can be used by shaping, rolling (including roll-forming), or pressing. Since the introduction of the first written standards in 1946, the use of cold-formed structural steel has become widespread. In the construction industry, load-bearing and non-load-bearing components are made of high-quality sheet steel. These construction materials include slabs, columns, beams, posts, and other structural pieces.

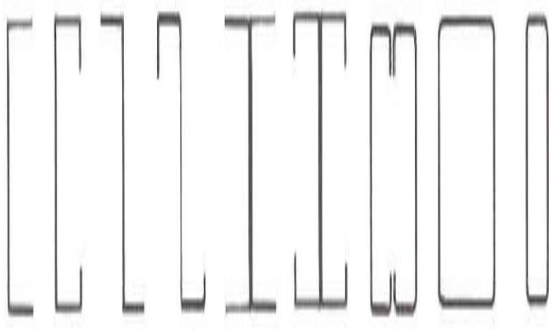

Figure 3Different types of cold formed steel section

II. OBJECTIVES

- To determine which material is better at withstanding unbalanced pressures and loads: steel or CFS. CFS and Normal steel were used in models to get comparative data.
- To determine whether or not steel deflection in C.F.S. sections is relatively less. Major goal behind this is to understand about deflection CFS.
- To get optimized sections used for industrial roofs. For this apply different type of sections and get optimized section for study.
- To study basic parameters like base reaction, bending moment, joint displacement, and axial forces in different kind of trusses. These are important parameters for each study so use them to improve the research work.

III. EXPERIMENTAL METHODOLOGY

Learn about four different types of industrial roof trusses in this chapter and analyse them. The best I-shape for a truss member is achieved by applying various types of members with various cross sections to them. In ETABS 2016, two distinct materials composed of cold-formed steel pieces and steel are used. Certain variables, including joint displacement, base shear, bending moment, and storey drift, are compared across all scenarios.

Model Geometery

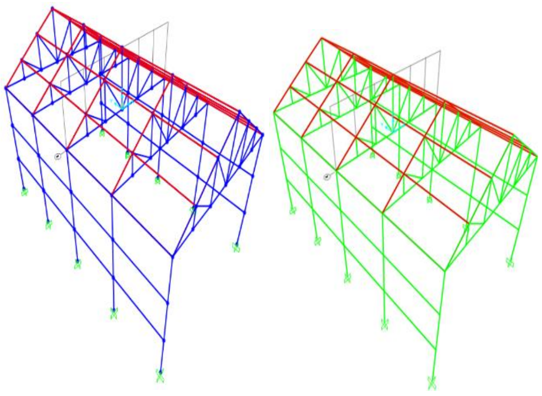

Figure 4 3D view of Hown bottom truss with steel or with cold formed steel

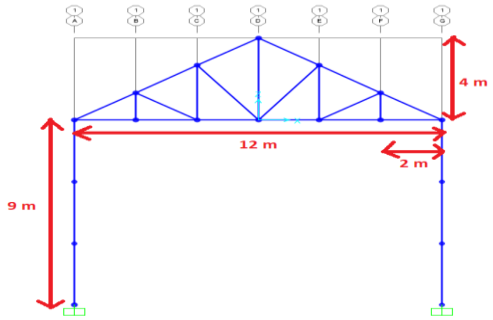

Figure 5 Plan view of Hown bottom truss

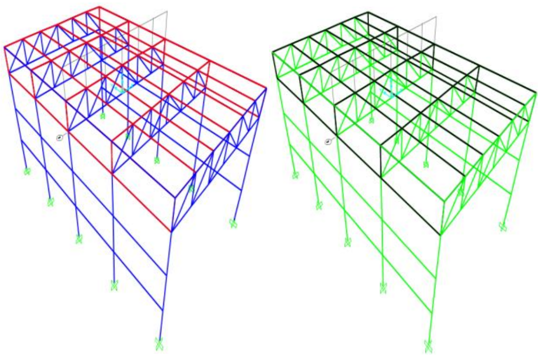

Figure 6 3D view of Howe truss with steel or with cold - formed steel

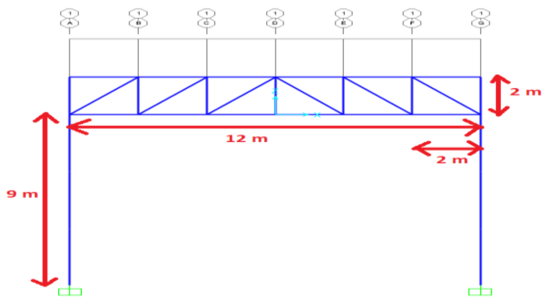

Figure 7 Plan view of Howe truss

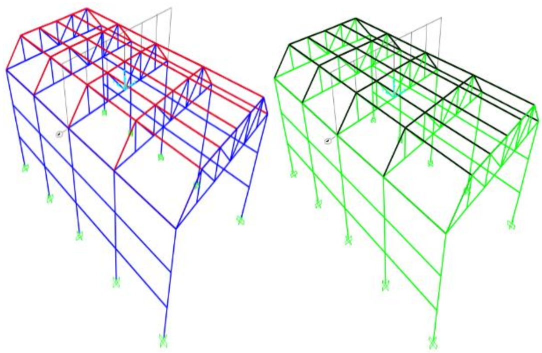

Figure 8 3D view of Pratt truss with steel or with cold formed steel

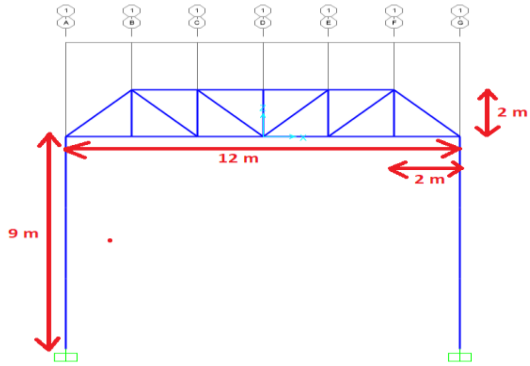

Figure 9 Plan view of Pratt truss

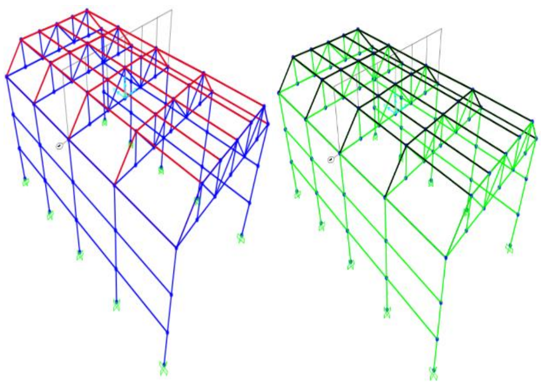

Figure 10 3D view of Warren truss with steel or with cold formed steel

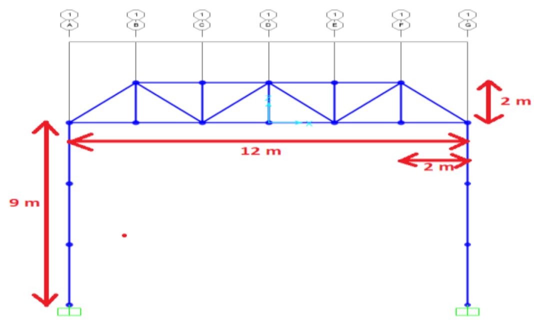

Figure 11 Plan view of Warren truss

IV. RESULTS AND MODELLINNG

In this section of the project, gather data from ETABS 2016 for joint displacement, storey drift, drift ratio, bending moment, and base shear. Drawing comparison Figure s between steel and cold-formed steel is a good idea.

Joint displacement

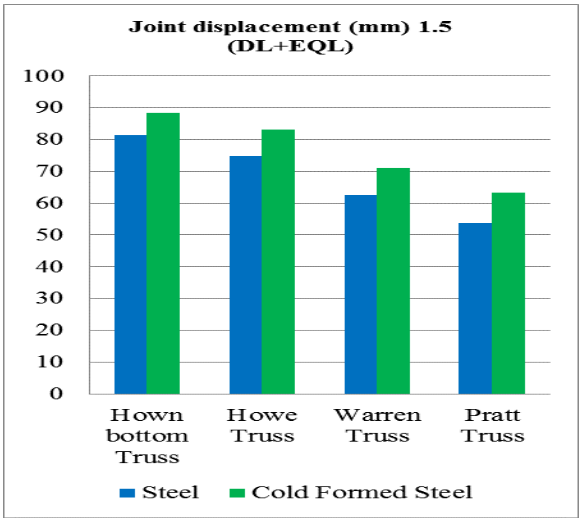

Figure 12Joint displacement in various trusses with steel and cold formed steel consider 1.5 (DL+EQL) load combination

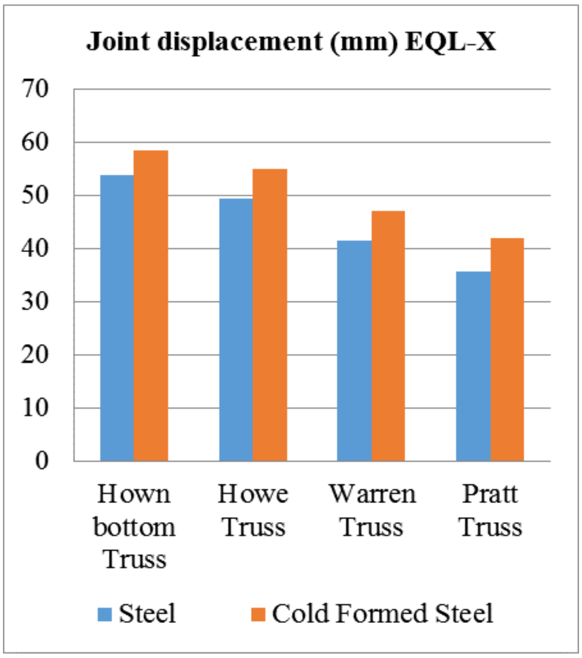

Figure 13Joint displacement in various trusses with steel and cold formed steel consider earthquake load

Storey drift

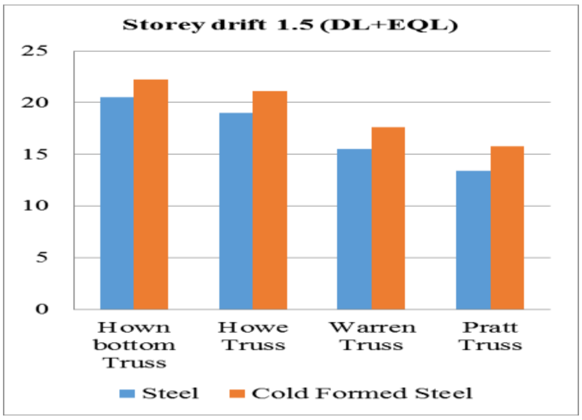

Figure 14Storey drift in various trusses with steel and cold formed steel consider 1.5 (DL+EQL) load combination

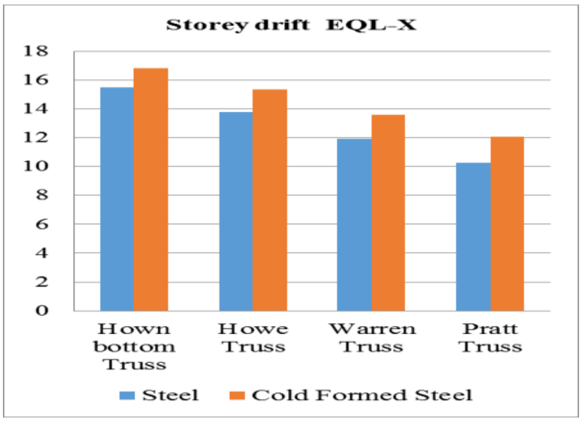

Figure 15Storey drift in various trusses with steel and cold formed steel consider earthquake load

Bending moment

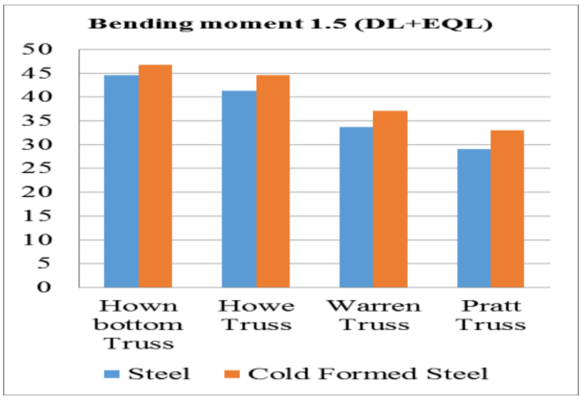

Figure 16Bending moment in various trusses with steel and cold formed steel consider 1.5 (DL+EQL) load combination

Base reaction

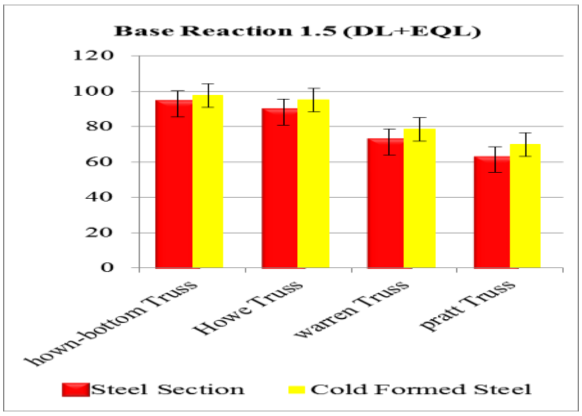

Figure 17. Base reaction in various trusses with steel and cold formed steel consider 1.5 (DL+EQL) load combination

V. CONCLUSION

Out of all the trusses, joint displacement due 1.5 (DL+EQL) load combination; in the bottom truss occurs most frequently. This maximum displacement was lowered from cold formed steel to steel. The maximum displacement in the Hown bottom is 88.33 mm, which will result in a reduction in steel thickness of 81.44 mm. The Howe truss's maximum displacement is 83.14 mm, which will result in a reduction in steel thickness of 74.72 mm. the most displacement possible in a warren truss is 71.13 mm, which will result in a 62.58 mm reduction in steel thickness. The Pratt truss's maximum displacement value is 63.23 mm, which will result in a reduction in steel thickness of 53.83 mm.

Out of all the trusses, joint displacement due earthquake load; in the bottom truss occurs most frequently. The maximum displacement was lowered from cold formed steel to steel. The maximum displacement in the Hown bottom is 58.37 mm, which will result in a reduction in steel thickness of 53.79 mm. the Howe truss's maximum displacement is 55.04 mm, which will result in a reduction in steel thickness of49.44 mm. the most displacement possible in a warren truss is 47.10 mm, which will result in a 41.40 mm reduction in steel thickness. The Pratt truss's maximum displacement value is 41.84 mm, which will result in a reduction in steel thickness of 35.58 mm.

Out of all the trusses, Storey drift due 1.5 (DL+EQL) load combination; in the bottom truss occurs most frequently. This maximum drift was lowered from cold formed steel to steel. The maximum drift in the Hown bottom is 41.58, which will result in a reduction in steel thickness of 38.37. he Howe truss's maximum drift is 39.32, which will result in a reduction in steel thickness of 35.35. The most drift possible in a warren truss is 33.26, which will result in a 29.28 reduction in steel thickness. The Pratt truss's maximum drift value is 29.57, which will result in a reduction in steel thickness of 25.19.

Out of all the trusses, Storey drift due earthquake load; in the bottom truss occurs most frequently. This maximum drift was lowered from cold formed steel to steel.The maximum drift in the Hown bottom is 27.17, which will result in a reduction in steel thickness of 25.04. the Howe truss's maximum drift is 25.87, which will result in a reduction in steel thickness of 23.24. The most drift possible in a warren truss is 21.91, which will result in a 19.26 reduction in steel thickness. The shows Pratt truss's maximum drift value is 19.46, which will result in a reduction in steel thickness of 16.55.

Out of all the trusses, bending moment due 1.5 (DL+EQL) load combination; in the bottom truss occurs most frequently. This maximum bending moment was lowered from cold formed steel to steel. The maximum bending moment in the Hown bottom is 46.74 kN-m, which will result in a reduction in steel thickness of 44.56 kN-m. The Howe truss's maximum bending moment is 44.53 kN-m, which will result in a reduction in steel thickness of 41.38 kN-m. The most bending moment possible in a warren truss is 37.04 kN-m, which will result in a 33.69 kN-m reduction in steel thickness. The Pratt truss's maximum bending moment value is 32.98 kN-m, which will result in a reduction in steel thickness of 29.05 kN-m.

The maximum base reaction in the Hown bottom is 97.51kN, which will result in a reduction in steel thickness of 92.81kN The Howe truss's maximum base reaction is 95.03kN which will result in a reduction in steel thickness of 88.16kN. The maximum base reaction possible in a warren truss is 78.56kN, which will result in a 71.32kN reduction in steel thickness. The Pratt truss's maximum base reaction value is 69.76kN, which will result in a reduction in steel thickness of 61.26kN.

VI. FUTURE SCOPE OF WORK

- In other study use different types of sections casted with cold formed steel and compare their results.
- To compare costing effect in cold formed steel and steel section also use for study.
- STAAD Pro and ETABS are further compared in the design and analysis of an industrial building.
- The lateral performance of home constructions made of cold-formed steel will also be beneficial for research.

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