A General Study of Light Gauge Steel Building – Case Study

V Venkatesan and R Ganesan
Department of Civil Engineering, Saveetha School of Engineering, Saveetha Institute of Medical and Technical Sciences Chennai, Tamil Nadu, India
Email: *hodcivil.sse@saveetha.com

Abstract. In general, light gauge steel structural Cold-Formed Steel (CFS) members can lead to added economical design than Hot rolled Steel (HRS) members due to their high strength to weight ratio, ease of building, and fabrication. It is increased post-buckling strength and yield strength. Such members are vulnerable to local buckling at comparatively low compressive, shear, bearing stress, and bending. The utilization of light gauge steel structures has gotten progressively famous in various fields of building development. The Cold forms of hollow steel sections have a high compressive loading rate, and using infill material like Geopolymer concrete brings the best result in beams and columns joints. Sound Insulation and Head are done correctly according to the necessities of external and internal walls. Economical construction is source income for poor people.

Keywords: Hot rolled steel; shear wall panel; Hollow sections & Concrete; Cold-formed steel.

1. Introduction

Cold-Formed Steel (CFS) units are widely used industrial/residential building component buildings. It is having more [1] advantages overcome in Hot Rolled Steel sections. The present work deals with the various Cold formed sections applicable [2] in special features like high compressive strength and tensile strength local buckling, high flexural strength, fire resistance, adequate wind, and seismic response using the bracing shear wall, respectively. The CFS hollow sections have high compressive loading rates, and [3] applicable of using infill material like geopolymer concrete brings the best result in beams and columns joints. These units are cold-formed steel from low alloy steel sheet or carbon, plate, strip, or flat bar in cold-rolling machinery or through press brake or bending brake processes. [4] The thicknesses of such associates generally range from 0.378mm to 6.35 mm, and 25.4 mm thick steel plate and bar can be cold-formed steel become structural forms as per our requirements and its strength is, we can increase up to 550Mpa.

2. Objectives

The main goals of the thesis work can be summarized in:
- Economic Construction all slums change to the permanent building
- Material Wastage to be reduced
- Structural member weight to be reduced

A. Light Gauge Steel Construction

The Figure 1 shows Basic construction of steel, light gauge steel structures have more advantages
• Their higher strength lets greater spacing among members when [5] compared to wood-frame construction and also faster construction
• It is easy to change or modify the shape of the building at any time and increase the plinth area at any life span

![Figure 1: Basic construction of steel](image1)

B. Disadvantages of Traditional Building
• Erratic Supplies = Erratic Delivery
• Dependent on In-experienced Labour
• Slow Delivery
• Material wastage
• Revise their work
• Incompatible Quality
• Unpredictable Cash Flow
• Unpredicted cost increased

![Figure 2: Truss detail](image2)

Cold-formed steel and other products are thin, light, and easy to produce, [6] cost less than their hot-rolled steel. A variety of steel thicknesses are used for non-structural also structural applications. Some of the countries using the system today: USA, Canada, Western [7] and Eastern Europe, China, Austria, New Zealand, India, Malaysia, Indonesia, South Africa, Gulf countries, and Algeria. Figure 2 are shown truss detail

3. Design Parameters

A. Wall systems
Wall thicknesses include [8] 150 mm stud and 89 mm stud with other parameters same as in isometric view, shown in Figure 3 Wall construction with a window open.

- Internal cladding boards change to moist block gypsum board for wet areas (bathroom and kitchen)
- New materials like magnesium board can also be clad
- Most materials can be clad on the boards for interior and exterior finishes

![Wall construction with a window open](image)

**Figure 3:** Wall construction with a window open

**B. Internal and External cladding**

- Sound Insulation [9] and Head are done properly according to the necessities.
- Many external and internal [10] cladding resources are accessible dependent on construction type.
- Electrical, plumbing, also heating installation necessities are useful through a wall besides joist spaces, Figure 4 in external wall cladding.

![External wall cladding](image)

**Figure 4:** External wall cladding
Lightweight: [11] They are lightweight and hence impose few structural restrictions on their use, at the same time giving improved impact resistance. Figure 5 shows External wall cladding with different thickness.

- Range of Colours: The polymer-based material, alco panel, soundproof panel, and various colours
- Design Flexibility: The [12] foam plastic insulation, sound insulation, Heat insulation used by most systems
- Energy Efficient and economy: The insulation improves energy-efficiency by wrapping the whole building in an uninterrupted insulation blanket. Shown in Figure 5 different thickness of external wall cladding.

C. Floor Systems

The Figure 6 in webbed floor Joists are made up of Cold-Formed Steel, C-Lipped Units in Figure 7. [13] The top and bottom cord lip available where the nets are coming. The nets have the swage at the finish to put inside the top and bottom cord.

D. Parameters
- Steel thickness
• Section Height
• Stud, joist, beam, or purling spacing.
• Section placing
• Joist Height

E. Floor Finish

**Figure 8:** Floor Type with Galvalume Corrugated Sheet

**Figure 9:** Truss/Beam Detail

F. Roofing System
Variety of roof styles possible to design and detail out with LSF technology [14] with flexibility for large spans numerous finishing materials can be applied on floor slabs and roofs as it is designed within the framework of load calculations. Figure 9 discussed truss beam and Floor Type with Galvalume Corrugated Sheet are shown in Figure 8.

Roof Trusses are made up of Cold-Formed Steel C-Lipped Units. The Trusses can [15] either be Triangular Trusses (For Sloped Roof) or Parallel Chord Trusses (For Flat Roof). The Figure shows 10 in roof structure.
G. Design Philosophy
The most critical Column, wall, beam, rafter, truss, purlin, and roof are checked against compulsory lots whether member services exceed the volume. Figure 10 shows Roof structure and wind bracing are shown in Figure 11.

- Completely calculated side loads are approved by a vertical member and flat strap X-type bracings.
- FCB, then other cladding materials, create notable benefaction to seismic and wind resistance
- Superior anchorage particulars are used to transmit the bracing tightness to the foundation

4. Standard List Building Codes

A. Standard Codes
- Cold-formed steel is designed following the IS 801 under the National Building Code -2016 (NBC) of India.
- The US building codes, developed by the International Code Council (ICC), reference the NASPEC to design Cold-formed steel.
- AISI has been approved by ICC 2006 also NFPA 2005-2006 Building Codes. AISI Approved by IBC, 2006 Edition also NFPA, 2005-2006 Edition:
- North American Cold-Formed Steel Specification 2001 Edition through 2004 Supplement
- 2004 Edition of Cold-Formed Steel Framing Standards
- The New Zealand/ Australian (NZ/AS) Cold-formed steel code is also based on the US NASPEC specification. Software processed engineering calculations and structural analyses are based on these codes.

B. IS Codes
• IS 456: 2000 – Design of Concrete
• IS 800: 2007 – Design of Steel Structures
• IS 875: Part 1 to 5 – Loads on Structure
• IS 1893: 2002 – Earthquake Resistant Design
• IS 801: 1975 & AS/NZS 4600:2005 – Design of Cold-Formed Steel

5. Conclusion
Nowadays, various technologies are employed to create ease and comfort, security, and saving in costs, especially in energy resources consumption. In the performed studies on the LSF system with other systems, the following results are presented: Using Cold-formed steel sections are followed by many advantages. The most important advantages are the lack of need to using thermal operations, lack of thermal tensions of residual in sections, the possibility of creating sections in various shapes to achieve the maximum resistive return in section, lightweight, high resistance and rigidity, high accuracy in implementing details, and rapid and easy installation. As the research findings revealed the amount of base cut in the LSF system compared to the reinforced concrete system is reduced up to 55.5%, and compared to the metal system is reduced to 38.1%.

The highest amount of displacement of the roof mass center in the LSF system compared to the reinforced concrete system is decreased to 56.2%, and compared to metal system is decreased to 38.1%. Compared to the reinforced concrete system, the total weight of the building in the LSF system is decreased to 572.8% and compared to the metal system. It is decreased to 58.7%. The amount of building skeleton weight in the LSF system compared to the reinforced concrete system is reduced up to 72.4%, and compared to the metal system is reduced to 55.8%. The amount of consumed concrete in LSF system compared to the reinforced concrete system is reduced up to 78.9%, and compared to the metal system is reduced to 56%. The amount of consumed steel and reinforcement in the LSF system compared to the reinforced concrete system is reduced up to 24.5%, and compared to the metal system is reduced to 54.3%. LSF construction system is formed using industrial construction production methods and using double-layer walls. Therefore, there is an appropriate system for each type of insulation. In case of appropriate supporting, using a system with these potentials can be followed by sustainable development in the building sector accelerating constructions, industrial building production in the country, and optimal use with the possibility of recycling construction materials. It can also be used as an appropriate method for thermal insulation without implementation cost, influencing load-bearing in construction with the capability of optimal energy consumption control and cultural effects to use natural resources and accuracy in constructions.

Considering the obtained results, it can be stated that using this kind of construction requires high attention to a certain part of a structure. For instance, it can be referred to the high importance of connections in cold-formed connections. Observing necessary factors and regulations obtained from the previous studies, the implemented structure can obtain specific features such as the decrease created in structure's displacement, high energy absorption capability due to an earthquake, and restraining tension concentration focus in specific parts of a structure.

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