The Effect of Filling the Walls with Lightweight Concrete in the Seismic Behavior Light Cold Formed Structure

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**A R T I C L E  I N F O**

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**ABSTRACT**

Cold formed structural system is a light steel frame (Lightweight Steel Framing) System that is briefly called LSF. This method is a good alternative to traditional methods. Wall voids are stuffed with insulating material such as glass wool and rock wool. In this study, constructs cold formed inside walls are filled with lightweight concrete and seismic behavior. It is analyzed that use of concrete in structures, cold formed filler walls increase peripheral resistance, decreased structure and increased general shift towards structural plasticity is hollow structures with walls.

**INTRODUCTION**

Light Steel Frame (Lightweight Steel Framing) System when LSF is called for short, is a system of building components called Master Runner is formed (Fig. 1). In this study, constructs cold formed inside wall are filled with lightweight concrete. These structures are capable of very good, and yet are safe and better than the one or two-story residential structures to be applied. However, its use in places of education and compliance issues is permitted with regulations and administrative requirements [1]. Accordance the regulations for the manufacture of cold formed sections related to these structures, the use of different types is allowed. Usually, this section contains a variety of sizes and thicknesses in ranges between 6/0 to 5/2 mm. Sections used in this system, mainly U, C are usually cold connections (screw and nut connection) are connected to each other (Fig. 2). The general C-shaped wall components (master) to distance 40 to 60 cm above and below the horizontal component U or C-shaped studs (track or runner) are attached, are formed. This type of roof light beam and joist, the wall is a professor and Ran hay. Usually, the roof sloping type using metal trusses made from cold formed profiles to be considered. Other parts of the building are carried out using cold formed profiles and different types of the boards (plaster, cement, wood, …) are covered [2, 3].

**Fig. 1:** Structural components of cold–formed structures system [1].

**Compared with the traditional structures of conventional:**

The method developed countries as a good alternative to traditional methods of construction, providing extended application started. Existing studies show that the use of cold-formed structural system due to reduced capabilities relative displacement, reducing structural weight by about 40% compared to conventional systems,
metal, concrete, saving about 60% compared to conventional concrete structures and 30% compared to conventional metallic systems with good performance is seismic [4].

**Fig. 2:** Screw and nut connection in cold-formed structures system [1].

**Design Regulations:**
Cold formed structural style with solid walls run for one to two story buildings and which require systems can be combined with shear walls or systems can be used. Its construction was authorized in all areas of the seismic design of the structural members of steel structures in accordance with the bylaws of cold formed AISI is done. This system is based on three components designed AISI regulations limit state method (LSD), the load and resistance factor (LRFD); Allowable Strength Design (ASD) is permitted [5].

**Structural characteristics of the model:**
Sections used in this analysis, members of the faculty (STUD) and Runner (RUNNER) C and U-shaped sections are made. Specification cold-formed sections are shown in Figure 1. Elevation model presented in this study covers a span of 3 width frame 6/0 mm and wall thickness of 10 cm is considered.

**Fig. 3:** RUNNER, STUD cross sections [5].

Steel and concrete material characteristics were estimated through analysis in table 1. [6,7,8].

<table>
<thead>
<tr>
<th>Ultimate compressive strength (MPa)</th>
<th>Poisson's ratio</th>
<th>Modulus of Elasticity (MPa)</th>
<th>kg/m³ Density</th>
<th>Consumable materials</th>
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<tr>
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<td>12000</td>
<td>1106/3</td>
<td>LWC</td>
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<tr>
<td>370</td>
<td>0/3</td>
<td>210000</td>
<td>785</td>
<td>CFS</td>
</tr>
</tbody>
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**The results of the analysis model:**
The results of the analysis in ABAQUS software charts force - displacement diagram is shown of the concrete cracking. Figure 4 shows the model built in ABAQUS.

In figure 5, diagrams the force - displacement is given. It is known that fill the walls with concrete base section increases and the shift is maximized. Compared with the concrete frame filled with concrete and not full frame shows filling with concrete walls, area under the curve of force displacement, which represents the energy absorption capability increases.

In Figure 6, cracking diagram shows the rate of loss of internal energy, causing cracks in the concrete. In other words, it is represented the most energy absorbed by load side. Most of cracking and breaking strain of the sample at the highest levels that is concrete connection to the master and the bottom frame in areas connected to the fulcrum. It is the most disruptive and tension within the concrete frame at the foot of the column.
Fig. 4: The model built in ABAQUS.

Fig. 5: Diagrams the force - displacement.

Fig. 6: Diagram cracking.

Conclusion:

The cold formed steel sections using light have many benefits. One of the most important sections such as ease of production without the use of heat, lack of residual thermal stresses in the sections, the sections of possibility of creating a to achieve the maximum possible output varied and favorite in sections of strength may, accuracy quick and easy installation in detail and in execution, increasing the thermal and sound insulation pointed out. Filling the walls with light weight concrete system of cold formed steel structures according to the findings includes:
- The use of concrete increases the area under the curve of force - displacement, increased strain, energy absorption capacity, increased plasticity, increased strength and reduced the contribution of the concrete compressive load is shifted to the side.
- To increase the local buckling of thin-walled sections, cold formed coil, which is the main weakness of concrete as a material in the roof frame, and thus fills a professor and runner-section components, causing buckling of the adverbial and overall buckling walls are used.
- Diagram cracking shows rate of energy loss and maximum energy absorbed by the load side. Most cracking in the areas of highest strain bearing connection is the connection to the master and the bottom frame from concrete. In the empty frame are most fissures and tensions at the foot of the column. In addition to the benefits mentioned using analytical results, fill the walls of the structure to prevent corrosion.
of structural members and connections to prevent loosening of joints and reducing vulnerability to fire against the wall.

REFERENCES