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REVIEW PAPER ON LGSF BUILDING AND CONVENTIONAL BUILDING

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ABSTRACT

The construction business is always changing and looking for effective and new building methods to deal with the problems of durability, cost-effectiveness, and sustainability. By examining many factors such structural integrity, construction time, energy efficiency, and environmental effect, this research compares the performance of Light Gauge Steel Frame (LGSF) structures with conventional buildings. The study technique included data analysis of both LGSF and conventional structures, case studies, and a thorough examination of the literature. The load-bearing capacity, resistance to seismic pressures, and durability against environmental conditions were used to evaluate the structural integrity. Based on the efficiency of assembly, which included the frame, cladding, and finishing procedures, construction time was assessed. By contrasting the thermal insulation qualities and total energy consumption of LGSF and conventional structures, energy efficiency was examined. The embodied energy, carbon emissions, and recyclable materials utilised in both construction systems were taken into account while evaluating the environmental effect. The results of this research show that LGSF buildings have a number of benefits over traditional structures. In addition to having great load-bearing capabilities and exceptional resistance to seismic stresses, LGSF structures also displayed remarkable structural integrity. Furthermore, compared to conventional building techniques, the prefabricated nature of LGSF components greatly shortened construction time. Better thermal insulation qualities in LGSF buildings resulted in lower heating and cooling demands in terms of energy efficiency. The use of recyclable steel and less trash during construction were determined to be the key reasons why the embodied energy and carbon emissions associated with LGSF buildings were found to be lower than those of conventional structures. For architects, engineers, and construction professionals looking to replace traditional building systems with LGSF, this research offers insightful information. The research shows that LGSF buildings have the potential to provide better structural performance, quicker construction times, better energy efficiency, and lower environmental impact. The design and construction of LGSF buildings should be improved by more research and development to overcome any shortcomings.

Keywords: Light Gauge Framing System, Cold Formed Steel, STRAP Software.

1. INTRODUCTION

In order to fulfil the rising demand for sustainable and effective structures, the construction sector is crucial. Alternative building systems that provide better performance, quicker construction, greater energy efficiency, and decreased environmental effect have gained popularity in recent years. The Light Gauge Steel Frame (LGSF) construction system, which makes use of cold-formed steel sections as the main structural components, is one such option. On the other hand, traditional building methods have long dominated the construction business. These systems often employ reinforced concrete or wood as their main structural components. However, traditional building techniques often come with a number of drawbacks, such as lengthier construction schedules, greater prices, and less design freedom. This research compares the performance of conventional buildings versus LGSF buildings in order to assess how well each performs in several areas. We want to offer a thorough knowledge of the benefits and restrictions of each building system by contrasting structural integrity, construction time, energy efficiency, and environmental effect. The ability of the LGSF building system to get beyond the drawbacks of traditional construction techniques has earned it attention. LGSF structures provide quicker assembly times, lower labour costs, and more design freedom by using lightweight steel frame components produced off-site. Furthermore, due to steel's inherent strength and longevity, LGSF structures can endure seismic pressures and unfavourable weather conditions. A key component of sustainable building design is energy efficiency. Effective insulation methods are often used in LGSF buildings, improving thermal efficiency and lowering energy costs for heating and cooling. In addition, using recyclable steel in LGSF construction results in a less environmental impact than using traditional building materials. A mix of a literature review, case studies, and data analysis will be used to carry out this comparative research. The results of this study will provide important new information on the functionality of LGSF structures and their potential as an alternative to traditional building systems. Architects, engineers, and construction specialists may choose the best building system for certain projects by considering the advantages and disadvantages of both LGSF and traditional structures. This research seeks to advance our understanding of environmentally friendly building techniques, assist

continuing initiatives to improve building performance, and lessen the negative environmental effects of the construction sector

Problem Statement:

The difficulty facing the construction sector is how to fulfil the rising demand for efficient, affordable, and sustainable building solutions. Despite being extensively utilised, traditional building techniques can have drawbacks including extended construction times, greater prices, and possible environmental impacts. In light of these difficulties, it is necessary to look at alternative construction systems that provide better performance and a smaller environmental impact.

The Light Gauge Steel Frame (LGSF) building concept has come to light as a possible remedy for the drawbacks of traditional construction techniques. The performance of LGSF structures with conventional buildings across a range of factors hasn't been thoroughly compared, however. The capacity of architects, engineers, and construction experts to choose the best building system for particular projects is hampered by this information gap. As a result, the issue raised by this research is the absence of a thorough comparison between LGSF structures and conventional buildings. This research attempts to close the knowledge gap and give a full understanding of the benefits and constraints of both building systems by evaluating factors including structural integrity, construction time, energy efficiency, and environmental effect.

The study specifically aims to respond to the following research queries:

When it comes to load-bearing capacity and resistance to seismic stresses, how does the structural integrity of LGSF structures compare to that of conventional buildings?

- Given the speed of assembly and finishing procedures, how long do LGSF buildings take to construct compared to conventional structures?
- What are the energy efficiency differences between LGSF structures and conventional buildings, especially in terms of thermal insulation and total energy consumption?
- How do LGSF buildings compare to typical structures in terms of their environmental effect, taking into account things like embodied energy, carbon emissions, and material recycling?Insights into the performance and potential of LGSF structures as an alternative to traditional building systems will be gained by addressing these research issues. The research will advance our understanding of sustainable building techniques and aid in the decision-making processes used by the construction sector to improve building performance and lessen environmental impact.**METHODOLOGY**

All aspects of the LGSF system will be investigated in this research, which was done to determine the advantages over RCC constructions. Secondary data collection is the procedure used to acquire the data. All of the information will be gathered from already completed research papers or books and magazines relating to building. We would also utilise certain information that is released by the federal government, such as BMTPC, CPWD publications, and state government information. The information gathered may be utilised directly in this article or, if necessary, may provide the foundation for calculations. On the basis of the data gathered, we must do some comparison study related to my issue. This study will incorporate both quantitative and qualitative data. In addition to data processing, computational tools like MS Project and Excel are used to process the obtained data.

3. LITERATURE REVIEW

Alia O. M. Ahmed & Nigel d. P. Barltrop etal.(2017) They have discussed the LGFS structure's seismic performance in this study.These constructions function very well when subjected to seismic stresses. When designing a building's construction, seismic pressures and earthquakes are major considerations. Due to their ductility, lateral loading-prone steel frames may be constructed without the need of shear panels by employing portal framing, which will allow the results to be proven. Another investigation is conducted about the choice of steel components and cold-formed steel.

Mohite M Prakash et al. (2015) He was able to say that this steel section is excellent in its flexural strength and having nice appearance via his research on cold formed steel in this article. In this essay, the author provides a thorough examination of cold-formed steel sections and a comparison of those sections using several codes to forecast the flexural strength of beams. The author came at a conclusion by comparing experimental results to a comparative research on the flexural strength of lipped channel sections.

Sumit Shah et al. (2018) in this paper some comparative analysis has done by author like cost ,time between RCC and Steel structure.

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Bhavin H. Zaveri et al.(2016) Review article compares structural performance, fire resistance, cost, timeliness, and seismic resistance of RCC and Steel structures. Studies on environmental effects of steel structures and sustainability have been conducted.

Alhalabi Zinah Shuman(2018) The longevity, recycling, and little trash generated on building sites make LGFS environmentally benign. The efficiency and flexibility of non-bearing wall placements are two of the important determining considerations. It is crucial to satisfy the construction demands, particularly for high-rise buildings with a mix of commercial and residential uses given the population's exponential growth.

4. STUDY AREA

The research is conducted on a variety of themes, including the relationship between time and cost, labour productivity, material selection, and the influence of waste on cost overrun. The project chosen for the study is a guest house project situated in an urban region of New Delhi. The primary variables that are taken into consideration as a study topic for this research are comparative analysis of the numerous material alternative possibilities and manner of construction. Project

: Extension Hotel Blue Stone. Area of building: 104.75 Sqm.

Location: Nehru place, New Delhi. Estimated cost : 5964236.436/

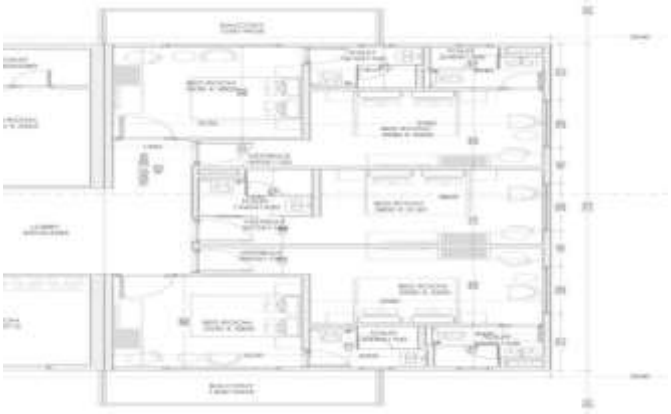

Figure no.1: Typical 1-3th floor plan

Table no.1 (General quantification of project RCC and Brick structure)

Item	Unit	QTY	RATE	AMOUNT
Excavation	Cum	124.72	181.85	22680.332
PCC	Cum	0.59	7738.2	4565.538
RCC	Cum	133.34	9400.85	1253509.339
Steel	kg	19132.49	77.89	1490229.646
Shuttering	Sqm	608	609.3	370454.4
Brick work	Cum	160.11	7809	1250298.99
Flooring	Sqm	95.56	1500.55	143392.558
Ceiling	Sqm	95.56	761.8	72797.608
Plaster	Sqm	907.08	307.9	279289.932
Plaster external	Sqm	272.44	266.85	72700.614
Paint	Sqm	1179.52	146.2	172445.824
Putty	Sqm	1179.52	115.15	135821.728
Door frame	Cum	2.235	130183. 05	290959.1168
Door shutter	Sqm	64.8	1886.7	122258.16
Glazing	Sqm	87	3250.95	282832.65
				5964236.436 /-

Table no.2 General quantification of project LGSF System

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Flooring	Sqm	95.56	1500.5 5	143392.558
Ceiling	Sqm	95.56	761.8	72797.608
Cement board(internal)	Sqm	907.08	1179.3	1069719.44 4
Cement board(external)	Sqm	272.44	1179.3	321288.492
Paint	Sqm	1179.5 2	146.2	172445.824
Putty	Sqm	1179.5 2	115.15	135821.728
Door frame	Cum	2.235	13018 3	290959.116 8
Door shutter	Sqm	64.8	1886.7	122258.16
Glazing	Sqm	87	3250.9 5	282832.65
total cost				5781819.53 9/-

Cost difference = 5964236.436 - 5781819.539

= 182,416.897/-

Table no.3 Comparative analysis

Factors	RCC and Brickstructure	LGSF structure
Construction Quality street	It depends on theworkers most or work done manually so the end product is inconsistent	It is Factory Controlled -End Product precision manufactured andassembled to veryhigh tolerances using advanced techniques.
Entire CycleTime	Entire Cycle Time depends on some uncontrolled factors like weather / material availability / local politics in procurement of Quarry material / Sand etc	All the material lightin weight and dry it makes construction process faster. Thus a 5 storey building can be completed in a span of 5 months with better finishing
Labor Dependency	Totally Dependent,High Manpower required	Factory Controlled &Low manpower required.
Thermal Insulation	Lower index in terms of Thermal Insulation	Steel buildings are thermally insulated.Because there is gapbetween the wall panels it makes the building cool.
Load Component	Heavy dead loads –Foundation gets heavier	1/3 rd of the weightof conventional. – Optimization in Foundation Design.
Type of Erection Equipmentneeded	Manual Working	MechanizedWorking
Portability toRemote / Hilly terrains	Very Difficult to procure materials (brick – Sand – Coarse Aggregates in Remote areas)	Huge savings in transportation costs as LGSF constructionis 1/3 weight of that of brick wall.
Erection	No scientific system available	All the materials are Part marked and are assembled as per the

5. CONCLUSION

- There is virtually little cost difference between LGFS and RCC.
- LGFS is more expensive than RCC for small structures or buildings, but for mass level construction, the total cost is always lower than RCC. Depending on the project's size.
- LGSF components are manufactured in a facility and delivered directly to the site, eliminating the requirement for on-site material procurement.
- 5–10% of materials are wasted on building sites, however by employing these precast pieces, we can save costs and waste.
- Since all steel is recyclable, LGFS may be regarded as a sustainable material.

- Unlike RCC and brick structures, LGSF offers better thermal performance thanks to the cavity between the wall panels.
- Why LGFS construction is quicker than RCC since 90% of the components are precast; all that is left to do is assemble them on site.
- Despite all its advantages, LGFS has certain disadvantages, such as its societal influence on Indians who may not be psychologically ready to use it.
- LGSF is a good choice for commercial and storage space since it can be created quickly off-site and can adapt to future modifications without creating non-hazardous or non-recyclable trash.
- As a result, we may see it as a sustainable strategy to meet the building industry's future need.

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