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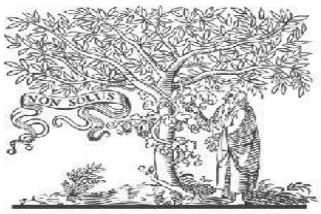

ELSEVIER SSRN

IJIEMR Transactions, online available on 25th July 2021. Link
:http://www.ijiemr.org/downloads.php?vol=Volume-09/ISSUE-07

DOI: 10.48047/IJIEMR/V09/I07/39

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Volume 09, Issue 07, Pages: 314-319

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Comparative analysis of LSM and WSM method of design of Roof truss

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Abstract:

As defined by the American Society of Civil Engineers, a truss is a structure that "consists only of two-force members, where the members are arranged such that the assembly as a whole acts as one entity." It is assumed that external forces and responses to those forces occur only at the nodes and cause forces to be generated in the members that are connected to the nodes alone. It may be either tensile or compressive in nature. The top chords of a truss are the beams at the top of the structure that are usually in compression. Bottom chords are the beams at the bottom of a structure that are usually under tension. The webs that run through the internal beams are referred to as webs. Panels are the regions that are contained inside the webs. For a safe design structure, there are four main objectives: usefulness, strength, and durability. Safety, economy, and grace are all important considerations. This article provides the results of an investigation on the behaviour of Howe type roof trusses and channel beams. Section purlins are determined via a comparison of the limit state technique and the working stress method. The following will be the comparison in this paper: Shear force, bending moment, deflection, and displacement are all examples of shear force. The information is derived from Indian data. IS 875-1975 (part III), IS 800 – 2007 (using the limit state technique), and IS 800-2007 (using the working stress method) are all standard codes. The steel table is used to get the technique as well as the section characteristics of the specimens. The structure has been planned. Under wind stress in a fixed-supported configuration the primary goal is to offer a technique that is effective. Economical, high bending strength, increased weight bearing capacity, and high flexural strength are all characteristics of steel. The findings of the research as a result, we can conclude that the limit state technique design has high bending strength, high load-carrying capacity, and minimal bending resistance. When compared to the working stress technique, there is less deflection and less local buckling and distortional buckling.

Keywords: **Truss, Purlin, flexure strength, Buckling, Distortional**

I. INTRODUCTION

A truss is made up of straight elements that are usually (but not always) linked at joints, which are commonly referred to as panel points. Trusses are usually (but not always) made out of triangles because of the structural stability provided by the form and design of the triangle. When the lengths of the sides of a triangle are fixed, a triangle is the most basic geometric form that will not change shape. In In contrast, in order for a four-sided figure to maintain its form, both the angles and the lengths of the figures must be set. There are two of them. Trusses are classified into the following categories:

The pitched truss, also known as the common truss, is distinguished by its triangular form. It is most often used in roofing applications. Construction. Some typical trusses are called based on their web arrangement, whereas others are not. The size of the chords and the web the span, load, and spacing all play a role in determining the configuration. The parallel chord truss, also known as the flat truss, derives its name from the fact that its top and bottom chords are parallel. It is often used as a flooring material. Construction.

Purlins are roof framing elements that span parallel to the building eave in steel construction, and they are also known as purlins in wood construction. Support the decking or sheeting on the roof. Purlins are supported by rafters or walls, which in turn support the purlins. Structural engineering, often known as A purlin (also known historically as a purline, purloyne, purling, or perling) is a structural component that runs longitudinally and horizontally in a structure. With the exception of a certain kind of frame with what is known as a crown plate.

There are three main kinds of wood framing used in traditional construction. purlin plate, main purlin, and common purlin are the three types of purlin. Purlins that are frequently utilised include channel and angle sections. Cold Purlins made of formed steel are the most frequently utilised structural components in India. Sections are given that are essentially "Z" sections, where the span of the roof purlins is sloping, and the length of the span is the maximum allowed by the building code. Cold formed steel is produced primarily via a series of processes. The process of producing steel sections in cold state sheets of uniform thickness is called structural components. Steel is measured in thickness. The thickness of the member varies from 0.4 mm to 6.4 mm. The yield point and ultimate strength of the material are increased during the cold forming process. Sections of steel (1). Cold formed steel sections, also known as light gauge steel sections, are a kind of steel segment that has been cold formed. These parts are constructed of Heat is not used to create thin sheets of consistent thickness; instead, cold is used. The thickness of the sheet used is typically between 1/8 and 1/4 inch. 1mm and 8mm are the thicknesses. Typical applications for these kinds of sections include purloins and girts, light struts for roofs, and purlins for walls. Sheeting and floor decking are examples of such materials.

1.1 King Post Truss

Is a kind of truss that is used to support a king post.The majority of the time, this specific truss is constructed of wood, but it may also be constructed of a mix of steel and wood as well. It everything boils down to the architect and the design of the building structure, after that. The King Post Truss has a maximum span of 8m, making it ideal for large structures. For a variety of different kinds of homes, particularly smaller ones

1.2 Pratt Truss is a kind of truss.

There are many kinds of steel roof trusses available, and this is one of the most popular and cost-effective. This specific kind of truss has a number of advantages. intriguing characteristics, primarily as a result of the fact that the vertical elements exert stress while the diagonal members

are relaxed Introducing compression into the equation. It is essential to note that these trusses may be utilised for spans ranging from 6 to 10 metres in length. Queen Post Truss is a kind of truss that is used to support a queen post. The Queen Post Truss is intended to be a highly dependable, basic, and adaptable kind of roof truss that may be used in a variety of situations. Given a period of time it has a good spread, about 10m, and a straightforward design that makes it suitable for a broad variety of applications. Establishments.

1.3 Howe Truss is a kind of truss.

This kind of truss is made of a mix of steel and wood, which gives it an exquisite appearance while also providing a very pleasing appearance. Design. Almost everything is constructed of wood, with the exception of the tension members and vertical members, which are both manufactured. Made of steel in order to provide additional stability and dependability! One of the things that distinguish the Howe Truss is the fact that it is made of wood. The fact that it has a very broad span, since it can cover a distance ranging from 6 to 30 metres. Due to its adaptability, it is very helpful for a variety of applications. A variety of project kinds

Figure 1: Various Types of Roof Trusses

1.4 Fan Truss is a kind of support for fans.

As you can see from numerous roof truss types' images, the Fan Truss has a relatively basic design and is constructed of lightweight materials, such as aluminium. Made entirely of steel in this specific instance, the trusses are joined together to create a fink roof truss. On top of that, the most distinguishing feature of this place is it is important that the upper chords be divided into shorter lengths, since this will enable the structure to receive purlin support. In addition, you get a medium. The span with this kind is about 10-15m, which is more than sufficient for the majority of projects.

1.5 Roof Truss for the North Light

The North Light Roof Truss is suited for greater spans of more than 20m and up to 30m. It is available in a variety of lengths. This occurs as a result of it is less expensive to construct a truss with a broad, bigger set of lattice girders, which includes support trusses, rather than a narrow, smaller set. This is one of the methods. It is one of the oldest, as well as the most cost-effective, options available on the market, since it enables you to bring in adequate ventilation. Ventilation. Furthermore, as a result of this, the roof has greater resilience. If you are searching for kinds of roof trusses design that are both durable and versatile, this is a very excellent option to consider. Out. While it may be used for industrial structures, this truss can also be used for drawing rooms and other similar areas. Are very big.

1.6 Roof Trusses with a Quadrangular Cross Section

Large venues, such as auditoriums or stadiums, benefit from the usage of these since they are designed for long-distance transmissions. Even railway sidings are included.

1.7 Roof Truss with Parallel Chords

These kinds of trusses are designed especially for those of us who wish to participate in roof building but do not have access to a crane. To begin with, you have a big budget. There is nothing special about utilising them since they are made of wood and don't need any special tools. Neither a beam nor a bearing wall is required. Instead, they choose for complete pieces of wood, which reduces the amount of work required for the project overall.

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Collaborating with them however, it will require more space in the attic, and the span may not be the best, but the cost may be worth it in the end. If you are on a tight budget, this is the route to take.

1.8 Roof Truss with Scissors

A Scissor Roof Truss is a kind of roof truss that is often seen in cathedrals. It does not need the use of beams or bearing walls, although it does. Because it does not provide enough room for insulation, its energy efficiency is very low. On the other hand, there are advantages. The main difference is that the ceiling is vaulted and you have extra room in the attic as a result.

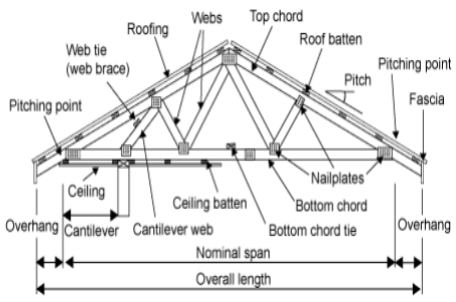
II. OBJECTIVE OF THE PAPER

The main objective of the study provides which are the economical method and, high bending strength, more load carrying capacity and high flexural strength by analysis of both working stress and limit state method in STAAD Pro software.

III. MATERIALS USED FOR ANALYSIS

Density of steel: 7850 kg/m3 Poisson ratio: 0.3 Modulus of rigidity: 0.769x105N/mm2 Coefficient of thermal expansion: 12 x 10.

3.1 COMPONENT OF ROOF TRUSS



Slope is the measure of how "steep" a roof is. For example, if a roof is "4 in 12", the roof rises 4 inches for every horizontal run of 12 inches. The pitch of the roof is a big factor in determining the kinds of materials that can be used and the longevity of the roof. Usually, a steeper roof (higher pitch) will last longer due to its better drainage capabilities. Top Chord - Main member of a truss running along the underside supporting the decking.

- Bottom Chord - Main member of a truss running along the lower side between supports.
- Peak the highest part of the truss.
- Overhang that portion of the roof truss structure that extends beyond the exterior walls of a building.
- Cantilever - a beam anchored at one end projecting into space

3.2 LOAD ON ROOF TRUSS

There is a dead load. Single-story industrial buildings have dead loads on their roof trusses that include the dead load of claddings and dead load of purloins, as well as self weight of the trusses in addition to the weight of bracings, among other things. Furthermore, extra specific dead loads such as those caused by Roof truss dead loads may be caused by truss-supported hoist dead loads, as well as by specific ducting and ventilation weight, among other things. As If you lengthen your clear span length (column free span length), the self weight of your moment resistant gable frames will rise proportionately (Fig. 2.2b) rises by a significant amount. Roof trusses are more cost-effective in such situations. The following dead loads are applied to the project:

Self weight

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Member Load = -12 KN/m

Floor Load = -2 KN/m

3.3 Loading in real time

It is necessary to include the gravitational load due to erection and maintenance, as well as dust load, among other things, while calculating the live load on roof trusses. The intensity is calculated in accordance with IS: 875-1975. Additional unique live loads, such as snow loads in very cold regions, crane loads, and other similar situations it may be necessary to take into account active loads in trusses supporting monorails.

The following is how the Live load is applied in the project:

- 6 KN/m2 is the member force.

3.4 There is a lot of wind.

Unless the roof slope is very steep, the wind load on the roof trusses would typically consist of an uplift force perpendicular to the roof. As a result of the suction action of the wind blowing over the roof As a result, the wind stress on roof truss typically operates in the opposite direction as the wind. When a force is applied to a truss member, it may cause the forces to reverse, and its magnitude can be greater than the force applied by gravity. The It will be discussed later in this chapter how to calculate wind load and what impact it has on roof trusses. The following wind loads are applied to the project:

WL in X direction
WL in Z direction
Load combination:

1. 1.5 (DL+LL+WL)
2. 1.2(DL+LL+WL)

3.5 NUMERICAL DATA OF ROOF TRUSS

The Building is located in Industrial Area Jaipur. Both ends of the truss are fixed. 1. Span of the roof truss = 12m

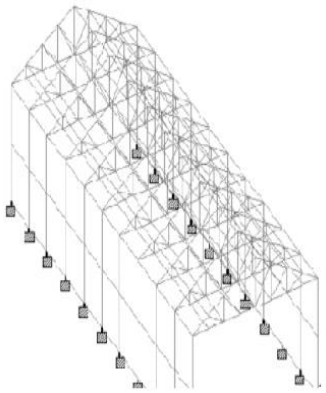

Fig: 3 Structure of roof truss from STTAD Pro [Refer from STAAD Pro]

2. Spacing of the truss = 3m
3. Height of the building = 12m
4 Length of the building = 20 m
5. Rise of the truss= 3m
6. Pitch of the truss = 1 in 4

IV. ANALYSIS:

Comparative Table

Table: 1 Comparative analysis of Different parameter of LSM and WSM Method

S.No.	LSM			WSM		
1. Shear Force	Maxx Fx	Maxx Fy	Maxx Fz	Maxx Fx	Maxx Fy	Maxx Fz
	931.319	73.757	26.431	1055.306	51.404	30.861
2. Bending Moment	Maxx Mx	Maxx My	Maxx Mz	Maxx Mx	Maxx My	Maxx Mz
	931.319	73.757	26.431	1055.306	51.404	30.861
3. Reaction	X	Y	Z	X	Y	Z
	20.7	719.201	16.497	20.399	694.379	16.599

V. RESULTS

There were two techniques utilised for the study and comparison of different characteristics such as shear force, bending moment, reaction force, and weight of the construction, which were completed. The information is derived from the Indian standard codes IS 800 WSM and IS 800 WSM-A.It is suggested that you use the LSM, Steel Table, and IS 875 Part III with the Calculation of Wind Load. The findings of the limit state approach are as follows: In comparison to the working stress technique, the bending moment and load bearing capacity are greater.

VI. CONCLUSIONS

In this paper work, the total roofing load configuration is the same in both the limit state and operating stress methods since the total roofing load configuration is the same. The In comparison to the working stress technique, the limit state method has a greater load bearing capability, according to the findings. Actual both methods produce the same amount of deflection and bending tension. According to the findings of the research, the limit state approach design has a high probability of success. Bending strength, high load bearing capacity, little deflection, and the least amount of local buckling and distortional deformation are all desirable. When compared to the working stress technique, buckling.

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