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Design strategies for roof trusses are contrasted. LSM and WSM

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ABSTRACT

Using the term "single entity," we indicate a framework with just two forces. Members are subjected to tensile and compressive stresses as a result of external forces. Beams refer to the top and bottom of a truss, respectively. There are intervals between the webs that are called panelling. A well-rounded design framework incorporates safety, cost-effectiveness, and aesthetics into the overall design process. Howe roof trusses and channel section purlins are studied using limit state and working stress techniques. A comparison of shear force, bending moment, deflection and displacement is the subject of this investigation. The Indian Standard Codes IS 875-1975, IS 800-2007 (limit state approach), and IS 800-2007 are used to calculate specimen section characteristics (working stress method). The building is designed with a long-term support system in order to endure wind loads. These researchers are primarily interested in finding techniques that are low-cost and easy to maintain while yet being able to manage large weights. The best bending and load-bearing capacity may be achieved by using the limit state approach design.

They must be taken into consideration for their buckling strength, bending stiffness, and distortion stiffness.

INTRODUCTION

In the building business, panel points are used to connect two straight pieces of material together. The use of triangles to stabilise trusses is common, however this is not always the case. This is the only geometric form whose dimensions will never change since its sides are all of equal length. Four-sided figures need regular regulation of their angles and lengths in order to maintain their right shape. Trusses come in two varieties:

Thus, the pitched and common trusses have two separate triangle shapes. The most common usage of this material is for roofing. For example, trusses get their name from the web structure they have. The length, weight, and spacing of the chords and webs determine this.

There are parallel top and bottom strings, which is why it is known as a "parallel chord" kind of structure. This is a common building material for flooring.

the building is made of steel Purlins are classified as either horizontal or vertical. Structurally, purlins depend on the walls for their support. Without a crown plate, both purlins may be purchased. Rooftop "crown plates" are the term used by structural engineers and architects. Purlins of the later kind are what we see here. The purlin plate, primary purlins, and common purlins make up a purlin, on average. Purlins, channel and angle sections, and other roofing components are often used together. Cold-formed steel purlins play a vital role in Indian construction. When constructing a sloping roof with a lengthy span between the purlins, it is usual practise to employ "Z" sections. It is necessary to employ thick metal sheets to produce sectional steel sections for cold forming. Steel members are available in thicknesses ranging from 0.04 to 0.64 inches.millimetres. Cold forming improves both the At the time when a currency's value has reached its highest point of strength (1). Rolled stainless steel sheets are used to make cold-formed and light-gauge spools. Without the use of heat, these components are made from thin, uniformly sized metal sheets. Between 1 and 8 millimetres thick is typical for sheets.. When it comes to construction, purlins may be used to form anything from light supports to roof sheets to floor decking.

"Boots and Saddles"

Steel or wood may be used to build this truss, however wood is the preferred option. When it comes to architecture, who is in charge of it and how it's put together is of utmost importance. With a maximum length of 8 metres, the King Post Truss can accommodate a wide range of home sizes, particularly smaller ones.

Pratt Truss, a firm in the construction industry, makes use of it.

This is the most popular and least expensive kind of steel roof truss. Accordingly, when stress increases in the main strut, tension decreases in the diagonal strut. The typical length of this kind of building is 10 metres.

The King of the Post Trusses.

The Queen Post Trellis is a great option because to its adaptability and reliability. Because of its simple construction and 10-meter spread, it may be used by a wide range of organisations.

A Howe Truss is a particular kind of truss used in the construction business.

Structurally solid and visually appealing, the truss composed of steel and wood is an excellent choice. Steel tension sections keep the building stable and long-lasting despite the fact that the bulk of it is constructed of wood. The Howe Truss is well-known for its use in long-distance transportation. Because of this, a wide range of uses are conceivable.

One of the many alternatives available to you is a rooftop system.

Roof truss styles are depicted in these images, including a steel fan-truss design. The fink roof truss is constructed

using this technique. The top chords of a building may be divided into smaller sections to provide purlin support. Generally speaking, a span of 10-15 metres is appropriate for most projects.

The north light comes from the roof trough.
North Light Roof Trusses are capable of supporting spans up to 30 metres. Installation is less expensive, which correlates to an increase in the use of lattice structures. This method may be used to bring in more natural light and air into your place of business or residence. A weather-resistant roof is one of the additional advantages.

One of the better roof truss design solutions. This truss may also be used to support industrial structures, such as ballrooms and drawing rooms.
With Quadrangular Roof Trusses

Large auditoriums and even train sheds are common locations for them.

Parallel Chords in the Roof Truss

This set of trusses was designed for those of us who want to build a roof but don't have the money to do it. Their wooden construction means no supporting beams or walls are required to keep them in place. Logs are more efficient than individual pieces of wood in terms of both time and labour. To save money, even if your attic space has been taken up and your bed cover isn't perfect, it may be worth it..

Step-by-step instructions on using scissors to cut a roof framing system

Structurally, the cathedral roof is noted for its scissured trusses. Energy efficiency is poor since there are no beams or bearing walls to support the structure. The vaulted ceiling of the attic, on the other hand, gives more storage space.

Is there a point to all of this?

So the study's major objective is to develop a low-cost method that also delivers higher load bearing capacity, better bending strength, and more flexibility via the use of STAAD Pro's working stress and limit state approaches to flexibility.

MATERIALS USED FOR ANALYSIS

Density of steel: 7850 kg/m^3
Poisson ratio: 0.3
Modulus of rigidity: 0.769x10^{5}N/mm^2
Coefficient of thermal expansion: 12 x 10^6

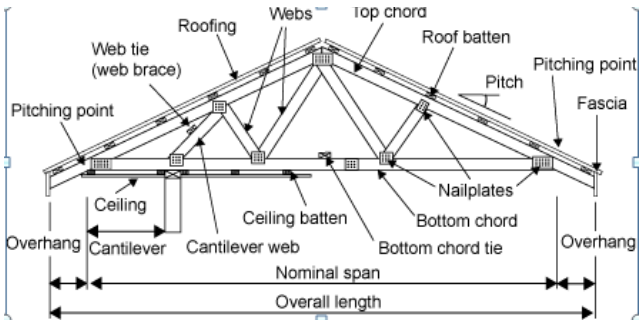

Fig: Components OF ROOF TRUSS [Ref no. 9]

COMPONENT OF ROOF TRUSS

Slope To say that a roof is "steep" is to use this expression. For example, if a roof is "4 in 12," it rises 4 inches for every 12 inches horizontally. The pitch of a roof has a significant impact on the roofing materials and the roof's lifespan. Because of its improved drainage characteristics, a steeper (higher pitch) roof often lasts longer.
In order to keep the decking in place, it is supported by the top chord, a main truss component that runs down the bottom. The bottom chord is the most important portion of the truss, going from support to support..

This is the point at the top of the structure.

In addition, there is an overhang. Extending beyond the outside walls of a structure, this is where the roof trusses meet.

With one end anchored to the earth and another extending into space, a cantilever is defined.

Loading of the Roof Truss

The roof trusses of single-story industrial buildings sustain the dead weight of claddings and purlins, as well as the weight of their own trusses and supplementary bracing. There may be additional dead loads, such as hoist weights supported by the trusses, specialised ducting and ventilation weight, and so on, in addition to the roof trusses' weight. When the clear span length (column free span length) grows, the moment resistant gable frame self weight (Fig. 2.2b) increases dramatically. In this case, it's more cost-effective to employ roof trusses...

In the Project the dead load are applied as:
Self weight
Member Load = -12 KN/m
Floor Load = -2 KN/m

Live load
The live load on roof trusses is made up of the gravity force from erection and service, as well as the dust load and other elements, and the intensity is established by IS:875-1975. A crane's live load in a truss supporting a monorail, for example, or snow loads in very cold places may need to be taken into consideration.

In the Project the Live load are applied as:
Member Force= - 6 KN/m

Wind load

Due to suction action of the wind blowing over a rooftop, wind loads on roof trusses are typically an uplift force perpendicularly along their lengths. A corollary of this is that, in most cases, the wind load on roof trusses is inversely proportional to the gravity load, and its magnitude may be more than the gravity load. As we go through this chapter, we'll go through how to calculate wind loads and how they effect roof trusses.

In the Project the Wind Load are applied as:
WL in X direction
WL in Z direction
Load combination:

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

NUMERICAL DATA OF ROOF TRUSS

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

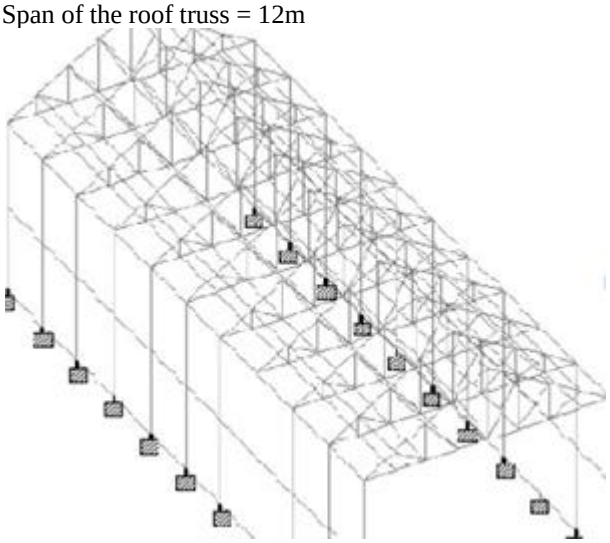

Fig: Structure of roof truss from STTAD Pro [Refer from STAAD Pro]

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

SPECIFICATIONS OF MEMBER

1. ISMC250
2. ISA65X65X6
3. ISA50X50X6

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	73.737	26.431	1035.306	51.404	30.861
2. Bending Moment	Maxx Mx	Maxx My	Maxx. Mz	Maxx Mx	Maxx My	Maxx. Mz
	931.319	73.737	26.431	1035.306	51.404	30.861
3. Reaction	X	Y	Z	X	Y	Z
	20.7	719.281	16.497	20.399	694.379	16.599

RESULTS

The shear force, bending moment, response, and weight of the structure were all compared using two different methodologies. The Steel Table and IS 875 Part III Wind Load Calculation were used to calculate the wind load. For bending moment and load bearing capacity, the limit state technique is superior than the working stress method.

CONCLUSIONS

There is no difference in the overall roof load arrangement between the limit state and operational stress approaches. Limit state theory can bear more weight than operational stress, according to these findings. Both techniques have the same deflection and bending stress. The limit state method design has a larger bending strength, more load-carrying capacity, and smaller deflection than the working stress design.

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