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Analysis and Design of Scissor Truss by STAAD Pro Software Method

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***Abstract*: Analysis and design were carried out for Scissor type of roof trusses two different type of steel sections i.e. Angle section and I section on STAAD pro software. The analysis for optimum section were carried out for combination of truss with two sections each making different combinations of truss and sections and the best optimized section with truss was found on STAAD pro software. Comparative study was made and it was found that Scissor truss with angle section to be optimum and economical.**

***Keywords*: Scissor Truss, STAAD Pro.**

1. Introduction

A truss is a structure composed of members connected together to form a rigid framework. Steel trusses are widely used in construction due to their high strength, light weight, and ability to span large distances efficiently. They are typically used in the roofs of industrial buildings, railway platforms, bridges, and warehouses.

The purpose of this project is to analyze and design a steel truss for a specified span and loading conditions as per the Indian Standard Code IS 800:2007. The project includes determining the loads acting on the structure, analyzing internal member forces using structural methods, and designing the truss members and connections accordingly.

The project also includes the preparation of detailed structural drawings and the application of software tools for modeling and analysis. The overall objective is to gain practical knowledge of steel design principles and enhance understanding of real-world structural systems through this project work.

Steel roof truss is a structure interconnected by of slender members joined together at their end points by welded, bolted or rivet connection. Joint connections are created by bolted or welded connection by the end members together to a common plate which is known as a gusset plate. Double cantilever truss or roof truss. Every structure must have to fulfill the structural criteria and economical requirements. Hence there is need of perfection in truss design to obtain minimum weight and economy of the steel roof truss.

2. Objective of the Study

1) Firstly, choosing the eligible and economical steel roof truss and then study the various properties of selected truss and then comparing the different truss on their parameters like strength, life span, ductility, durability, economy of the structure and time required for completion etc.
2) To analyse and design of industrial warehouse steel roof truss by using angle section and calculate the quantity of steel obtained.
3) To analyse and design of steel roof truss which is Scissor type roof truss by using Angle section and calculate the quantity of steel required.
4) To govern the most effective truss geometry in terms of weight among the truss geometry.
5) To analysis and design the both truss section on STADD PRO software.

3. Methodology

1. Project topic finalization.
2. Literature survey.
3. Planning of roof truss.
4. Calculation of forces on truss.
5. Analysis and design of truss using angle section.
6. Comparison of results.
7. Comparing the respective results of both truss sections on STAAD PRO software.
8. Conclusion.

4. Truss Analysis

The steel trusses sections have been analyzing as simply supported on columns. The support at both the ends is assume to be hinged for the purpose of analysis. The analysis of truss is done for dead load, live load and wind load according to IS: 875(Part 3)-1987.

A. Desing f Scissor Truss

Span of Truss – 21.34m
Type of Truss- SCISSOR
Spacing of Truss- 3m
Height of column- 6m

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Grade of steel fy-410
Connection bolted
Rise of truss = span/5 = 21.34/5 = 4.26m

Pitch of truss = $\tan^{-1}\left(\frac{Rise}{\frac{Span}{2}}\right) = \tan^{-1}\left(\frac{4.26}{10.67}\right) = 21.76$

B. Dead Load on Truss

Sloping Area =Lenth of Principal rafter x Spacing of truss

A =10.67 x 3
A = 32.01m^2
Wt= A x d
Wt = 32.01 x 150
Wt = 4801.5 N/m^2

Load on each point =$\left(\frac{total\ load}{no.of\ panals}\right) = \frac{4801.5}{14} = 342.96$ N/m^2
= 0.342 KN/m^2

Load on end point = 0.342/2 = 0.171 KN/m^2

C. Live Load on Truss

Live load on roof of truss is taken as = (750-20 (Θ-10)) x (plan Area)

$\Theta = \tan^{-1}\left(\frac{Rise}{\frac{Span}{2}}\right)$ $\Theta = \tan^{-1}\left(\frac{4.26}{10.67}\right)$

Θ = 21.76 Θ > 10

Plan Area = span/2 x spacing of truss

= (750 – 20 (21.76 -10)) x (10.67 x 3)

= 16478.74 N/m^2

Live load on each point = $\frac{16478.74}{14}$ = 1177.0985 N/m^2
= 1.177 KN/m^2

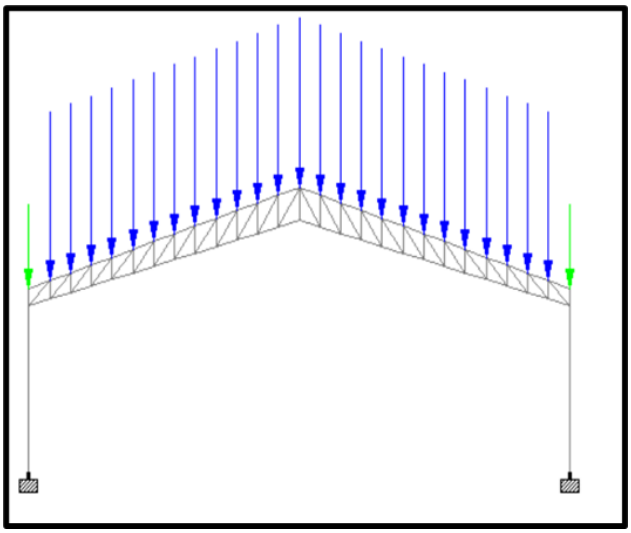
Load on end point = 1.177/2 = 0.5885 KN/m^2

Table 1
Properties given to the angle section steel roof truss

Node Displacement Summary

	Node	L/C	X (mm)	Y (mm)	Z (mm)	Resultant (mm)	rX (rad)	rY (rad)	rZ (rad)
Max X	2	2:LIVE LOAD	**8.512**	-0.117	0.000	8.513	0.000	-0.000	0.000
Min X	1	2:LIVE LOAD	**-8.512**	-0.117	-0.000	8.512	-0.000	0.000	-0.000
Max Y	179	3:WIND LOAD	-0.000	**1.969**	0.002	1.969	-0.000	0.000	0.000
Min Y	5	2:LIVE LOAD	0.000	**-23.811**	0.000	23.811	-0.000	-0.000	-0.000
Max Z	45	3:WIND LOAD	-0.072	0.993	**0.134**	1.005	-0.000	0.000	-0.000
Min Z	915	3:WIND LOAD	-0.072	0.993	**-0.134**	1.005	0.000	-0.000	-0.000
Max rX	903	3:WIND LOAD	-0.027	0.986	0.000	0.987	**0.000**	-0.000	-0.000
Min rX	33	3:WIND LOAD	-0.027	0.986	-0.000	0.987	**-0.000**	0.000	-0.000
Max rY	898	3:WIND LOAD	0.144	0.840	-0.108	0.859	0.000	**0.000**	0.000
Min rY	28	3:WIND LOAD	0.144	0.840	0.108	0.859	-0.000	**-0.000**	0.000
Max rZ	55	2:LIVE LOAD	7.570	-3.336	0.000	8.272	0.000	-0.000	**0.005**
Min rZ	20	2:LIVE LOAD	-7.569	-3.335	-0.000	8.272	-0.000	-0.000	**-0.005**
Max Rst	5	2:LIVE LOAD	0.000	-23.811	0.000	**23.811**	-0.000	-0.000	-0.000

D. Properties Given to the Angle Section Steel Roof Truss



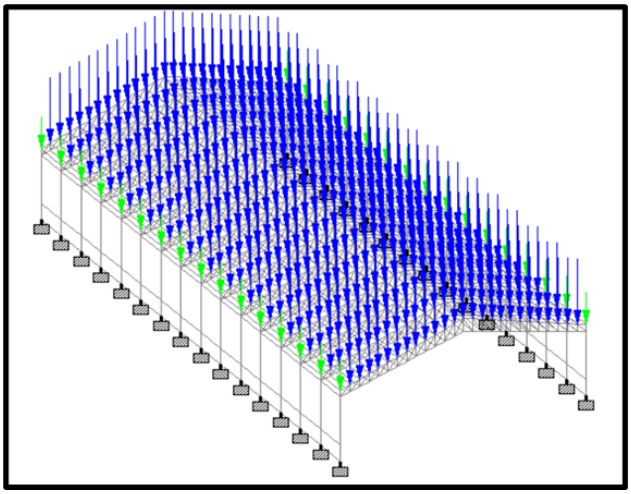
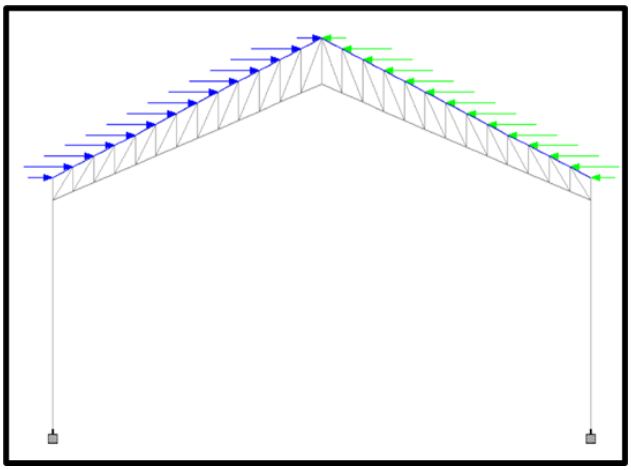


Fig. 1. Dead load & live load analysis



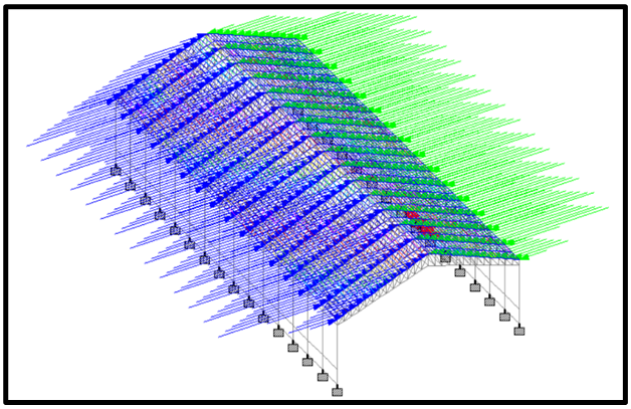


Fig. 2. Wind load analysis

5. Results

Table 2

S.No.	Member	Angle Section Pass
01	Principal Rafter	ISA 75 X 75 X 6 Mm
02	Main Tie	ISA 75 X 75 X 6 Mm
03	Vertical Member	ISA 75 X 75 X 6 Mm
04	Inclined Member	ISA 75 X 75 X 6 Mm

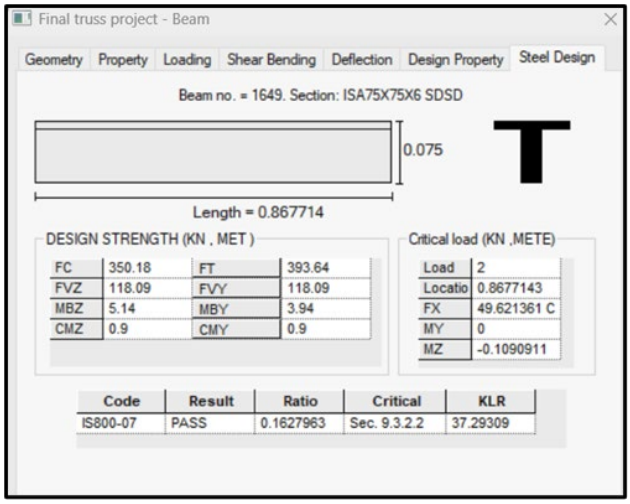


Fig. 3. Principal rafter

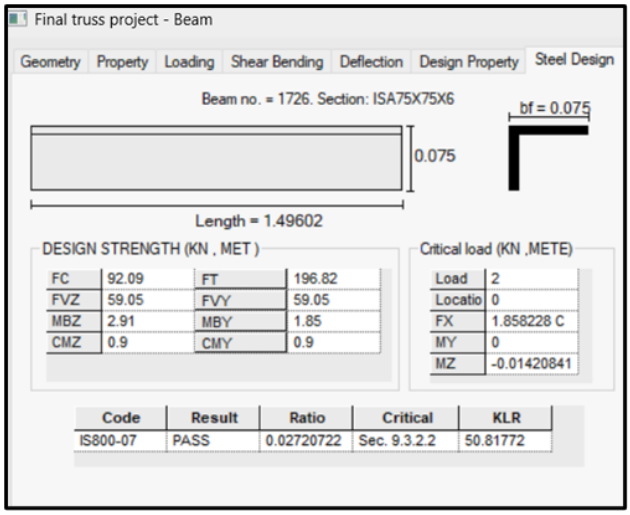


Fig. 4. Inclined member

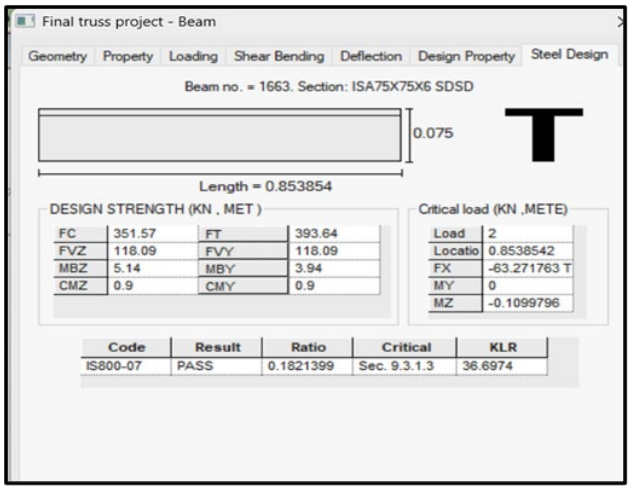


Fig. 5. Mai tie

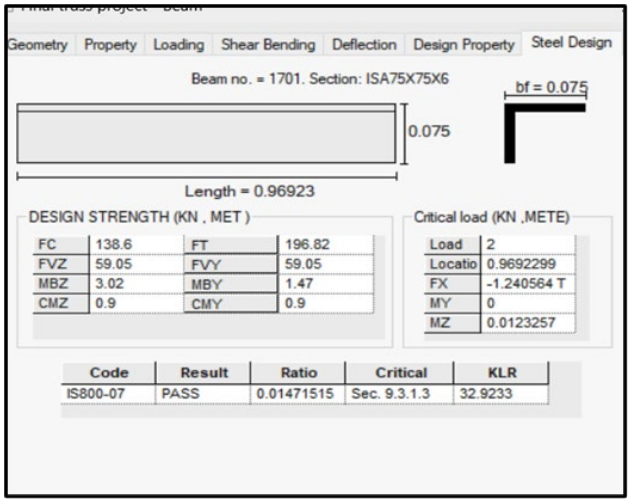


Fig. 6. Vertical member

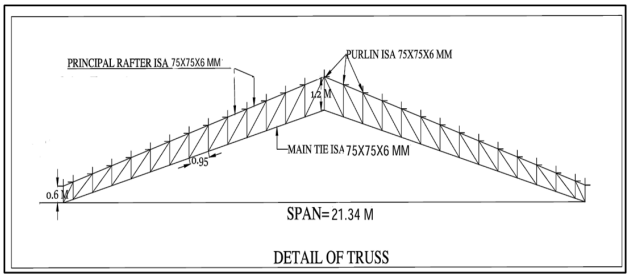


Fig. 7. Detail of truss

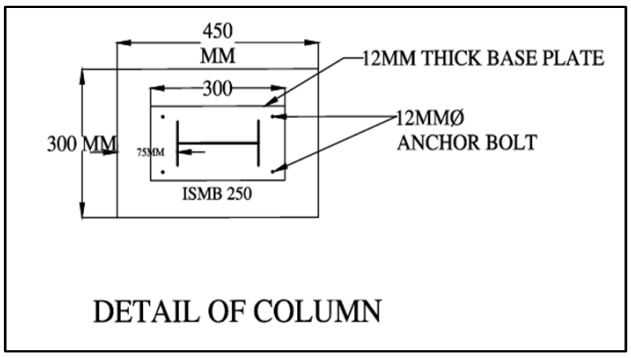


Fig. 10. Detail of column

6. Conclusion

This paper presented analysis and design of scissor truss by STAAD pro software method.

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