ANALYSIS AND DESIGN OF ROOF TRUSS BY SOFTWARE METHOD

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Abstract: Analysis and design was carried out for three different type of roof trusses namely fink truss, pratt truss and howe truss for 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 three trusses with two sections each making six 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 Fink truss with angle section to be optimum and economical.

***Index Terms*- Angle, I section, Fink, Pratt, Howe, Optimum, Staad Pro.**

I.INTRODUCTION

Steel is a material which has high strength per unit mass. Steel is a common building material used throughout the construction industry. Industrial buildings are generally designed as enclosures that provide space for internal activities, which may involve use of overhead cranes or suspended equipments as well as provision of office space or mezzanine floors. Its primary purpose is to form a skeleton for the building or the structure essentially the part of the structure that holds everything up and together. Steel is 100% recyclable material. Of all the structural building material in use today steel is perhaps the most universally acceptable as versatile material for engineering construction. Function of all the structure is to withstand stresses due to loads i.e., wind, earthquake etc. without failure or undue distress such as excessive deflections, dangerous vibrations etc. Steel as a building material has been studied and tested for many years. In this paper the study is done for the stability analysis of industrial shed i.e., pitched roof truss. Trusses are triangular frame works, consisting of essentially axially loaded members which are more efficient in resisting external loads since the cross section is nearly uniformly stressed.The loads are assumed to be acting only at the nodes of the trusses. The trusses may be provided over a single span, simply supported over the two end supports, in which case they are usually statically determinate. Such trusses can be analyzed manually by the method of joints or by the method of sections. softwares are also available for the analysis of trusses such as STAAD Pro V8i , ETabs etc. In this research work we have used Staad pro software for analysis.

Most common types of roof trusses are pitched roof trusses wherein the top chord is provided with a slope in order to facilitate natural drainage of rainwater and clearance of dust/snow accumulation. These trusses have a greater depth at the mid-span. Due to this even though the overall bending effect is larger at mid-span, the chord member and web member stresses are smaller closer to the mid-span and larger closer to the supports. The typical span to maximum depth ratios of pitched roof trusses are in the range of 4 to 8, the larger ratio being economical in longer spans. Pitched roof trusses may have different configurations. The different types of roof trusses used for analysis were fink truss, Pratt truss, and Howe truss. Fink trusses are used for longer spans having high pitch roof, since the web members in such truss are sub-divided to obtain shorter members

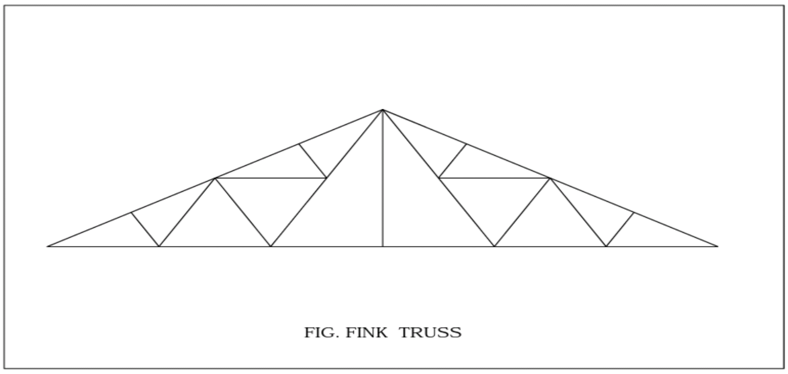


Image 1: Fink Truss

In Pratt trusses web members are arranged in such a way that under gravity load the longer diagonal members are under tension and the shorter vertical members experience compression. This allows for efficient design, since the short members are under compression. However, the wind uplift may cause reversal of stresses in these members and nullify this benefit.

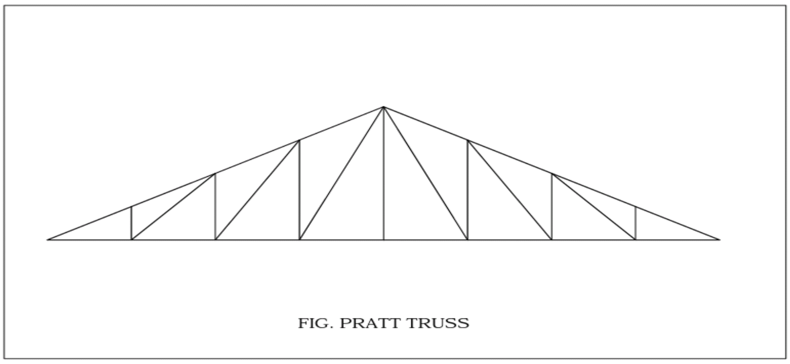


Image 2: Pratt Truss

The converse of the Pratt is the **Howe** truss. This is commonly used in light roofing so that the longer diagonals experience tension under reversal of stresses due to wind load.

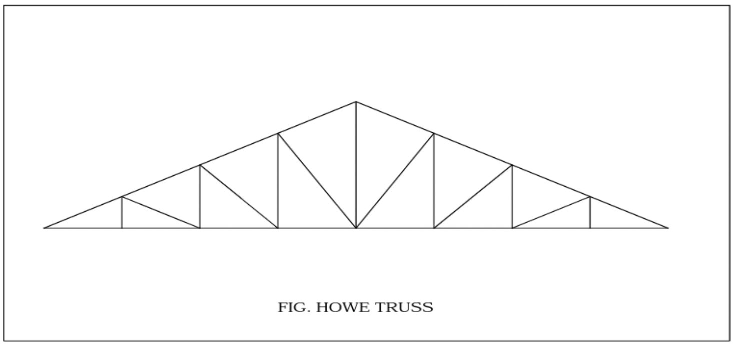


Image 3: Howe Truss

II. LITERATURE REVIEW

Shivani Meher et.al. (2018) has carried out work to know the different types of force/load effects to be considered while designing industrial warehouse with the help of literature review. This structure is proposed to design according to IS 800:2007 and the dead, live, the wind load analysis is done according to IS 875:1987 (Part-I, Part-II, Part-III). The area for proposed warehouse design was decided and proper architectural plan was prepared according to the requirements. The forces acting on the adjacent members when one of the members is under loading and calculating the excess stresses and ratios induced in these connected members and also, the moments and forces produced are obtained and mentioned. Then different members of warehouse for e.g. Truss members, columns and connections, etc. were designed and final result are obtained. Finally the conclusion is made that warehouse can be designed easily adopting simple design procedure and IS specifications.

Manoj Nallanathe et.al. (2018) had performed work on steel roof truss having 18m and 30 m span has been analyzed with design of tubular sections of truss members. Trusses were designed in two ways one is conventional and prefabricated. And the main point is first we have to check and the efficiency of truss. In this case truss was drawn by using STAAD Pro v8i 2007.Actually conventional is better than the prefabricated and utility, safety, economical and must be fulfilled. This paper presents a study on efficiency and economical of roof trusses and purlins by comparison method. Overall two methods were designed and comparison of all the trusses, the main point is after completing the analysis under that post processing mode will check the utility check up. The utility check up is always below 1. This load calculations and designs done by using IS800 2007LSD. This paper is about that different types of truss and to find that utility ratio in STAAD.pro. and to find the prefabricated and conventional truss. The main objective of this study is to determine the optimized truss profile and its effect to the design of plane truss by using tubular sections with the aid of STAAD Pro v8i 2007. Minimum mass is chosen as the objective function. For a structural design to be satisfactory, generally four major objectives – utility, safety, economical and elegance must be fulfilled.

Chetan Jayprakash Chitte (2018) revealed by carrying out analysis and design of Pratt Truss for 30m span by Limit State Method (IS 800:2007) and Working Stress Method (IS 800:1984). The data's are calculated using Indian Standard code IS 875-1975 (part I, II & III), IS 800 – 2007 using limit state method, IS 800-2007 using working stress method and the section properties of the specimens are obtained using steel table. The structure is designed under Wind loading with fixed supported condition. The main aim is to provide the method which is economical, more load carrying capacity and high flexural strength. The studies gives conclusion that the limit state method design gives high load caring capacity with minimum quantity of steel required as compare to working stress method, which results in economical design of truss design.

Srikant Boga et.al.(2018) has revealed that Conventional structure with pipe and tube section concept are a new concept in the construction of single storey steel industrial building which fulfils this requirement along with reduced time and cost as compared to conventional structures. The objective of this paper is to do comparative study between Conventional Steel Building and Conventional Structure with Pipe & Tube Sections of Industrial Warehouse Using STAAD-Pro.

Tejas D. parekh et.al. (2017) had carried out work by selecting howe type of truss using various span and rise. Four different spans such as 7m, 14m, 21m and 28m have been taken into consideration. Four rise criteria such as, L/3, L/4 and L/5 are taken. Angle section and Tube section have been compared for particular span and rise. Analysis was done using STAAD- Pro software and various results had been obtained. The safe and economical steel section was decided on the weight obtained of each truss after the analysis.

Shilpa Chouhan et.al. (2017) has performed work on to optimize the steel truss pattern for increase structural efficiency. We have tested the considered models using Staad.Pro and ETABS. They have designed steel truss of different spans i.e. 7m, 10m, 12m, 15m and 18m. The designed steel truss structures are analyzed for increasing structural efficiency with different configurations. Our proposed work shows that more strength beam and strength angle is required if we design the same structure with same material in ETABS as compared to Staad.Pro which demonstrates that it requires less strength. By analyzing the graphs, We could also conclude that as the span of structure increases the strength beam and strength angle condition is increasing considerably in ETABS as compared to Staad.Pro. In this study, main focus is to analyze the steel truss configurations for comparison among STAAD. Pro & ETABS by taking into consideration the strength parameters. The analysis results shall compare to acquire optimum and perfect truss design.

Rajat Palya et.al. (2017) had carried out work on sizing optimization procedure for composite steel-3-dimensinal frames. An evolutionary optimization method is employed to minimize structural cost subject to constraints associated with:
(a) Indian provisions for safety of steel structures, (b) I.S. 800:2007 provisions for safety of steel members, (c) Structural system. For the numerical analysis of steel structure, a variety of damage scenarios is considered. The results obtained demonstrate the effectiveness of the proposed optimization approach of particular importance is the investigation of the variation in the structural cost achieved when collapse resistance constraints are incorporated in the design process. By enforcing the satisfaction of additional design requirements on system resistance and safety against local failure, structural cost is inevitably increased. This increase is quantitatively explored by comparing designs obtained with and without collapse resistance constraints. Here in this research work we will analyze two structures of same geometry and loadings with optimization of steel by using two different sections.

Er. Sanjeev Kumar et.al. (2016) had carried out work on Howe Roof Truss of span varying from 10m to 40m has been analyzed for different geometries to get the desired optimum truss design. The various truss analyses are performed by using structural analysis software i.e. STAAD Pro. The analysis results are compared to obtain optimum and accurate truss design. In investigating the effectiveness of various truss geometries, a total of 80 truss geometries are analyzed. The analysis of all sets of trusses enables comparisons to be made among the various spacing, spans, and pitches. This study includes the determination of dead load, live load and wind load as per Indian Standard Codes IS 800:2007 and IS 875(Part 3)-1987. The Howe truss is analyzed by taking different pacings at different spans and pitches.The loads at each panel and node are calculated manually and then the loads are entered into STAAD PRO software for analysis and designing.The STAAD PRO OUTPUT method is used for determining the steel takeoff (weight).The truss with a least value of steel takeoff is considered as most economical truss.

Avanti Patrikar et.al. (2016) has studied optimization of Fink Truss by Fully Stressed Design (FSD) method using STAAD.Pro software version STAAD.Pro V8i (SELECT series 5). Three spans of the trusses have been considered and each truss has been subjected to 27 types of load cases by changing nodal load locations. Central node load has
been kept constant in each truss as 100 kN. Three sets of load condition is taken, viz, 100 kN, 120 kN and 150 kN. Total 81 trusses have been analyzed in this study to achieve a target stress of 100 MPa. Steel take-off for each case and maximum displacement for each case have been calculated and compared in this study and it shows that weight does not always increase with increase in the span or height. Results of the study could be helpful in designing a truss that does not waste material.

Kavita K. Ghogare et.al. (2014) had revealed in her work by carrying out work for single storey steel building with pitched roof in zone II. It is nothing but the industrial structure. The industrial structures shall be designed and constructed to resist the wind effects in accordance with the requirements and provisions of IS:875 (Part 3):1987. This standard describes the procedure for wind resistant of such structures .The stability analysis of single storey steel building with pitched roof is carried out using Software Computer Aided Design i.e., (STAAD PRO) .The main parameters consider in this paper to compare wind performance of buildings are bending moment ,shear force ,deflection and axial force. In this paper we only focus on industrial shed i.e., pitched roof truss.

Miss. Kavita K. Ghogare (2014) had performed analysis for multistorey steel building with pitched roof is done .The industrial structures shall be mainly designed and constructed to resist the wind effects in accordance with the requirements and provisions of IS:875 (Part 3):1987. This standard describes the procedure for wind resistant of such structures .The seismic analysis & design of multistorey steel building is carried out using Software Computer Aided Design i.e., (STAAD PRO) .The main parameters consider for comparing wind performance of buildings are bending moment ,shear force ,deflection and axial force. This paper work is focused on industrial shed truss and supporting columns. The seismic design of building frame presented in this project is based on IS:1893:2002, IS:1893:2005 and IS:800:2007 .The building consists of two storey. The selection of arbitrary sections has been done following a standard procedure.

Subhrakant Mohakul et.al. (2014) has stated that shed is typically a simple single storied structure in a back garden or on allotment that is used for storage, hobbies, or as a workshop. Sheds vary considerably in the complexity of their construction and their sizes, from small open sided tin roofed structures to large wood framed sheds with shingled roofs, windows and electrical outlets. Sheds used in industries are very large structures. Industrial Shed constructions are metal sheathing over a metal frame, plastic sheathing and frame. Large enclosures or industrial type buildings are very common in Visakhapatnam Steel Plant. Steel offers numerous possibilities to achieve both pleasant and flexible functional use. For buildings of large enclosure, the economy of the structure plays an important role. For longer spans, the design is optimized in order to minimize the use of materials, cost and installations effort. Increasingly, buildings are designed to reduce energy costs and to achieve a high degree of sustainability. Large open spaces can be created that are efficient, easy to maintain, and are adaptable as demand changes. Steel is chosen on economic grounds as well as for other aspects such as fire, architectural quality and sustainability. In most cases, an Industrial building is not a single structure, but is extended by office and administration units or elements

III.METHODOLOGY

The analysis carried out on staad pro software is performed step by step with the following process

1. Load calculation is made from given problem statement. ie. Dead load live load and wind loads are calculated with help of loading details given in IS875 PART 3,1987

2. Creating models on software by using beams and nodes.

3. Giving the member properties.

4. Defining the loads which have calculated.

5. Making the load combination and assigning to the members.

6. Analyzing the model and design.

7. Final results are obtained

Before we proceed with the actual analysis and design of structure following points are considered –

1. The structural system and type
2. The selection of the construction material
3. The location, ground conditions i.e., geography of the area
4. The design concept.
5. IS codes used with the use of proper method, IS code and also all analysis and design done by STAAD PRO.

IV. CALCULATIONS

PROBLEM STATEMENT-

Design is done for howe , pratt& fink type roof truss for an industrial building using angle section & I section for each type of truss for the following data:

1) Overall length of the building = 30 m
2) Overall width of the building = 20 m
3) Spacing of the trusses = 6m
4) Rise of truss = ¼ of span
5) Self weight of purlin = 200 N/m
6) Height of column = 9 m
7) Roofing = Asbestos cement sheets = 170 N/m2
8) Both the ends are hinged.

The building is located in industrial area at Bhuj ,Gujrat.

LOAD CALCULATION-

Step 1 :- Given data.

Type of truss=Howe type truss
L = 30 m
Span = 20 m
Spacing of truss = 6 m
Rise of truss = ¼ of span
Self weight of purline = 200 N/m^2
Height of column = 9 m
Roofing = Asbestos cement sheets = 170N/m^2

Step 2 :-Diagram.

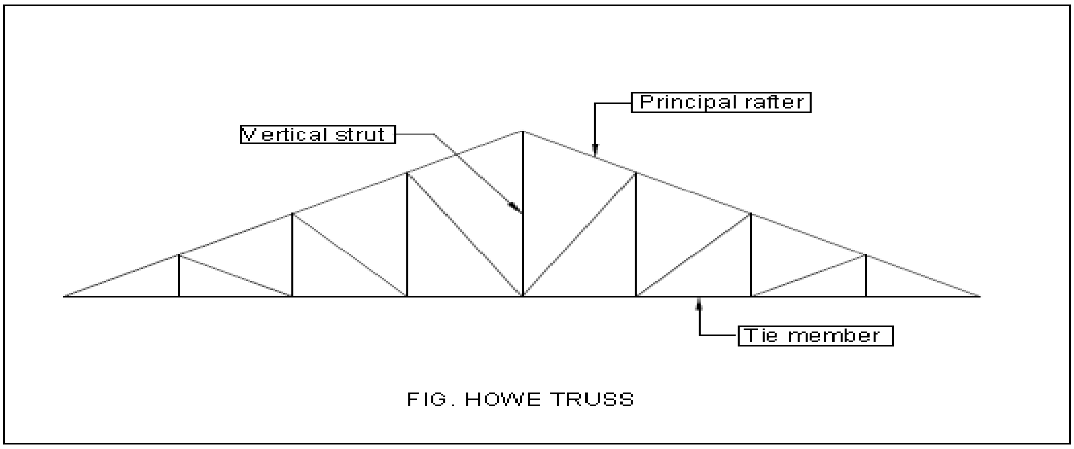


Image 4: Howe truss with components

Step 3 :- Calculation of θ .

tan θ =5/10

θ =26.56˚

Step 4:- Calculation of length of rafter.

Length of principal rafter= $\sqrt{rise^2+(span/2)^2}$
= 11.18 m
Length of each panel = 11.18/4
= 2.795 m

Step 5 :- Calculation of dead load .

Assume weight of bracing = 15 N/m2
Dead load of AC sheet = 170 N/m2
Self weight of roof truss = (span/3 +5)× 10
=(20/3 +5)×10
=116.66 N/m2
≈120 N/m2
Self weight of purline = 200 N/m2
Total dead load = 170+120+200+15 =505 N/m2

1. =2.795 x 505 = **1.4 kN/m**

DL on intermediate panel = 2.795 x 5 x505
=7. 057 KNs
DL on end panel = 7.057/2 = 3.528 KN

Step 6 :- Calculation of live load .

θ = 26.56˚
Live load = 750-20(26.56-10)
= 418.68 N/m2
≈ **1 kN/m**
Live load on each intermediate panel = 418.68×5×2.795=5.851KN
Live load on each end panel = 5.851/2 = 2.925 KN

Step 7 :- Calculation of wind load .

a. Basic wind velocity = Vb= 50 m/sec (IS:875 (PART 3) 1987, clause 5.2, page no. 53)
b. Mean probable design life of structure in years = 50 years

I. Risk coefficient-

YEAR	WIND SPEED	K1
50	50	1

Table 1 (IS:875 (PART 3) 1987, clause 5.3.1, page no. 11)

II. Terrain factor

Height	K2
10	1
12	?
15	1.05

Table 2 (IS:875 (PART 3) 1987, clause 5.3.2.4,page no. 12)

By interpolation k2=1.02

III. Topography factor (k3) :-

k3 = 1 when θ is greater than 3˚ i.e., θ > 3˚ (as per IS:875:Part 3:1987)

IV. Calculation of wind speed (VZ) :-

VZ = k1× k2× k3×Vb
= 1×1.02×1×50
= 51 m/s

V. Calculation of design wind pressure(pd) :-

pd = 0.6× (VZ)2
= 0.6× (51)2
= 1560.6 N/m2
= 1.56 KN/m2

VI. Calculation of external & internal air pressure coefficients:-

External air pressure coefficient :-
Cpe for the condition ½ < h/w < 3/2 and
For θ = 26.56, from IS: 875: Part 3:1987,table no. 5

Angle θ	Wind ward(EF)	Lee ward(EG)
20	-0.4	-0.7
26.56	**-0.26**	**-0.7**
30	0	-0.7

Table 3: Table showing Wind ward and Lee wards values

Therefore,

Cpe (windward side) = -0.26
Cpe (leeward side) = -0.7

Internal air pressure coefficients:-

The internal air pressure coefficients (Cpi) = ± 0.5 when the opening in the building upto (5 % to 20 %)

VII. Calculation of wind load:-

1) Wind load = [Cpe – Cpi] × pd × A
Where,
A = area, Pd = design wind pressure
Wind load = [Cpe – Cpi] × pd × A
= [- 0.7 - 0.5] × 1.560 × 5 × 2.795
= -25.155 KN
≈ 25.155 KN (Uplift)

2) Wind load per unit length of purline = 25.155/5 = **5.031KN/m**

3)Wind load on the panel points :-
Windward side,
F = [Cpe – Cpi] × pd × A

= [-0.26 – 0.5] × 1.560 × 5× 2.795
= -16.5687 KN
Therefore, wind load on each intermediate panel point = - 16.5687KN
And wind load on end panel = (-16.5687)/2
= - 8.2843 KN
Leeward side,
F = [Cpe – Cpi] × pd × A
= [-0.7 -0.5] × 1.560× 5 × 2.795
= -26.1612 KN
Therefore, wind load on each intermediate panel point = - 26.1612 KN
And wind load on each end panel = - 26.1612/2
= - 13.0806 KN.

The same process is repeated for Fink truss and Pratt truss.

Example was taken under consideration with dimensions and material grade as follows – Design a HOWE type roof truss for an industrial building for the following data:

1) Overall length of the building = 30m
2) Overall width of the building = 20 m
3) Spacing of the trusses = 5 m
4) Rise of truss = ¼ of span
5) Self weight of purline = 200 N/m2
6) Height of column = 9 m
7) Roofing and side covering = Asbestos cement sheet = 170 N/m2

Use steel of grade Fe415.
Structural diagram information:

Total nodes = 156 Total beams = 335

A. All the values of constant are calculated using IS:875(Part 1):1987,IS:875(Part 2):1987,IS:875(Part3):1987,IS:800:2007
B. Whole design is done in STAAD PRO Software using IS:800:2007
C. For analysis and design static method is adopted.
D. In this paper the above example solved and all analysis & design is done.
E. Table below shows the results from solving above example.
F. All the results of analysis and design are obtained using basic load cases and their load combinations with the help ofStaad Pro Software only.

Basic load cases

Number	Name
1	Dead load (DL)
2	Live load (LL)
3	Wind load (WL)

Table 4: Basic load Cases

Combination of load cases

Combination	Combination L/C name	primary	L/C name
4	1.7(D.L + L.L)	1	D.L
		2	L.L
5	1.7(D.L)	1	D.L
6	1.3(D.L + L.L)	1	D.L
		2	L.L
7	1.7(D.L +W.L)	1	D.L
		3	W.L
8	1.7(D.L –W.L)	1	D.L
		3	W.L
9	1.3(D.L +L.L+W.L)	1	D.L
		2	L.L
		3	W.L
10	1.3(D.L + L.L –W.L)	1	D.L
		2	L.L
		3	W.L

Table 5: Combination of load cases

Outputs

1. Howe Truss

a. Angle Section

Sr.No.	Name of member	Section	Wt/m (N/m)	Length	Weight (KN)	Rate/KN (Rs)	COST (lakh)
1	**Principal rafter**	ISA200X200X12	359	156.52	56.190	3550	1.995
2	**Tie member**	ISA100X100X7	118.7	140	16.618	3550	0.589
3	**Vertical strut**	ISA150X150X10	223.7	98.10	7.829	3550	0.278
4	**Member 1**	ISA110X110X8	131.5	52.49	6.902	3550	0.245

5	**Member 2**	ISA75X75X5	55.9	35	1.956	3550	0.069
6	**Member 3**	ISA20X20X3	8.8	17.5	0.156	3850	0.006
7	**Member 4**	ISA150X150X10	223.7	63.1	14.113	3550	0.502
8	**Member 5**	ISA130X130X8	156	49.49	7.720	3550	0.274
9	**Member 6**	ISA130X130X8	156	39.13	6.104	3550	0.217
10	**Bracing**	ISA40X40X3	17.7	178.83	3.165	3800	0.120
11	**Purlin**	ISJC 100	56.9	270	15.363	3650	0.561
				TOTAL	136.116	**4,85,600/-**	

Table 6: Output values for Howe truss with Angle section

b. I- Section

Sr.No.	**Name of member**	**Section**	**Wt/m (N/m)**	**Length**	**Weight (KN)**	**Rate/KN (Rs)**	**PRICE (lakh)**
1	**Principal rafter**	ISWB175	215.57	156.52	33.74	3800	1.282
2	**Tie member**	ISWB175	215.57	140	30.179	3800	1.147
3	**Vertical strut**	ISHB200	365.08	35	12.778	3670	0.469
4	**Member 1**	ISWB150	166.7	52.50	8.752	3700	0.324
5	**Member 2**	ISLB125	116	35	4.060	3700	0.150
6	**Member 3**	ISLB175	163.6	17.50	2.863	3650	0.105
7	**Member 4**	ISSC120	256.56	63.10	16.189	3650	0.591

8	**Member 5**	ISLB200	194.34	49.50	9.620	3650	0.351
9	**Member 6**	ISLB150	139.05	39.13	5.441	3700	0.201
10	**Bracing**	40X40X3	17.7	178.89	3.216	3800	0.120
11	**Purlin**	ISJC 100	56.92	270	15.369	3650	0.561
				TOTAL	142.29	**5,30,400/-**	

Table 7: Output values for Howe truss with I section

2. Pratt Truss

a. Angle Section

Sr.No.	Name of member	**Section**	**Wt/m**	**Length**	**Weight (KN)**	**Rate/KN (Rs)**	**COST (lakh)**
1	**Principal rafter**	ISA150X150X10	223.7	156.52	35.014	3550	1.243
2	**Tie member**	ISA150X150X10	223.7	140	31.318	3550	1.112
3	**Vertical strut**	ISA65X65X5	48.1	35	1.688	3600	0.061
4	**Member 1**	ISA120X120X8	156	52.488	8.188	3550	0.291
5	**Member 2**	ISA100X100X8	118.7	35	4.154	3550	0.147
6	**Member 3**	ISA70X70X5	52	17.5	0.910	3550	0.032
7	**Member 4**	ISA200X200X12	359	78.26	28.095	3550	0.998
8	**Member 5**	ISA130X130X8	156	63.09	9.842	3550	0.350
9	**Member 6**	ISA125X95X6	99.1	49.49	4.904	3550	0.174
10	**Bracing**	ISA40X40X3	17.7	178.83	3.166	3800	0.120
11	**Purlin**	ISJC 100	56.9	270	15.363	3650	0.561
				TOTAL	142.727	**5,08,900/-**	

Table 8: Output values for Pratt Truss with Angle section

b.I-Section

Sr.No.	Name of member	Section	Wt/m (N/m)	Length	Weight (KN)	Rate/KN (Rs)	COST (lakh)
1	**Principal rafter**	ISLB200	194.35	156.52	30.419	3650	1.110
2	**Tie member**	ISLB200	194.35	140	27.209	3650	0.993
3	**Vertical strut**	ISLB125	146	35	4.060	3700	0.150
4	**Member1**	ISWB150	166.6	52.488	8.744	3700	0.324
5	**Member2**	ISWB150	166.6	35	5.831	3700	0.216
6	**Member3**	ISLB75	59.2	17.50	1.036	3650	0.038
7	**Member4**	ISHB150	265.03	78.26	20.742	3670	0.761
8	**Member5**	ISWB175	215.84	63.10	13.620	3800	0.518
9	**Member6**	ISWB150	166.6	49.49	8.245	3700	0.305
10	**Purlin**	ISJC100	56.92	270	15.369	3650	0.561
11	**Bracing**	ISA100X100X8	118.3	178.83	21.163	3550	0.751

TOTAL	156.458	**5,72,700/-**

Table 9: Output values for Pratt Truss with I section

3.Fink Truss

a. Angle section

Sr.No.	Name of member	Section	Wt/m	Length	Weight (KN)	Rate/KN (Rs)	COST (lakh)
1	**Principal rafter**	ISA130X130X10	193.3	156.524	30.256	3550	1.074
2	**Tie member**	ISA150X150X10	223.7	140	31.318	3550	1.112
3	**Vertical strut**	ISA65X65X5	48.1	35	1.683	3600	0.061
4	**Member 1**	ISA150X75X10	165.8	21.03	3.486	3550	0.124
5	**Member 2**	ISA200X150X12	312	42.063	13.123	3550	0.466
6	**Member 3**	ISA100X100X6	90.2	42.063	3.791	3550	0.135
7	**Member 4**	ISA110X110X8	131.5	84.126	11.062	3550	0.393
8	**Member 5**	ISA100X100X6	90.2	46.662	4.208	3550	0.149
9	**Member 6**	ISA75X75X5	55.9	21.031	1.175	3550	0.042
10	**Purlin**	ISJC100	56.9	270	15.363	3650	0.561
11	**Bracing**	ISA40X40X3	17.7	178.83	3.166	3800	0.120
TOTAL					118.0189	**4,23,700/-**	

Table 10: Output values for Fink truss with Angle section

b.I-Section

Sr.No.	Name of member	Section	Wt/m (N/m)	Length	Weight (KN)	Rate/KN (Rs)	COST (lakh)
1	**Principal rafter**	ISHB150	265.03	156.51	41.480	3670	1.522
2	**Tie member**	ISWB175	215.86	140	30.218	3800	1.148

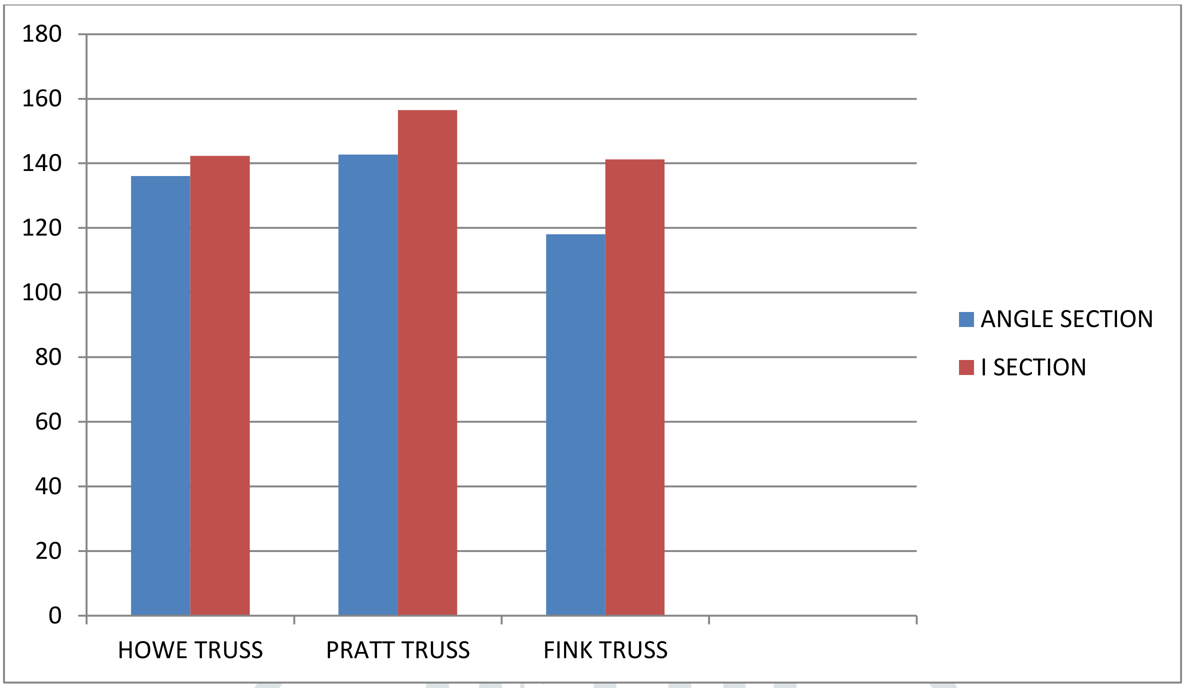
3	**Vertical strut**	ISLB125	116	35	4.06	3700	0.150
4	**Member 1**	ISLB125	116	21.03	2.439	3700	0.090
5	**Member 2**	ISLB125	116	42.063	4.879	3700	0.181
6	**Member 3**	ISSC120	256.60	42.063	10.793	3650	0.394
7	**Member 4**	ISLB125	116	84.126	9.758	3700	0.361
8	**Member 5**	ISLB175	163.63	46.66	7.635	3650	0.279
9	**Member 6**	ISLB100	78.36	21.03	1.648	3700	0.062
10	**Purlin**	ISJC100	56.92	270.00	15.369	3650	0.561
11	**Bracing**	ISA100X100X6	89.87	144.22	12.962	3550	0.460
				TOTAL	**141.242**	**5,20,800/-**	

Table 11: Output values for Fink truss with I section

V. RESULTS AND DISCUSSION

Type of truss	Howe		Pratt		Fink	
Type of section	Angle	I	Angle	I	Angle	I
Weight in KN	136.116	142.29	142.727	156.458	118.018	141.242
Price(Rs)	4,85,600	5,30,400	5,08,900	5,72,700	4,23,700	5,20,800

Table 12: Table showing Weight and cost analysis for Howe, Fink and Pratt Truss with corresponding Angle and I-Section



Graph 1: Graph of Weight Comparison

Graph 2: Graph of Cost Comparison

VI.CONCLUSION

From the result tabulated in above tables it is conclude that,

- To construct a howe truss for industrial shed with angle section requires less steel as compared with the truss construct with I section hence angle section howe truss is economical

- Similarly to construct a partt truss for industrial shed with angle section requires less steel as compared with the truss construct with I section hence angle section partt truss is economical

- Similarly to construct a fink truss for industrial shed with angle section requires less steel as compared with the truss construct with I section hence angle section fink truss is economical

- On the other hand to construct a industrial shed by using Angle section , fink truss is requires less steel as compare to the other two trusses and cost of steel is also less hence fink truss economical.

- Similarly, to construct a industrial shed by using I- section, fink truss is requires less steel as compare to the other two trusses and cost of steel is also less hence fink truss economical.

- From above possibilities finally it is concluded that Fink truss with Angle section is economical.

VII.REFERENCES

1. Shivani Meher, Ruchita Nar, Sadichha Jagadale, Gautami Kalal, "Design of Industrial Warehouse", International Journal of Engineering Research & Technology (IJERT), Vol. 7 Issue 02, pp.302-306,February-2018.

2. Manoj Nallanathe, Ramesh bhaskar, Kishore, "Efficency Study Of Different Steel Truss Using (Staad.Pro)", International Journal of Pure and Applied Mathematics, Volume 119 No. 17,pp. 3095-3101, 2018.

3. Chetan Jayprakash Chitte, " Analysis and Design of Pratt truss by IS800:2007 & IS 800:1984", IJCEM International Journal of Computational Engineering & Management, Vol. 21 Issue 2, pp.9-14,March 2018.

4. Srikant Boga, Ashok Kankuntla, Pradeep Dara, Praveen Mamdyal, "Optimum Design Of An Industrial Warehouse Using Staad-Pro, IJARIIE, Vol-4 Issue-4, pp.749-752, 2018.

5. Tejas D. parekh, Disha parmar, Yati tank, "Analysis of Howe Roof Truss using Different Rise and Span", International Journal of Engineering Trends and Technology, Volume 47 Number 3 ,pp.146-147,May 2017.

6. Shilpa Chouhan, Rohit Sharma, Abhishek Gupta, "Optimization of steel truss configuration for structural efficiency using STAAD.Pro and ETABS", International Journal of Advance Research in Science and Engineering, Vol-6,Issue 9,pp.994-1004, 2017.

7. Rajat Palya, Deependra Singh Raghuvanshi, "Study On Different Truss Structures For Ware House Design", International Journal of Mechanical And Production Engineering, Volume- 5, Issue-11, pp.117-120, Nov.-2017.

8. Er. Sanjeev Kumar, Brahmjeet Singh, Er. Bhupinder Singh, "Optimization of Roof Truss Using Staad pro V8i", International Journal of Recent Research Aspects, Vol. 3, Issue 1, pp. 86-90,March 2016.

9. Avanti Patrikar, K. K. Pathak, "Fully Stressed Design of Fink Truss Using STAAD.Pro Software", Open Journal of Civil Engineering, ,pp. 631-642, 2016.

10. Kavita Ghogare, Dr. S.K. Deshmukh, " Stability Analysis Of Industrial Shed Sujected To Wind Load", Internationaljournalforengineeringapplicationsand Technology, ISSN 2321-8134, pp.78-81,2014.

11. Miss. Kavita K. Ghogare, "Seismic Analysis & Design of Multistorey Steel Building", International Journal for Research in Applied Science & Engineering Technology, Volume 2 Issue XI, pp. 364-372, November 2014.

12. Subrakant Mohakul, Dr. Shaikh Yajdani, Abhay Dhurde, "Design of Industrial Shed and Analysis of Stresses Produced on Failure of a Joint", International Journal of Civil Engineering and Technology, Vol-5,Issue-8,pp.114-127, 2014.