IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

COMPARISON BETWEEN CONVENTIONAL STEEL SECTIONS FOR VARIOUS STEEL ROOF TRUSS BY USING INDIAN CODE

R.G.MASKE, S.P.REURE, P.V.BANUR, S.S.MANE, R.D.CHOUDHARI, S.B.ZENDGE

[1]Assistant Professor, Dept. of Civil Engineering. N.K. Orchid College of engineering and technology, Solapur, Maharashtra, India
[2]Student, Dept. of Civil Engineering, N.K. Orchid College of engineering and technology, Solapur, Maharashtra, India
[3]Student, Dept of Civil Engineering, N.K. Orchid College of engineering and technology, Solapur, Maharashtra, India
[4]Student, Dept. of Civil Engineering, N.K. Orchid College of engineering and technology, Solapur, Maharashtra, India
[5]Student, Dept of Civil Engineering, N.K. Orchid College of engineering and technology, Solapur, Maharashtra, India
[6]Student, Dept. of Civil Engineering, N.K. Orchid College of engineering and technology, Solapur Maharashtra, India

Abstract: The roof truss is an important structure to keep a building safe, protect it from rain and sunshine, and protect home appliances and equipment inside it. Roof trusses are generally used in industrial buildings. There are many types of truss available for the construction of roof truss. Analysis and design an economical and stable 2D truss for the usage in industrial purpose like storage rooms, workshops, warehouses etc., using STAAD. .Vi8. It follows the method of design steps of steel truss type structure as per the guidelines of IS: 800-2007 and IS:875-1987 part 1,2 and 3 codes and certain amount of decision based on engineering judgments / practices and information from past experiences. In the present study, how truss, Pratt truss, and Fink truss has been taken using various span and rise. There same spans such as 12m have been taken into consideration. Rise criteria such as, L/5 and L/6 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. The uses of steel structure are not only economical but also Eco friendly at the time when there is a threat of global warming. Steel roof trusses have a broad range of applications in construction industry owing to their various rewards involving of good load transfer mechanism without negotiating with the structural appearance. Steel is usually considered over any other building material for construction of trusses, since structural steel is durable and can be well molded to give desired shape to the structure. The results are compare to obtain the best and most efficient truss analyses software.

Key Words: Types of Truss, Types of Loads, Indian code, Steel sections, Total cost of various trusses

I. INTRODUCTION

In structural engineering the name truss describes a triangular design. A joint framed structure that sustained the inclined, vertical or vertical or horizontal load a truss consist of angular, channel, plates and it all started in Bompano Beach. The frame work, typically consisting of rafters, posts, and struts, supporting the roofs of auditoriums, cinema halls, stadiums, railways, stations, airports and others. Benefit of Roof Trusses There's a good reason why roof trusses have stood the tesr of time in construction, and it's due to the number of structural benefits they provide to homes and buildings. A roof truss is considered the most important key component in engineering system in a building. They several critical function and design depends on various factors. Without roof, buildings would be exposed to all kinds of elements, rendering them completely useless. Here are some of the benefits of installing a roof truss.

Benefit of Roof Trusses

There's a good reason why roof trusses have stood the test of time in construction, and it's due to the number of structural benefits they provide to homes and buildings.

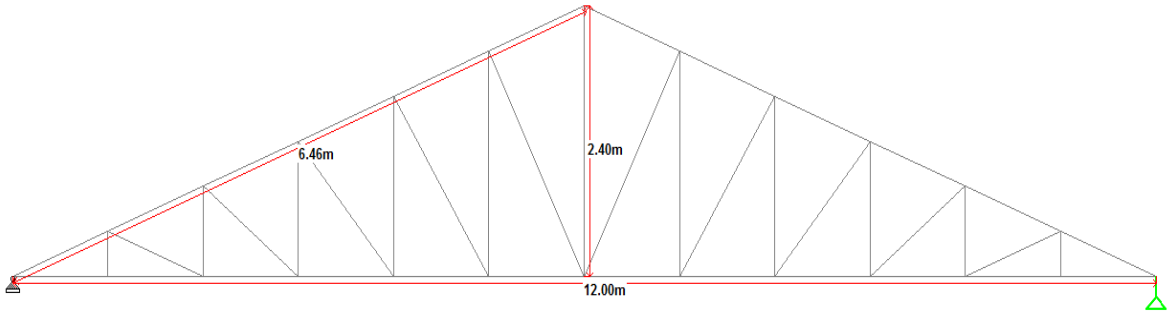
A roof truss is considered the most important key component in engineering system in a building. They serve a critical function and design depends on various factors. Without roof, buildings would be exposed to all kinds of elements, rendering them completely useless, Here are some of the benefits of installing a roof truss.

LOAD CALCULATION :-

- **DESIGN OF HOWE TRUSS:-**

1. Span of truss = 12m
   Pitch = (1/5)
   Pitch = (rise)/(span)
   (1/5) = (rise / 12)
   Rise = 2.4M
   Alpha = 21.80
   L = 6.46m

2. Tan alpha = 2.4 /(SPAN / 2)
   Alpha = tan-1x (2.4 / 6)



Howe Truss

Geometry of Truss

3. Sloping length
   L = SQRT (6_2 + 2.4_2)
   Divide sloping length
   Panel length = 6.46 / 6
   = 1.07m

- **DEAD LOAD CALCULATION :-**

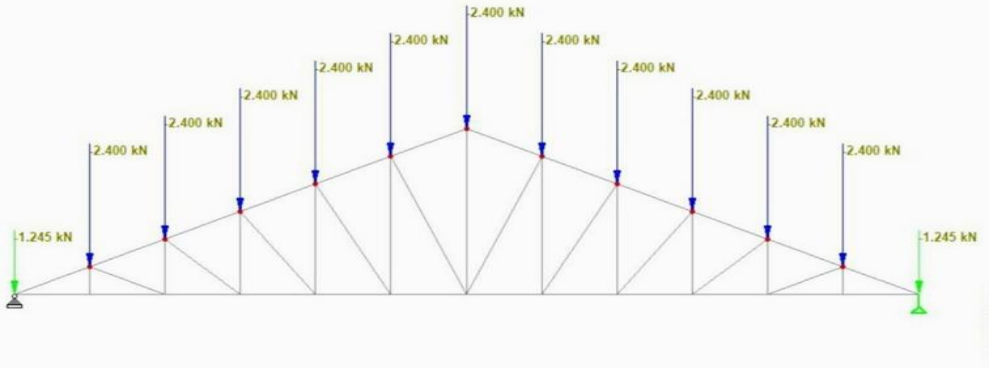
Self weight of GI sheet = 171 KN/m^2
Weight of purline = 350N/m^2
Weight of bracing = 13 N/m^2
Now,

a) Self weight of truss = ((L/3) x 10
= ((12/3) x 10
= 90 N/m^2

b) Dead load per m^2 of plain area
= Wt of FI sheet + wt of bracing + self wt of truss.
= 171 + 13 + 90
= 274 N/m^2 of plain area.
= panel length in plan = 1.07 x cos 21.80

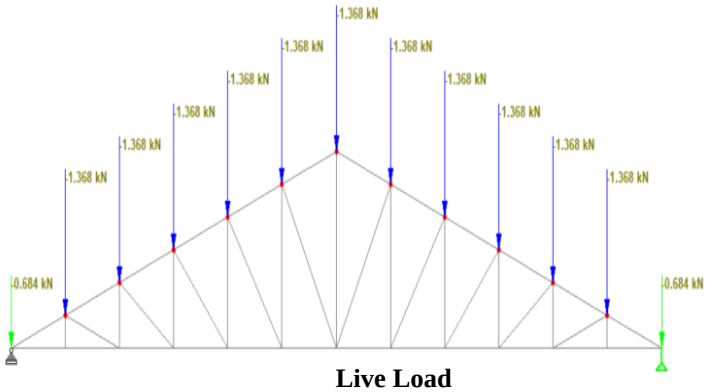
= 0.99m
= 1m.

dead load on intermediate panel point+
= (dead load per m^2 x panel legth in plan x spacing) +
(wt of purlin x spacing of truss)
= (274 x 1 x 4) + (380 x 4)
= 2496 N
= 2.4 KN
dead load on end panel point :-
= (2.4/2)
= 1.245 KN.



- **LIVE LOAD CALCULATION :-**

As alpha = 21.80 > 10
For this truss access in not provided.
As per table 2, page no 14 of IS 875 – part II 1987.
Live load per m^2 :-
= 0.75 – 0.002 (alpha – 10)
= 0.75 – 0.02 (21.80 - 10)
= 0.514 KN/m^2> 0.4 KN/m^2
Live load on roof truss:-
= (2/3) x L.L per m^2
= (2/3) x 0.514
= 0.342 KN/m^2
Live load on intermediatepanel point :-
= (live load x panel length in plan x spacing of truss)
= (0.342 x 1 x 4)
= 1.368 KN
Live load on end panel point :-
= (1.368/2)
= 0.684KN.



Live Load

- **Calculation of wind load :-**

1. **Basic Wind speed (Vb)**
(As per IS 875 Part III, Appendix A, Page No. 53) As building situated in pune MIDC area
Vb= 39 m/s
2. **Risk coefficient (K1)**
(As per table No. 1 Page No. 11 of IS 875 part III) for all general buildings having mean probable life of 50 years.
For, Vb=39 m/sK1 = 1
3. **Terrain, Height, Structure size factor**
As per clause No. 5.3.2 Page No.8 (IS:815 part III) Forpune MIDC area. It is terrain category III
Greatest dimension of structure is 24m
It is class B
As per table No. 2 Page No. 12 (IS: 875 Part III)
HEIGHT KG
150.97
20 1.07
16.4?
K2-0.981
4. **Topography factor (K3):-**
As per clause No 5.3.3.1 Page No. 12 (IS: 875 PartIII)
K3= 1.0
5. **Design wind speed (Vz):-**
Vz = Vb x K1 x K2 x K3
= 39 x 1x 0.981 x 1
Vz=38.529 m/s
6. **Design wind pressure (Pz)**
As per clause No. 5.4 Page No.12 (IS: 815 Part III)
P=0.6 x Vz^2
=0.6 x 38.5292 2
Pz=878.25 N/m2

7. **Internal wind pressure coefficient (Cpi) :-**
Assume,
Permeability of shed is High
Cpi = +0.7
Cpi = -0.7

8. External wind pressure coefficient (Cpe) :-

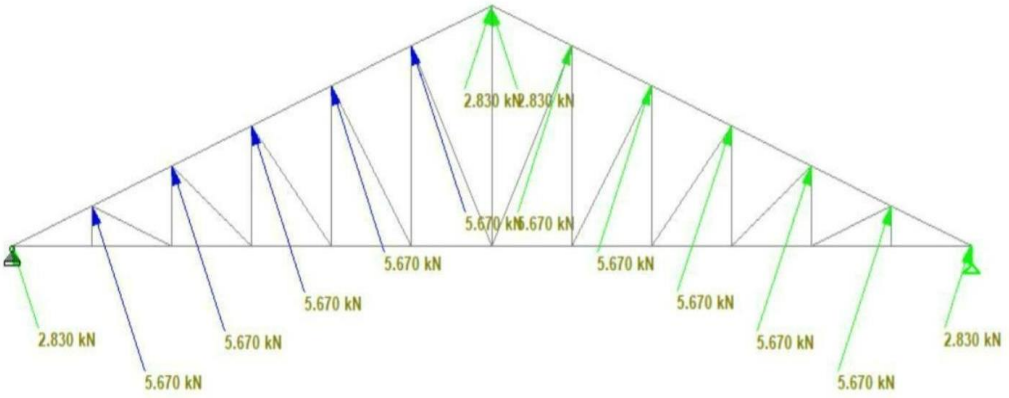
As per Table No. 5 Page No.16 (IS: 875 Part III)
(h/w)= 14/ 12 = 1.17
As (h/w) lies in between 1/2 <h> 3/2
Alpha= 21.80 deg

Wind word	lee word			
Wind angle	0	90	0	90
Face	EF	EG	GH	EG
Cpe-0.538	-0.8	-0.5	-0.638	

Max Cpe = 0.8
Max [Cpe - Cpi]
Cpe- Cpi = -0.8 -0.7
= -1.5
Cpe- Cpi=-0.8-(-0.7)-0.1
= Max [Cpe - Cpi]= -1.5

9. Wind load on indiviual member

As per clause 6.2.1 Page No. 13 (IS: 875 Part III)
F= [Cpe - Cpi] A x Pz
Where,
A exposed surface area.
A = slopping length x spacing of Truss
6.46 X 4
= A = 25.84 m
F= [Cpe -Cpi] A x Pz
F= 1.5 x 25.84 x 878.25
F= 34.04 KN (uplift)
On one side of roof truss for intermediate panel points and two end Panel point
Wind load on intermediate Panel Point.
(W1/2) + W1+ W1+ W1 + W1 + W1 + (W1/2) =34.04
6W1 = 34.04
W1 = 5.67 KN
Wind load on end panel point
(W1/2) = (5.67/2) = 2.83 KN
For similar in all calculations



SQUARE PIPE - HOWE TRUSS							
SR NO	**SECTION SIZE**	**LENGTH OF SECTION (M)**	**WEIGTH IN KN/M**	**TOTAL WEIGHT IN (KN)**	**TOTAL WEIGHT IN (Kg)**	**MARKET RATE PER KG**	**TOTAL COST (IN RS.)**
1	ST TUB127503.6	4	0.365	1.46	148.878536	67	9974.86
2	ST TUB75754.0	4.15	0.349	1.44835	147.6905669	67	9895.27
3	ST TUB63634.5	4.15	0.322	1.3363	136.2646491	67	9129.73
4	ST TUB80403.2	2	0.108	0.216	22.0258656	67	1475.73
5	ST TUB89894.5	4.31	0.485	2.09035	213.1563341	67	14281.47
6	ST TUB89893.6	2.15	0.198	0.4257	43.40931012	67	2908.42
7	ST TUB75753.2	2.15	0.148	0.3182	32.44736312	67	2173.97
8	ST TUB25252.6	4.8	0.08	0.384	39.1570944	67	2623.53
9	ST TUB30302.6	5.35	0.11	0.5885	60.0102866	67	4020.69
10	ST TUB35352.6	4	0.098	0.392	39.9728672	67	2678.18
11	ST TUB49492.9	2.4	0.096	0.2304	23.49425664	67	1574.12
12	ST TUB32322.6	2.56	0.057	0.14592	14.87969587	67	996.94
13	ST TUB38382.6	3.12	0.084	0.26208	26.72471693	67	1790.56
14	ST TUB63633.6	2	0.127	0.254	25.9007864	67	1735.35
15	ST TUB45452.6	3.77	0.123	0.46371	47.28525064	67	3168.11
16	ST TUB49493.6	4.47	0.216	0.96552	98.45561923	67	6596.53
		TOTAL WEIGHT=		**10.98103**	**1119.753199**		**75023.46**
						ADD GST 18%	***13504.22***
						TOTAL AMOUNT =	**88527.68789**

ROUND PIPE - HOWE TRUSS							
SR NO	SECTION SIZE	LENGTH OF SECTION (M)	WEIGTH IN KN/M	TOTAL WEIGHT IN (KN)	TOTAL WEIGHT IN (Kg)	MARKET RATE PER KG	TOTAL COST (IN RS.)
1	ST PIP1016.OM	6.15	0.586	3.60	367.495	66.2	24328.20
2	ST PIP889.OM	4.15	0.345	1.43	145.998	66.2	9665.06
3	ST PIP761.OH	4.15	0.322	1.34	136.265	66.2	9020.72
4	ST PIP761.OM	2	0.128	0.26	26.105	66.2	1728.13
5	ST PIP761.OL	2	0.114	0.23	23.250	66.2	1539.12
6	ST PIP1016.OH	4.31	0.486	2.09	213.596	66.2	14140.04
7	ST PIP889.OL	2.15	0.145	0.31	31.790	66.2	2104.47
8	ST PIP213.OL	2.4	0.022	0.05	5.384	66.2	356.43
9	ST PIP269.OL	2.4	0.033	0.08	8.076	66.2	534.64
10	ST PIP337.OL	5.35	0.106	0.57	57.828	66.2	3828.22
11	ST PIP424.OL	6.56	0.167	1.10	111.712	66.2	7395.33
12	ST PIP603.OM	2.4	0.094	0.23	23.005	66.2	1522.92
13	ST PIP424.OM	3.12	0.096	0.30	30.543	66.2	2021.92
14	ST PIP603.OL1	3.77	0.12	0.45	46.132	66.2	3053.94
15	ST PIP603.OL2	4.47	0.157	0.70	71.563	66.2	4737.45
		TOTAL WEIGHT =		12.74	1298.740		85976.58
					ADD GST 18%		***15475.78***
					TOTAL AMOUNT =		**101452.36**

SQUARE PIPE - PRATT TRUSS							
SR NO	SECTION SIZE	LENGTH OF SECTION (M)	WEIGTH IN KN/M	TOTAL WEIGHT IN (KN)	TOTAL WEIGHT IN (Kg)	MARKET RATE PER KG	TOTAL COST (IN RS.)
1	ST TUB 72723.2	2	0.13	0.26	26.72	67	1790.01
2	ST TUB 63633.6	4.15	0.27	1.10	112.14	67	7513.60
3	ST TUB 63633.2	9.35	0.54	5.00	510.09	67	34175.86
4	ST TUB 80403.2	2	0.11	0.22	22.03	67	1475.73
5	ST TUB 48483.65	2	0.09	0.19	19.17	67	1284.43
6	ST TUB 45452.9	2	0.07	0.14	14.68	67	983.82
7	ST TUB 63634.5	4.31	0.33	1.44	146.79	67	9835.08
8	ST TUB 75753.2	2.15	0.15	0.32	32.45	67	2173.97
9	ST TUB 70703.25	2.15	0.14	0.30	30.47	67	2041.77
10	ST TUB 25252.6	4.8	0.08	0.38	39.16	67	2623.53
11	ST TUB 32322.6	2.4	0.05	0.13	12.97	67	869.04
12	ST TUB 40402.6	3.2	0.09	0.29	29.69	67	1989.51
13	ST TUB 48482.6	8.47	0.33	2.77	282.43	67	18922.79
14	ST TUB 45452.6	3.77	0.12	0.46	47.29	67	3168.11
15	ST TUB 35352.6	3.12	0.08	0.24	24.50	67	1641.34
16	ST TUB 30302.6	2.56	0.05	0.14	13.91	67	932.23
		TOTAL WEIGHT=		**13.38**	**1364.49**		**91420.83**
					ADD GST		***16455.75***
					TOTAL AMOUNT =		**107876.5741**

ROUND PIPE- PRATT TRUSS							
SR NO	SECTION SIZE	LENGTH OF SECTION (M)	WEIGHT IN KN/M	TOTAL WEIGHT IN (KN)	TOTAL WEIGHT IN (Kg)	MARKET RATE PER KG	TOTAL COST (IN RS.)
1	ST PIP889.OL	4.15	0.279	1.16	118.07	66.2	7816.09
2	ST PIP761.OM	4.15	0.265	1.10	112.14	66.2	7423.88
3	ST PIP761.OL	4.15	0.237	0.98	100.29	66.2	6639.47
4	ST PIP603.OH	2	0.095	0.19	19.37	66.2	1282.60
5	ST PIP603.OM	7.2	0.282	2.03	207.04	66.2	13706.26
6	ST PIP603.OL1	10.47	0.333	3.49	355.53	66.2	23535.76
7	ST PIP761.OH	6.46	0.501	3.24	330.03	66.2	21847.79
8	ST PIP213.OL	3.2	0.03	0.10	9.79	66.2	648.05
9	ST PIP269.OL	1.6	0.022	0.04	3.59	66.2	237.62
10	ST PIP337.OM	2.4	0.057	0.14	13.95	66.2	923.47
11	ST PIP424.OM	3.2	0.098	0.31	31.98	66.2	2116.96
12	ST PIP483.OL	3.77	0.12	0.45	46.13	66.2	3053.94
13	ST PIP424.OL	3.12	0.079	0.25	25.13	66.2	1663.87
14	ST PIP337.OL	2.56	0.051	0.13	13.31	66.2	881.35
		TOTAL WEIGHT=		**13.60**	**1386.36**		**91777.10**
					ADD GST 18%		*16519.88*
					TOTAL AMOUNT =		**108296.98**

ROUND PIPE - PRATT TRUSS

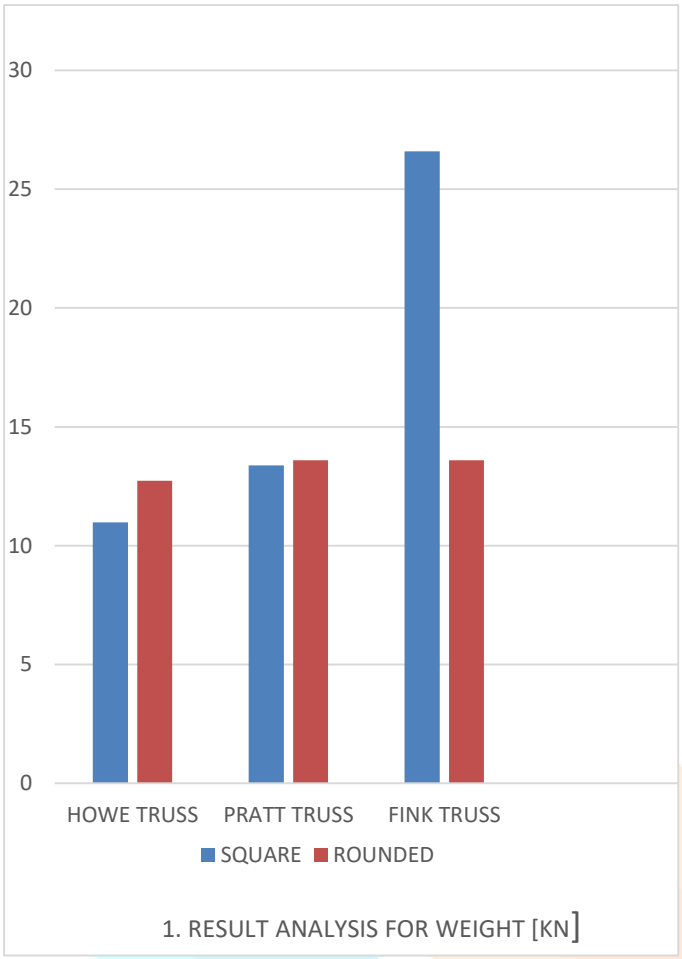
SR NO	SECTION SIZE	LENGTH OF SECTION (M)	WEIGHT IN KN/M	TOTAL WEIGHT IN (KN)	TOTAL WEIGHT IN (Kg)	MARKET RATE PER KG	TOTAL COST (IN RS.)
1	ST PIP889.OL	4.15	0.279	1.16	118.07	66.2	7816.09
2	ST PIP761.OM	4.15	0.265	1.10	112.14	66.2	7423.88
3	ST PIP761.OL	4.15	0.237	0.98	100.29	66.2	6639.47
4	ST PIP603.OH	2	0.095	0.19	19.37	66.2	1282.60
5	ST PIP603.OM	7.2	0.282	2.03	207.04	66.2	13706.26
6	ST PIP603.OL1	10.47	0.333	3.49	355.53	66.2	23535.76
7	ST PIP761.OH	6.46	0.501	3.24	330.03	66.2	21847.79
8	ST PIP213.OL	3.2	0.03	0.10	9.79	66.2	648.05
9	ST PIP269.OL	1.6	0.022	0.04	3.59	66.2	237.62
10	ST PIP337.OM	2.4	0.057	0.14	13.95	66.2	923.47
11	ST PIP424.OM	3.2	0.098	0.31	31.98	66.2	2116.96
12	ST PIP483.OL	3.77	0.12	0.45	46.13	66.2	3053.94
13	ST PIP424.OL	3.12	0.079	0.25	25.13	66.2	1663.87
14	ST PIP337.OL	2.56	0.051	0.13	13.31	66.2	881.35
		TOTAL WEIGHT=		**13.60**	**1386.36**		**91777.10**
					ADD GST 18%		*16519.88*
					TOTAL AMOUNT =		**108296.98**

SQUARE PIPE - FINK TRUSS							
SR NO	**SECTION SIZE**	**LENGTH OF SECTION (M)**	**WEIGTH IN KN/M**	**TOTAL WEIGHT IN (KN)**	**TOTAL WEIGHT IN (Kg)**	**MARKET RATE PER KG**	**TOTAL COST (IN RS.)**
1	ST TUB89893.6	15.32	1.407	21.56	2198.02	67	147267.49
2	ST TUB72724.0	3.16	0.254	0.80	81.85	67	5483.71
3	ST TUB63634.5	3.16	0.254	0.80	81.85	67	5483.71
4	ST TUB75753.2	3	0.206	0.62	63.02	67	4222.24
5	ST TUB40402.6	2.5	0.071	0.18	18.10	67	1212.70
6	ST TUB45452.6	8.11	0.264	2.14	218.33	67	14627.79
7	ST TUB30302.6	2.83	0.058	0.16	16.74	67	1121.42
8	ST TUB25252.6	3.22	0.053	0.17	17.40	67	1165.97
9	ST TUB35352.6	2.5	0.061	0.15	15.55	67	1041.89
		TOTAL WEIGHT =		**26.58**	**2710.85**		**181626.93**
					ADD GST 18%		***1798.27***
					TOTAL AMOUNT =		**183425.20**

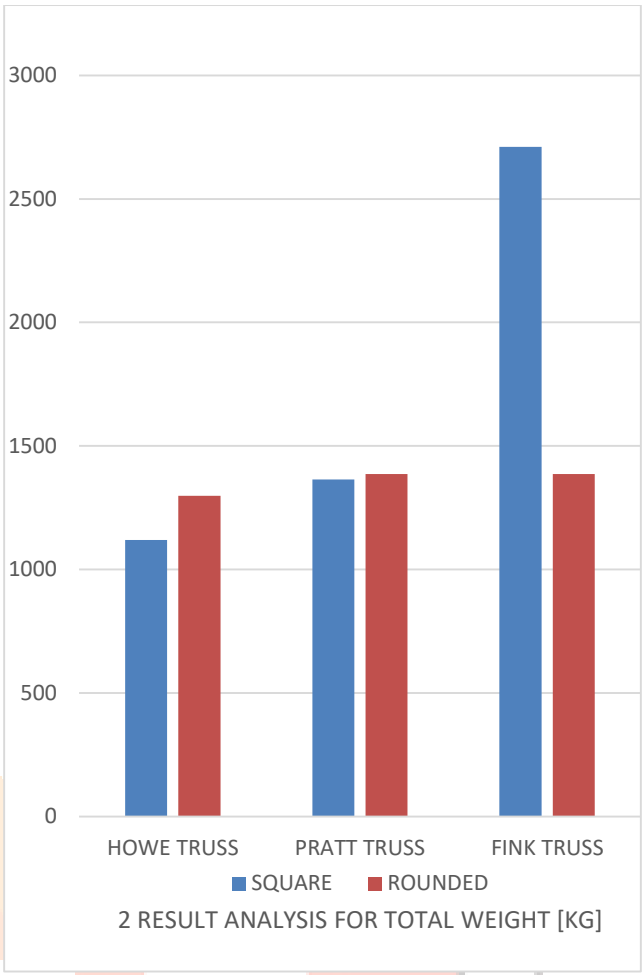
ROUND PIPE - FINK TRUSS							
SR NO	**SECTION SIZE**	**LENGTH OF SECTION (M)**	**WEIGHT IN KN/M**	**TOTAL WEIGHT IN (KN)**	**TOTAL WEIGHT IN (Kg)**	**MARKET RATE PER KG**	**TOTAL COST (IN RS.)**
1	ST PIP889.OL	4.15	0.279	1.16	118.07	66.2	7816.09
2	ST PIP761.OM	4.15	0.265	1.10	112.14	66.2	7423.88
3	ST PIP761.OL	4.15	0.237	0.98	100.29	66.2	6639.47
4	ST PIP603.OH	2	0.095	0.19	19.37	66.2	1282.60
5	ST PIP603.OM	7.2	0.282	2.03	207.04	66.2	13706.26
6	ST PIP603.OL1	10.47	0.333	3.49	355.53	66.2	23535.76
7	ST PIP761.OH	6.46	0.501	3.24	330.03	66.2	21847.79
8	ST PIP213.OL	3.2	0.03	0.10	9.79	66.2	648.05
9	ST PIP269.OL	1.6	0.022	0.04	3.59	66.2	237.62
10	ST PIP337.OM	2.4	0.057	0.14	13.95	66.2	923.47
11	ST PIP424.OM	3.2	0.098	0.31	31.98	66.2	2116.96
12	ST PIP483.OL	3.77	0.12	0.45	46.13	66.2	3053.94
13	ST PIP424.OL	3.12	0.079	0.25	25.13	66.2	1663.87
14	ST PIP337.OL	2.56	0.051	0.13	13.31	66.2	881.35
		TOTAL WEIGHT=		**13.60**	**1386.36**		**91777.10**
					ADD GST 18%		***16519.88***
					TOTAL AMOUNT =		**108296.98**

RESULT AND CALCULATION

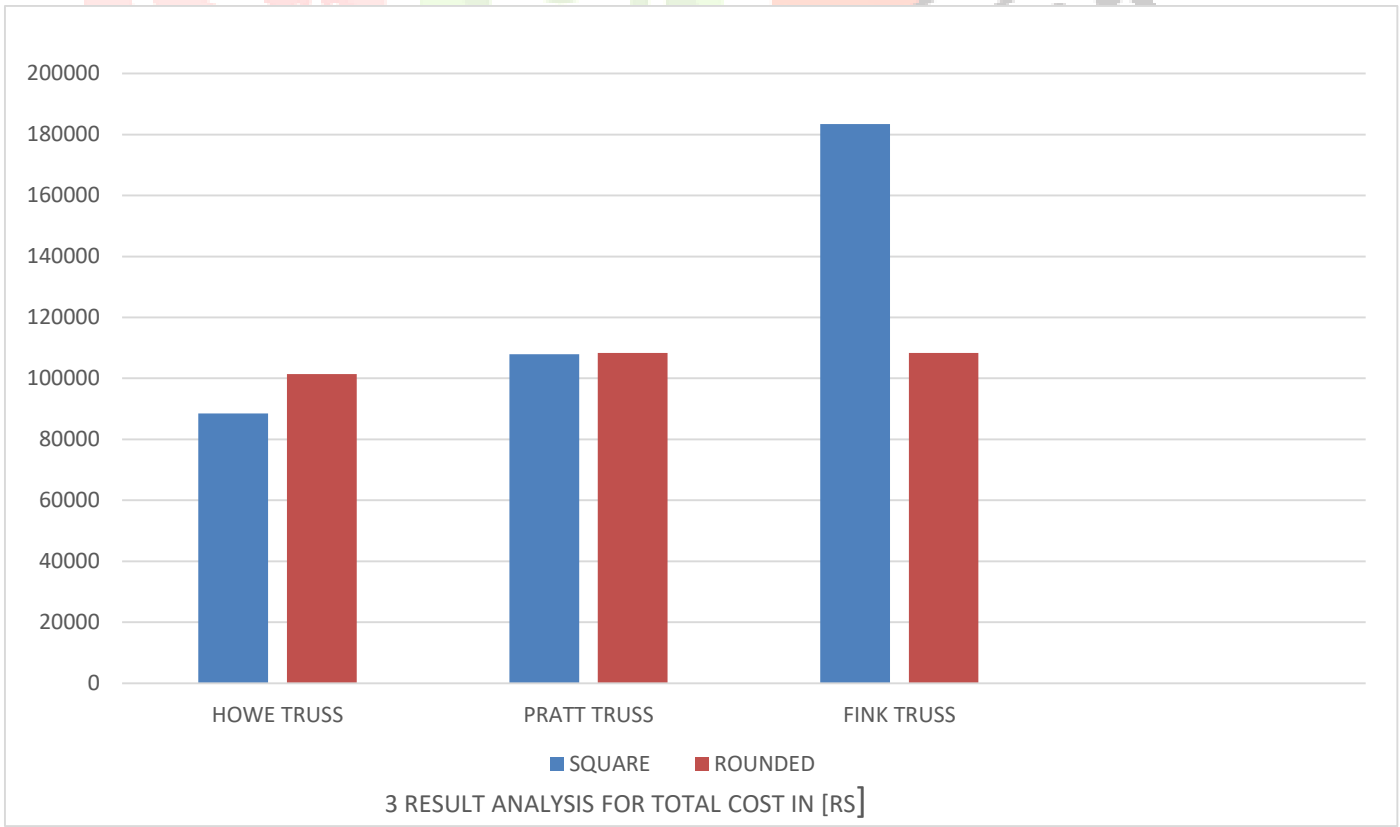
TYPES	**HOWE**		**PRATT**		**FINK**	
TYPES OF SECTION	SQUARE	ROUNDED	SQUARE	ROUNDED	SQUARE	ROUNDED
WEIGHT IN [KN]	10.981	12.736	13.381	13.595	26.584	13.595
WEIGHT IN [KG]	1119.75	1298.73	1364.48	1386.36	2710.84	1386.36
TOTAL PRICE [RS]	88527.68	101452.36	107876.57	108296.97	183425.20	108296.97



1. RESULT ANALYSIS FOR WEIGHT [KN]



2 RESULT ANALYSIS FOR TOTAL WEIGHT [KG]



3 RESULT ANALYSIS FOR TOTAL COST IN [RS]

CONCLUSION:-

In the End of the project according to above graphs we made cost comparison with respect to sections and would like to conclude the following conclusions:

1. **How Truss Angular Section vs Howe truss Tubular Section**
   From graph 3 we compared the Howe truss angular section with Howe truss Tubular. Section and we get the results that tubular section is costly than the angular section. So we can prefer angular section.
2. **Pratt Truss Angular Section vs Pratt Truss Tubular Section**
   From graph 3 we compared the Pratt truss angular section with Pratt truss tubular section and we get the results that both section is equal cost.
3. **Fink Truss Angular Section vs Fink Truss Tubular Section**
   From graph 3 we compared the fink truss angular section with Fink truss tubular section and obtain results that angular section is costly than tabular section.
4. **Square Section vs Rounded Section**
   From table, we compared the Square section with Rounded section and obtain results that
   A. Howe truss: rounded section is costly than square section.
   B. Pratt truss: rounded section is costly than square section.
   C. Fink truss: square section is costly than rounded section.

REFERENCES:-

1. Dr. N. Subramanian, ‘ Design of steel structures’
2. Dr. N. Subramanian (2008), “ Pre-engineered Buildings Selection of framings System, Roofting and Walf Materials”, The Master bulder,
3. IS: 800-2007:- General Construction in Steel- Code of Practice.
4. IS: 875 (Part 1) – 1987 :- Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structures – Dead Loads.
5. IS : 875 (Part 2) – 1987 :- Code of Practice for Design Loads (Other Than Earthquake) for Buildings and Structure – Live Loads.
6. Shivani Meher , Ruchita Nar, Sadichha Jagadale, Gautami Kalal, “Design of industrial Warchouse”, International Journal of Engineering Research & Technology (IJERT), Vol. 7 Issue 02, pp.302-306, February -2018.
7. Manoj Nallanathe, Ramesh bhaskar, Kishore, “ Efficiency Study Of Different Steel Truss Using (Staad.Pro)”, International Journal of Pure and Applied Mathematics, Volume 119 No. 17,pp. 3095-3101, 2018.
8. 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.
9. 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.
10. 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.
11. 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.
12. Avanti Patrikar, K. K. Pathak, “Fully Stressed Design of Fink Truss Using STAAD . Pro Software”, Open Journal of Civil Engineering , pp. 631-642,2016.
13. Kavita Ghogare, Dr. S. K. Deshmukh, “ Stability Analysis Of Industrial Shed Subjected To Wind Load”, International journal for engineering application sand Technology, ISSN 2321-8134,PP.78-1,2014.8