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Comparison between Conventional (Angular) Steel Section and Tubular Steel Section

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Abstract: The main purpose of this study is to regarding the economy, load carrying capacity of structural member. This study involving comparison between sectioned structural members for given requirement of superstructure part of an industrial building. Study reveals that, upto30% to 40% saving in cost is achieved by using tubular sections.

Keywords - IS:800-2007, IS:806-1968, IS 875-1987 For tubular section, STAAD Pro 8Vi.

I. Introduction

This study is about designing components of roof truss by conventional angle section and tubular section. Tubular sections are an economical, efficient and strong alternative to conventional angle sections in steel structure.

Advantages of Tubular Section:

i. For tubular sections, higher strength to weight ratio could result in up to 30% to 40% saving in steel.
ii. Due to the high torsional rigidity and compressive strength tubular section behaves more efficiently than conventional steel section.
iii. For dynamic loads tubes have higher frequency of vibration than any other rolled section.
iv. Ease of maintenance.
v. Free from sharp edges.
vi. Ease of fabrication and erection.

Objective and scope of present work

To determine the effectiveness of tubular sections an industrial shed is considered analysis and design is carried out using conventional steel and tubular steel structure and also cost comparison is made for above sections.

II Model Formulation

Data for an Industrial Shed:

Type of truss:- Fink type of truss.
Location:-Aurangabad, Maharashtra, India.
Geometry of truss:- span=18m, θ=18.43˚.
No. of panel points:- 9.
Spacing of purlins=1.17m.
Sloping length=7m.
Spacing of truss=7m.
No of trusses=7

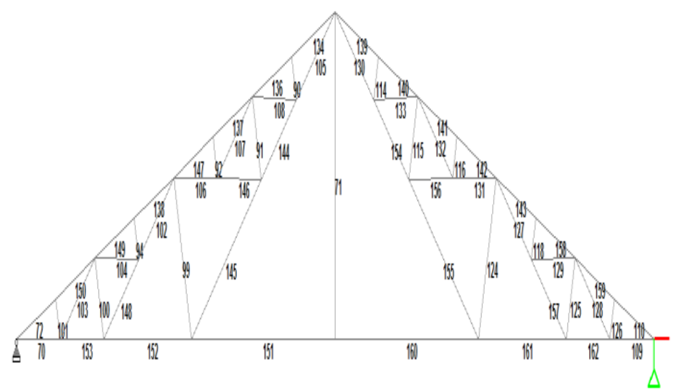


Fig. Geometry of Truss
Span = 18 m and Rise = 3 m
Fink Type Truss with member numbers

Truss Analysis:

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

APPROACH:

i) Dead load analysis is done according to IS 875 (Part1) with the help of STAAD-PRO 8Vi
ii) Live load analysis is done according to IS 875 (Part2) with the help of STAAD-PRO 8Vi
Designing is done according to IS 800, IS806 and STAAD PRO 8Vi.

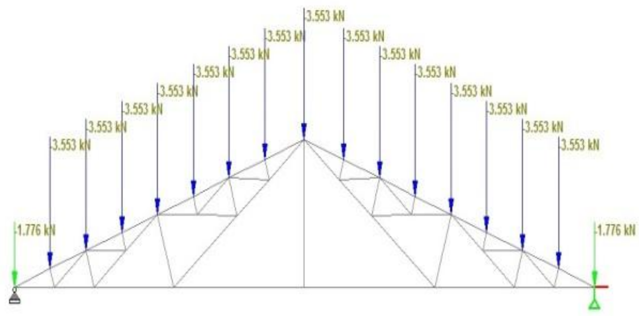
III. LOADING CALCULATION

i) DEAD LOAD CALCULATION: (As per IS: 875 Part –I)

1) Self-weight of truss =(L/3+5)*10=0.110KN/m2
2) Self-weight of CGI sheet=0.1127KN/m2
3) Self-weight of fixtures=0.05KN/m2
4) Self-weight of bracing=0.012KN/m2
5) Self-weight of purlin=0.1873KN/m2

Total Dead Load:

1) On intermediate purlin=3.553 KN
2) On end purlin=1.776 KN



Dead Load Distribution

ii) LIVE LOAD CALCULATION: (As per IS:875 Part –II)

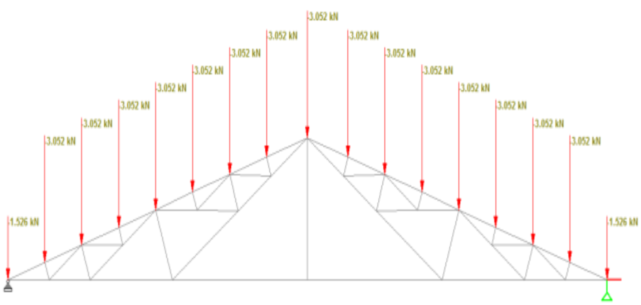
Live load permissible=0.75-0.02(θ-10°)=0.5814KN/m2

Live load of truss=(2/3)*0.5814=0.3876KN/m2

Total Live Load:

1) On intermediate purlin=3.05 KN

2) On end purlin = 1.525KN



Live Load Distribution

iii) WIND LOADCALCULATION: (As per IS: 875-III)

Basic wind pressure(V_b)=39m/s

V_z=k1*k2*k3*V_b

=1*0.916*1*39= 35.724m/s

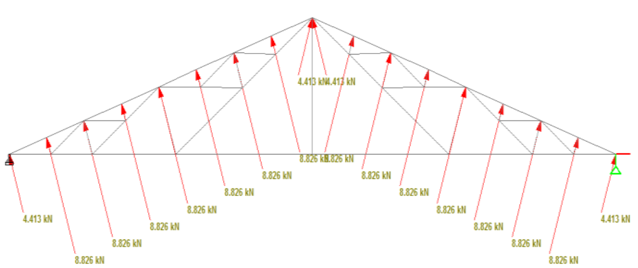
P_z=0.6(V_z)2= 0.765KN/m2

F_w=Pz*A*C_{pmax}= 66.126KN

Total Wind Load :

1) On intermediate purlin=8.265KN

2) On end purlin=4.13KN



Wind Load Distribution

IV Results and Discussion

Load Combination:

For Angular Steel sections

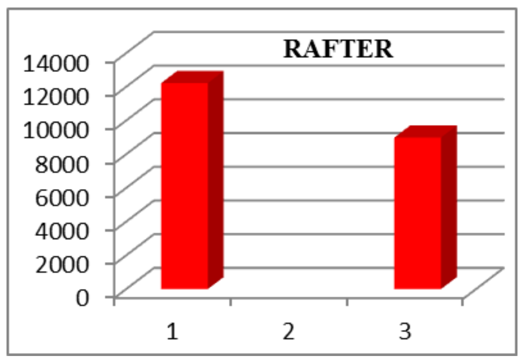
- 1.5 (Dead load+ live Load)
- 1.5 (Dead load +Wind load)
- 1.2 (Dead Load+ Live Load + Wind load)

For Tubular Steel Sections

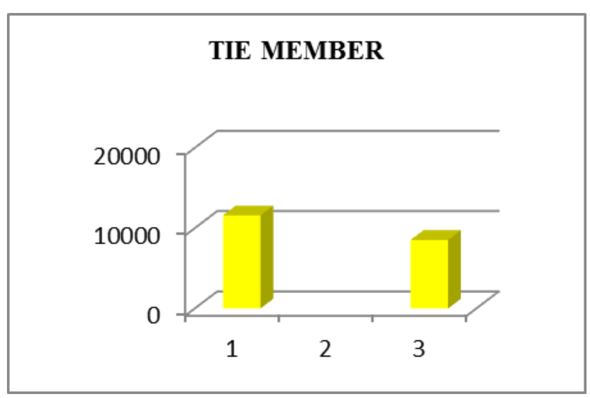
- (Dead load+ live Load)
- (Dead load +Wind load)
- (Dead Load+ Live Load + Wind load)

Using above results design is carried out for required load carrying capacity. Optimum sections are assigned to truss members and purlin members. Comparison is made for self-weight and cost of various elements of truss such as principal rafter, tie member, strut member, sling member, purlin member.

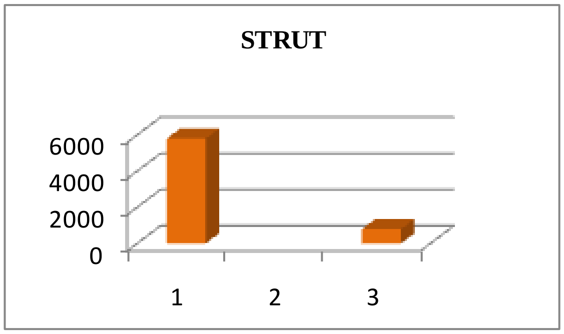
Graph 1.Variation of cost for principal rafter of Fink Truss
Graph 2. Variation of cost for Tie member of Fink Truss
Graph 3.Variation of cost for Strut of Fink Truss
Graph 4. Variation of cost for Sling of Fink Truss
Graph 5. Variation of cost for Purlin member of Fink Truss



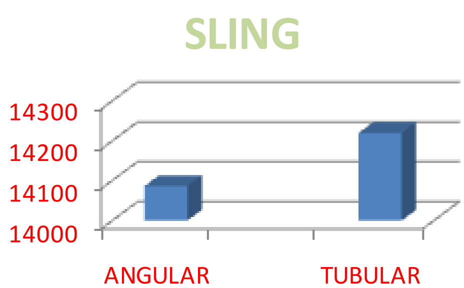
Graph 1 Variation of cost for principal rafter of Fink Truss



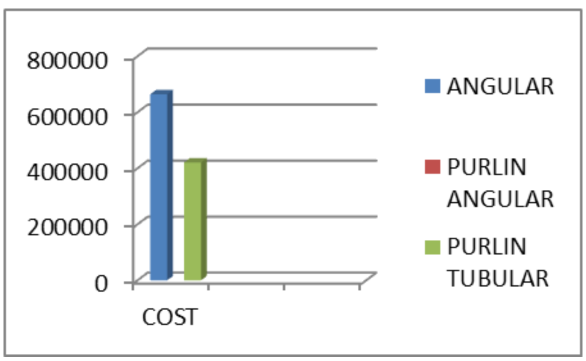
Graph 2 Variation of cost for Tie member of Fink Truss



Graph 3 Variation of cost for Strut of Fink Truss



Graph 4 Variation of cost for Sling of Fink Truss



Graph 5 Variation of cost for Purlin member of Fink Truss

Total Cost Analysis and Saving:

Total saving of tubular section over angular section is 36%.

Member	***Angular***	***Tubular***	***Saving***
Purlin	664221	420789	36.65%
Rafter	12222	8992	26.42%
Strut	5788	793	86.30%
Sling	14086	14220	-0.90%
Tie Member	11592	8530	26.41%
Total Cost (In Rs.)	**707909**	**453324**	**36%**

V. Conclusion

Above study reveals that tubular sections proves to be economical. Total saving of almost 36% in cost is achieved. Effectiveness of Tubular section can be verified for different plan areas for various types of trusses. Structural members having larger unsupported lengths can be assigned tubular sections will derive overall economy.

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