COMPARATIVE ANALYSIS OF 2D ROOF TRUSS CONFIGURATION

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Abstract : ***The construction industry all over the world is dominated by the structural steel as the steel is a durable material and can be molded into desired shape to give an ultimate and an attractive look to the structure. Steel trusses have different geometries such as A-type, Pratt type, Howe truss, Warren type, etc. and also has different sections such as tubular section, square hollow section and rectangular hollow section. In this present work, a comparative study of different types of truss, such as Warren type, Howe type and Pratt type and K type truss for the span of 36m and for different rise has been done. The hollow sections are used in place of the conventional sections. The analysis is done in the Staad pro v8i software. After comparison the steel truss structures having the lower weight will be found out and is said to be most economical one.***

Key Words - truss configuration, hollow sections, truss design, lowest weight.

I. INTRODUCTION

Trusses are the triangular frame works in which the members are subjected to essentially axial forces due to externally applied load. Steel members subjected to axial forces are generally more efficient than members in flexure since the cross section is nearly uniformly stressed. Trusses, consisting of essentially axially loaded members, thus are very efficient in resisting external loads. They are extensively used, for larger spans. Since truss systems consume relatively less material and more labour to fabricate, compared to other systems, they are particularly suited in the Indian context. Trusses are of two types, plane truss and space truss. Plane truss are the trusses in which the members are oriented in two dimensions and they all lie in the same plane. Also, the forces acting on the truss lie in the same plane. While in space truss the members are oriented in three dimensions and the forces may act from any direction. Plane truss are mainly divided into three types: a) Pitched roof truss, b) Parallel chord truss c) Trapezoidal roof truss

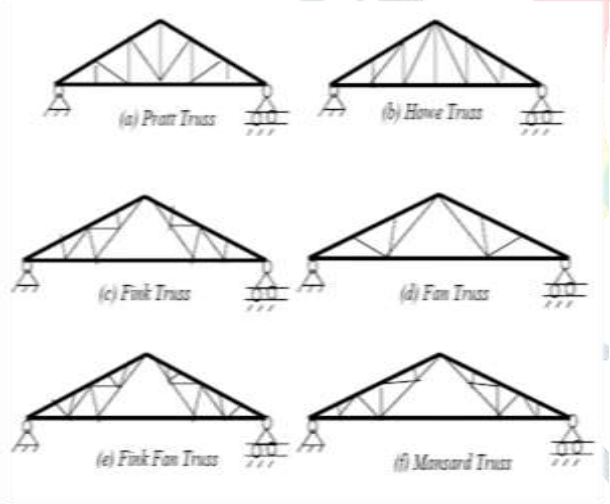


Figure 1.1 Pitched roof trusses

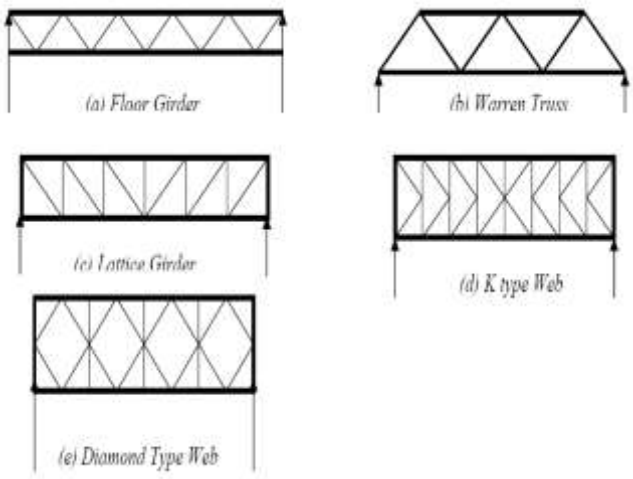


Figure 1.2 Parallel chord trusses

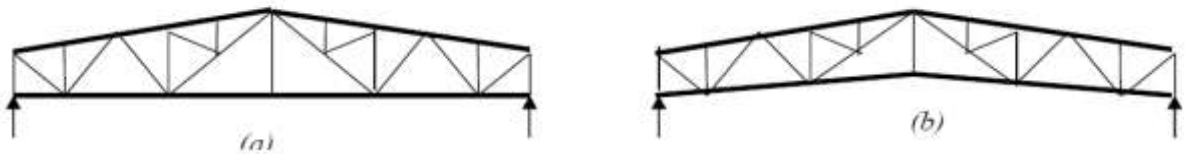


Figure 1.3 Trapezoidal roof truss

II. STRUCTURAL MODELING STEPS & DETAILS

The step by step procedure for this study is as under:

1) Generate Geometry of Standard truss configuration
2) Calculate Dead load, Live load and Wind load.
3) Create Staad file from basic input and perform analysis.
4) Create steel design command to perform steel design.
5) Call Staad result and result interpretation.

Our main objective is to find out the truss configuration which has minimum weight for the same loading. In this work the rise and section vary for different configuration of the truss. The different values required for the load calculation and for the modeling in the software are shown in the table 2.1.

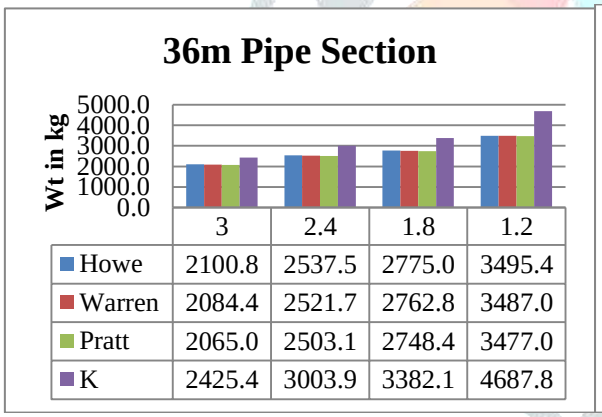
Table 2.1 Geometry and design data

Criteria	**Values**
Span	36
Rise	Between 1/12 to 1/48
Bay Spacing	4 m
Height up to eaves level	12m
Total Dead Load (Sheeting + Purlin + Fixing + Service)	Varies with geometry
Total Live Load	Varies with geometry
Basic Wind Speed	44m/s (Surat)
Life of structure	50 years
Wall Opening	5 to 20%
Wt. of Purlin in N/m^2	90
Wt. of Wind Bracing in N/m^2	15
Wt. of GI sheets in N/m^2	130
Yields strength of steel	310 N/mm^2

III. RESULTS

3.1 Summary of Truss Weight for Different Section

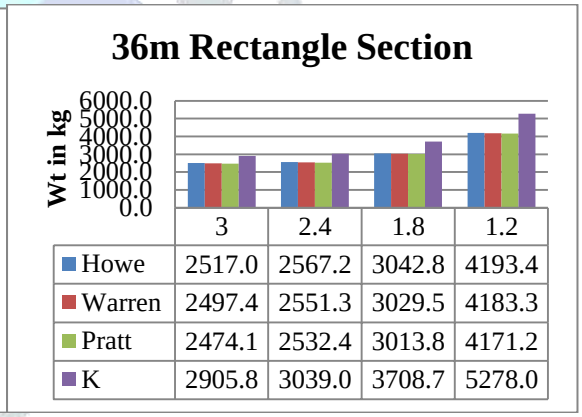
i. Pipe Section



	3	2.4	1.8	1.2
Howe	2100.8	2537.5	2775.0	3495.4
Warren	2084.4	2521.7	2762.8	3487.0
Pratt	2065.0	2503.1	2748.4	3477.0
K	2425.4	3003.9	3382.1	4687.8

Chart 3.1: Truss wt. Vs. Truss configurations for pipe section with change in rise

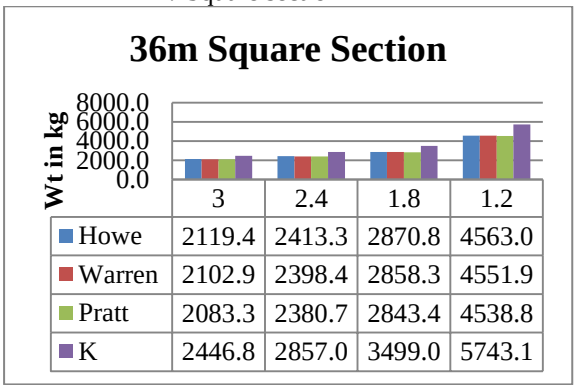
ii. Rectangular section



	3	2.4	1.8	1.2
Howe	2517.0	2567.2	3042.8	4193.4
Warren	2497.4	2551.3	3029.5	4183.3
Pratt	2474.1	2532.4	3013.8	4171.2
K	2905.8	3039.0	3708.7	5278.0

Chart 3.2: Truss wt. Vs. Truss configurations for rectangular section with change in rise

iii. Square section



	3	2.4	1.8	1.2
Howe	2119.4	2413.3	2870.8	4563.0
Warren	2102.9	2398.4	2858.3	4551.9
Pratt	2083.3	2380.7	2843.4	4538.8
K	2446.8	2857.0	3499.0	5743.1

Chart 3.3: Truss wt. Vs. Truss configurations for square section with change in rise

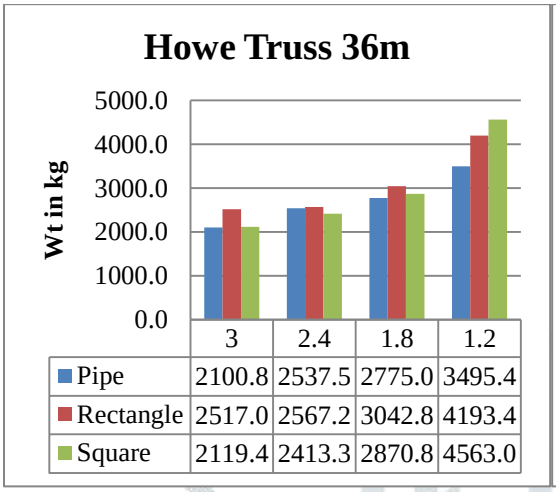
The weight of the truss is compared for different truss configuration such as Howe truss, Warren Truss, Pratt truss and K truss for three different sections such as Pipe section, Rectangle section and Square section and the results for each of the truss configuration is shown in

chart 1, chart 2 and chart 3. From the above charts it can be concluded that the Pratt truss configuration has the minimum weight than other three configurations.

3.2 Summary of Truss Weight for Different Truss Configuration

Now, the weight of the truss is compared for three different sections such as Pipe section, Rectangle section and Square section for Howe truss, Warren truss, Pratt truss and K truss and the results for each of the truss configuration is shown in chart 4, chart 5 and chart 6 and chart 7. From the above charts it can be concluded that the Pipe section has the minimum weight than rectangular or square sections.

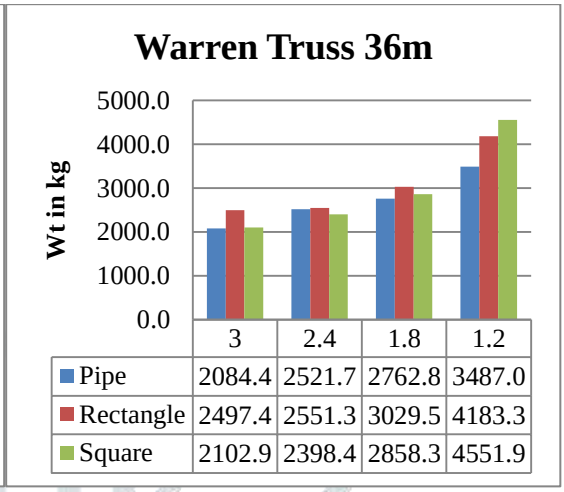
i. Howe Truss



	3	2.4	1.8	1.2
Pipe	2100.8	2537.5	2775.0	3495.4
Rectangle	2517.0	2567.2	3042.8	4193.4
Square	2119.4	2413.3	2870.8	4563.0

Chart 3.4: Truss wt. Vs. Truss sections for Howe truss with change in rise

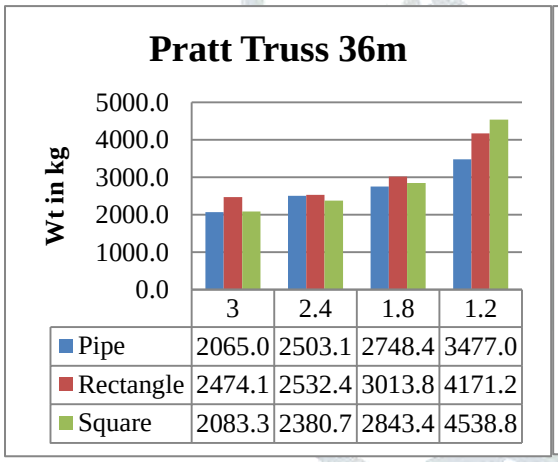
ii. Warren Truss



	3	2.4	1.8	1.2
Pipe	2084.4	2521.7	2762.8	3487.0
Rectangle	2497.4	2551.3	3029.5	4183.3
Square	2102.9	2398.4	2858.3	4551.9

Chart 3.5: Truss wt. Vs. Truss sections for Warren truss with change in rise

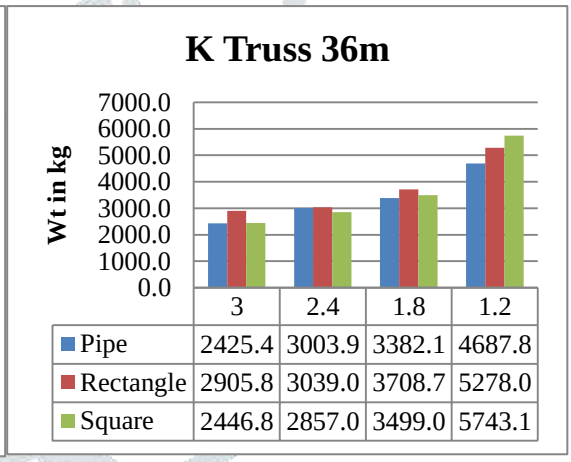
iii. Pratt Truss



	3	2.4	1.8	1.2
Pipe	2065.0	2503.1	2748.4	3477.0
Rectangle	2474.1	2532.4	3013.8	4171.2
Square	2083.3	2380.7	2843.4	4538.8

Chart 3.6: Truss wt. Vs. Truss sections for Pratt truss with change in rise

iv. K Truss



	3	2.4	1.8	1.2
Pipe	2425.4	3003.9	3382.1	4687.8
Rectangle	2905.8	3039.0	3708.7	5278.0
Square	2446.8	2857.0	3499.0	5743.1

Chart 3.7: Truss wt. Vs. Truss sections for K truss with change in rise

IV. CONCLUSIONS

a) For all the span of 36m, Pratt truss configuration is the most economical truss than Howe truss, Warren truss and K truss.

b) The economy of truss using the different section for different rise of the truss is different. For 3m rise of the truss Pipe section is more economical in all the cases. But there is an exception for 2.4m rise in which square section is more economical in all the truss configuration.

c) In all the truss configuration and for all the spans 3m rise is more economical than 2.4m, 1.8m and 1.2m rise

V. REFERENCES

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