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Design Aids For Typified Design of "A" Type Steel Roof Trusses Based On IS 800:2007 and IS 875:2015

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Abstract - *Working out the designs from the fundamentals is tedious and time consuming. This cannot be resorted to the design offices these days, where time plays an important role. Hence, this study has been compiled to assist the design engineers involved in steel designs to give a simpler, faster approach for designing of steel trusses. This study manual provides a range of "Ready-to-Use" designs for "A" type steel roof trusses by considering parameters like span and pitch of steel roof truss, height of column, basic wind speed. The main purpose of this study is to analyses the steel roof truss according to Indian Standard Code IS: 875(Part 3)-2015, in which, intensity of wind load is calculated considering different of class of structure, terrain category, height of structure, topography condition, permeability conditions, wind directionality factor, area averaging factor and combination factor and design of tension member, compression member by considering IS – 800: 2007 (Limit State Method). To prepare digital design aids of "A" type steel roof trusses by considering parameter like span, spacing and pitch of roof, height of structure, and permeability condition by using IS 800: 2007 and IS 875 (part 3): 2015.*

Key Words: A-type steel truss, IS 875:2015(part-3), IS 800:2007, STAAD Pro.

1. INTRODUCTION

The industrial buildings, a subset of low rise buildings are normally used for steel plants, automobile industries, utility and process industries, thermal power station, warehouse, assembly plants, storage, garages, small scale industries, etc. These building required large free space areas, such that columns, walls, and partitions are often eliminated or kept minimum. Because of the light weight, easy fabrication and to cover large area, steel trusses are widely used.

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. Steel is one of the friendliest environmental building materials. 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. In this present work the main objective is to determine the possibility of sand stone dust as replacement with fine aggregate in mortar in respect to the compressive strength. This study ensures that the sand stone dust is used as alternative of sand in respect to compressive strength.

2. ANALYSIS AND DESIGN APPROCH

The steel trusses have been analysed as simply supported on columns. And also assume that the connections between the members to be pin such that it's not capable of transferring moment and shear, only axial force acting on it.

2.1 Loads on Truss:

- Dead load - The dead load is due to sheeting or decking and their fixture, insulation, weight of purlins, and self-weight of truss. The self-weight of roof truss should be calculated by formula: ((span/3) +5)*10 N/sq m. Weight of roofing sheet (AC, GI sheet) should be taken 131 N/sq m. (as per IS – 875 (part 1): 1987, and some miscellaneous load 35 N/ sq m.

- Live load - The design of live load should be done by IS: 875 (part 2): 1987.

- Wind load - The design of wind load should be done by IS: 875 (part 3): 2015.

- Earthquake Load - The member forces due to the severest earthquake was always found to be less than that due to the minimum basic wind pressure. Hence the earthquake loads does not govern the design of structures with steel roof trusses.

2.2 Load combination:

Load combination is as per IS 800: 2007 by considering both strength and serviceability both.

2.3 Design:

- The member experiences a maximum compressive or tensile force under a particular combination of load. Hence the member has to be checked for both maximum compression and maximum tension and designed according to the governing forces.

- Design of tension member and compression member is done as per IS 800: 2007.
- Design of member section is given for Single equal and unequal, double equal and unequal Angle sections.
- Minimum size of angle section is ISA 50 x 50 x 5
- The bolted connection design is by using HSFG grade bolts only.

3. METHODOLOGY

I. Excel Spread sheet have been prepared for load calculations.

II. Excel VBA Programming have been used to make geometry of truss, giving load from prepared excel sheet to STAAD pro. By using open STAAD pro. Software.

III. Analysis of steel roof trusses have been done in STAAD pro.

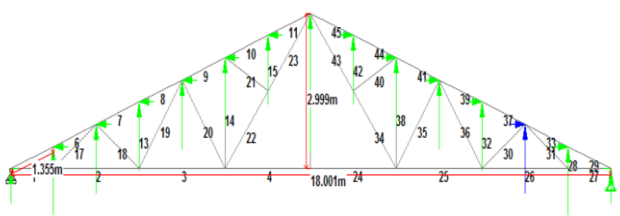
IV. Excel VBA Programming have been used to take axial force from STAAD pro to excel sheet.

V. Excel Spread sheet have been prepared for Design of Angle section with Bolted connection as per IS 800: 2007 (Limit State Method)

4. SAMPLE MODEL

Table 1: "A" type steel roof truss having following data

Span	18m
Pitch	1:3
Wind Speed	44 m/s
Permeability	Medium
Eaves height	6 m
Spacing of truss	6 m
Spacing of purlins	1.355 m
Terrain category	II



5. ANALYSIS RESULTS

The analysis result from STAAD.Pro

Members	Tension (KN)	Compression (KN)	Length of member
1	-172.53	286.41	1.29
2	-159.26	263.35	2.57
3	-132.72	217.21	2.57
4	-92.90	148.01	2.57
5	-304.73	181.85	1.36
6	-310.41	181.85	1.36
7	-267.47	153.88	1.36
8	-273.15	153.88	1.36
9	-230.21	125.90	1.36
10	-245.66	131.52	1.36
11	-251.34	131.52	1.36
12	-15.37	8.84	0.43
13	-15.37	8.84	1.29
14	-23.08	13.28	2.14
15	-15.37	8.84	1.07
16	0.00	0.00	3.00
17	-15.95	27.72	1.55
18	-27.72	15.95	1.55
19	-22.11	38.43	2.14
20	-38.43	22.11	2.14
21	-5.96	10.36	1.44
22	-40.79	70.89	1.98
23	-48.95	85.08	1.97

DESIGN RESULT:

Member	No.	Section	Dia of bolts	No. of bolts	Edge distance of bolt	Spacing of bolt
Tie	1	DEA 70 X 70 X 10	20	7	35	50
Tie	2	DEA 70 X 70 X 10	20	7	35	50
Tie	3	DEA 70 X 70 X 10	20	7	35	50
Tie	4	DEA 70 X 70 X 10	20	7	35	50
Rafter	5	DEA 65 X 65 X 6	20	4	35	50
Rafter	6	DEA 65 X 65 X 6	20	4	35	50
Rafter	7	DEA	20	4	35	50

		65 X 65 X 6				
Rafter	8	DEA 65 X 65 X 6	20	4	35	50
Rafter	9	DEA 65 X 65 X 6	20	4	35	50
Rafter	10	DEA 65 X 65 X 6	20	4	35	50
Rafter	11	DEA 65 X 65 X 6	20	4	35	50
Web	12	SEA 50 X 50 X 5	16	4	28	40
Web	13	SEA 50 X 50 X 5	16	4	28	40
Web	14	SEA 50 X 50 X 5	16	4	28	40
Web	15	SEA 50 X 50 X 5	16	4	28	40
Web	16	SEA 50 X 50 X 5	16	4	28	40
Web	17	SEA 50 X 50 X 5	16	4	28	40
Web	18	SEA 50 X 50 X 5	16	4	28	40
Web	19	SEA 50 X 50 X 5	16	4	28	40
Web	20	SEA 50 X 50 X 5	16	4	28	40
Web	21	SEA 50 X 50 X 5	16	4	28	40
Web	22	SEA 60 X 60 X 8	20	5	35	50
Web	23	SEA 60 X 60 X 8	20	5	35	50

5. CONCLUSIONS

- This Digital handbook provides analysis and design tables of A type steel roof trusses for any intermediate span, any pitch, any spacing by considering IS 875 – 2015 (Part 3) and IS 800 – 2007 (LSM)

- Single equal and unequal, double equal and unequal Angle sections with bolted connection are provided for truss members.

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