Design of Lean to Roof Steel Trusses with Hollow Circular tube using IS 875 (part-III):2015 & IS 800:2007

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Abstract*: *At present, SP-38:1987 is available which provides design for lean to roof type trusses and pitch roof trusses. The design of lean to roof truss has been carried out as per IS 800:1984 & IS 875 (Part-III):1964. Afterwards IS 800:1984 is revised in 2007, which is based on limit state method. Also, IS 875 (Part-III) is updated in 1987 and then in 2015 considering climate changes and economical parameters. Accordingly, study has been done to revise the design of trusses given in SP-38:1987. In the present study, design and comparison of lean to roof type truss with steel circular hollow tube section have been carried out using IS 875 (Part-III):2015 and IS 800:2007 limit state method using STAAD Pro. and their results compared with SP-38:1987 results. This study includes lean to roof truss system considering different parameters like span, spacing of truss, slope of roof and wind zones with all cases of wind load. At the end, a compiled report will be prepared, which will be helpful to design engineers to provide economic, easier, faster approach for designing of steel trusses.

***Keywords*: Lean to roof steel Truss, SP-38:1987, hollow circular tube section**

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I. INTRODUCTION

Presently, SP-38:1987 [1] is available which provides design of the lean to roof type trusses and pitch roof trusses with angle sections and tubular sections, which was based on old code of IS 875 for wind load and IS 800 for steel design. Now, newer code of wind load is available as IS: 875 (Part-III):2015 [2] and IS 800 are revised in 2007, but design of trusses considering these new codes are not available. Therefore, it is necessary to revise SP-38 as per the newer codes.

This study is about design of lean to roof steel trusses with hollow circular steel tube section for industrial building according to IS 875 (Part-III):2015 & IS 800:2007 [3]. The design of roof truss with tube section is economical as compared to angle section as the torsional resistance capacity and strength to weight ratio is higher as compared to angle section. The cost of tubular section is more as compared to angle section but, the total weight required for truss is less in case of truss design with tubular section as compared to angle section.

The truss considered for the design is simply supported on a column and all joints of truss members are fixed joint connections. Tie runners are provided at bottom chord of truss as shown in Figures 1 & 2. The analysis and design of truss are carried out by using STAAD pro.

The main objectives of this study are to (i) compare member axial forces of trusses designed by SP-38 with IS 875 (Part-III):1964 & IS 800:1984 and SP-38 with IS 875 (Part-III):2015 & IS 800:2007 and (ii) to compare weight of two trusses made by using angle and tube sections, respectively.

The design of lean to roof steel trusses using hollow circular steel tube section (TATA steel) has been carried out by considering following parameters:

Span	9m, 12m and 15m
Spacing of truss	4.5m and 6m
Slope of roof	1 in 3, 1 in 4 and 1 in 5
Wind zone	I, II, III

II. LITERATURE REVIEW

Dubey et al. [4-5] studied analysis of 12m span pitch roof truss under normal permeability condition according to IS 875 (Part-III):1987 in which, wind load intensity is calculated by considering terrain category, topography factor, different class of structure, structure size factor and height, and compared the obtained results with SP-38:1987 results.

Patel and Parmar [6] prepared design of lean to roof type steel roof truss by considering truss parameters like span 9m, spacing of truss 4.5m, wind speed 33 m/sec, slope 1 in 3 and high permeability and Indian codes IS 800:2007, IS 875 (Part-III):2015 using steel angle section with bolted connections.

Soni et al. [5] carried out design of A-type steel roof truss of 12m span, 1 in 3 slope of roof, 47 m/sec wind speed and large permeability with IS 875 (Part-III):1987 and compared it's weight with weight of truss having same configuration truss given in SP-38:1987. In addition, authors observed increase in weight of truss because of the different wind load calculation considered in SP-38:1987.

After studying above and other research papers [7-8], it is observed that many researchers have done different type of works on steel roof truss but, such type of work like preparation of design of lean to roof steel trusses with hollow circular tube using IS 875 (Part-III):2015 & IS 800:2007 has not been attempted.

III. METHODOLOGY

A. Load Calculation for Truss

1. Dead Load

As per IS 875 (Part-I):1987 [9], the dead load due to self-weight of truss, sheeting & insulation and their fixtures is 17 kg/m², self-weight of truss is 6 kg/m², and weight of purlins and miscellaneous loads are 3.5 kg/m².

- For 4.5m spacing of truss, ISMC 100 is used as a purlin with 12mm diameter sag rod.
- For 6m spacing of truss, ISMC 125 is used as a purlin with 12mm diameter sag rod.

2. Live Load

The live Load conforming to IS 875 (Part-II):1987 [10]

$$= [750 - 20(\Theta - 100)] \text{ N/m}^2 \text{ on plan area.} \quad (1)$$

where

Θ = Angle of roof truss

3. Wind Load

The design wind load calculations conforming to IS 875 (Part-III):2015 are shown below.

The wind pressure shall be given in SP-38:1987 is as follows:

For Zone I P_z = 1.0 kN/m²

Zone II P_z = 1.5 kN/m²

Zone III P_z= 2.0 kN/m²

The design wind pressure, P_d, is calculated by

$$P_d = P_z \times k_a \times k_c \times k_d \text{ kN/m}^2 \quad (2)$$

where

k_a = area averaging factor

k_c = combination factor

k_d = wind directionally factor

P_z = wind pressure

Then, wind force F is computed by

$$F = (C_{pe} - C_{pi}) \times A \times P_d \text{ kN} \quad (3)$$

where

C_{pi}= internal pressure coefficient

C_{pe}= external pressure coefficient

P_d= design wind pressure

A= surface area of cladding unit or structural element

4. Earthquake Load

Generally, earthquake force governs design of structure having a large mass like machine foundation, RCC structure, RCC bridge and retaining wall. As weight of steel truss is very low as compared to concrete structure, earthquake force does not govern in design of steel roof trusses.

B. Load Combinations

Load combinations for design of roof trusses conforming to IS 800:2007 are following:

1. For strength

- (DL + LL)
- 1.5 (DL+ WL)
- 1.2 (DL + LL + WL)
- 0.9 DL + 1.5 WL

2. For serviceability

- DL + LL
- DL + 0.8 LL + 0.8 WL
- DL + WL

IV. EXAMPLES OF TRUSS DESIGNS

Problem 1: Design 9m span lean to roof truss as shown in Fig. 1 by considering following parameters and compare with SP-38:1987 results.

Permeability - Normal Slope - 1 in 3

Wind Zone - II Truss spacing - 6 m

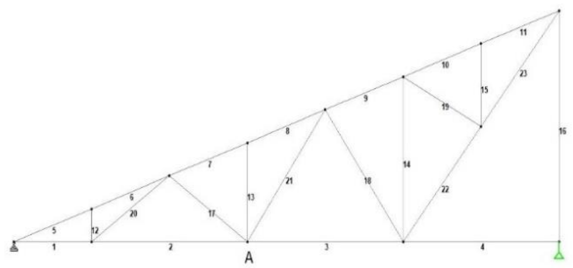

Fig. 1. Geometry of 9m span lean to roof truss ("A" shows position of tie runner)

TABLE I. COMPARISON OF MEMBER AXIAL FORCES OF TRUSS DESIGNED BY SP-38 WITH NEW CODE AND SP-38 WITH OLD CODE (ANGLE SECTION)

Member No.	Length (meter)	Compression force			Tension force		
		SP-38 with IS 875 (Part-III):1964 & IS 800:1984 (kN)	*SP-38 with IS 875 (Part-III):2015 & IS 800:2007 (kN)*	*Force increment %*	*SP-38 with IS 875 (Part-III):1964 & IS 800:1984 (kN)*	*SP-38 with IS 875 (Part-III):2015 & IS 800:2007 (kN)*	*Force increment %*
1	1.29	32.37 (2)	133.00 (2)	310.93	-53.74 (1)	-78.69 (1)	46.42
2	2.57	24.79 (2)	112.00 (2)	351.87	-45.01 (1)	-67.03 (1)	48.91
3	2.57	8.40 (2)	67.70 (2)	705.95	-27.03 (1)	-40.35 (1)	49.30
4	2.57	16.16 (2)	0.10 (2)	-99.38	-0.05 (1)	-0.06 (1)	37.78
5	1.355	56.01 (1)	83.00 (1)	48.18	-35.37 (2)	-103.00 (2)	191.23
6	1.355	55.91 (1)	82.84 (1)	48.17	-37.63 (2)	-109.00 (2)	189.65
7	1.355	37.95 (1)	56.70 (1)	49.40	-23.56 (2)	-69.80 (2)	196.21
8	1.355	37.84 (1)	56.62 (1)	49.64	-25.90 (2)	-75.30 (2)	190.72
9	1.355	18.97 (1)	28.31 (1)	49.21	-11.17 (2)	-33.50 (2)	199.91
10	1.355	22.60 (1)	33.76 (1)	49.38	-16.91 (2)	-48.20 (2)	185.04
11	1.355	22.47 (1)	33.71 (1)	50.02	-19.23 (2)	53.70 (2)	-379.28
12	0.429	5.67 (1)	8.60 (1)	51.64	-5.19 (2)	-15.60 (2)	200.81
13	1.286	5.83 (1)	8.85 (1)	51.89	-5.30 (2)	-16.00 (2)	202.06
14	2.143	8.89 (1)	13.32 (1)	49.90	-8.08 (2)	-24.00 (2)	197.07
15	1.071	5.75 (1)	8.84 (1)	53.90	-5.23 (2)	-15.90 (2)	204.02
16	3	20.95 (1)	31.29 (1)	49.35	-19.07 (2)	-52.50 (2)	175.34
17	1.548	10.83 (1)	15.91 (1)	46.87	-9.88 (2)	-28.70 (2)	190.49
18	2.144	15.03 (1)	22.44 (1)	49.32	-13.69 (2)	-37.60 (2)	174.75
19	1.438	3.50 (2)	10.40 (2)	197.48	-3.84 (1)	-5.79 (1)	50.73
20	1.542	9.02 (2)	26.30 (2)	191.45	-9.75 (1)	-14.04 (1)	44.05
21	2.141	13.49 (2)	40.10 (2)	197.17	-14.83 (1)	-22.32 (1)	50.54
22	1.975	25.02 (2)	68.90 (2)	175.40	-27.49 (1)	-41.07 (1)	49.37
23	1.975	29.82 (2)	82.50 (2)	176.63	-32.79 (1)	-49.18 (1)	50.00
Average				**126.28 %**	**Average**		**110.66%**

TABLE II. COMPARISON OF MEMBER AXIAL FORCES OF TRUSS DESIGNED BY SP-38 WITH NEW CODE AND SP-38 WITH OLD CODE (TUBE SECTION)

Member No.	Length (meter)	Compression force			Tension force		
		SP-38 with IS 875 (Part-III):1964 & IS 800:1984 (kN)	*SP-38 with IS 875 (Part-III):2015 & IS 800:2007 (kN)*	*Force increment %*	*SP-38 with IS 875 (Part-III):1964 & IS 800:1984 (kN)*	*SP-38 with IS 875 (Part-III):2015 & IS 800:2007 (kN)*	*Force increment %*
1	1.29	32.37 (2)	127.00 (2)	292.39	-53.74 (1)	-75.12 (1)	39.78
2	2.57	24.79 (2)	112.00 (2)	351.87	-45.01 (1)	-66.42 (1)	47.55
3	2.57	8.40 (2)	67.70 (2)	705.95	-27.03 (1)	-40.28 (1)	49.03
4	2.57	16.16 (2)	0.15 (2)	-99.07	-0.05 (1)	-0.09 (1)	95.56
5	1.355	56.01 (1)	79.41 (1)	41.78	-35.37 (2)	-98.00 (2)	177.09
6	1.355	55.91 (1)	78.94 (1)	41.18	-37.63 (2)	-103.00 (2)	173.70
7	1.355	37.95 (1)	56.57 (1)	49.07	-23.56 (2)	-69.70 (2)	195.79
8	1.355	37.84 (1)	56.47 (1)	49.25	-25.90 (2)	-75.20 (2)	190.34
9	1.355	18.97 (1)	28.26 (1)	48.96	-11.17 (2)	-33.40 (2)	199.02
10	1.355	22.60 (1)	33.60 (1)	48.65	-16.91 (2)	-48.00 (2)	183.86
11	1.355	22.47 (1)	33.52 (1)	49.19	-19.23 (2)	-53.40 (2)	177.72
12	0.429	5.67 (1)	7.54 (1)	32.93	-5.19 (2)	-14.10 (2)	171.89
13	1.286	5.83 (1)	8.78 (1)	50.77	-5.30 (2)	-15.90 (2)	200.17
14	2.143	8.89 (1)	13.24 (1)	49.04	-8.08 (2)	-23.90 (2)	195.83
15	1.071	5.75 (1)	8.78 (1)	52.71	-5.23 (2)	-15.80 (2)	202.10
16	3	20.95 (1)	31.22 (1)	49.01	-19.07 (2)	-52.40 (2)	174.82
17	1.548	10.83 (1)	15.32 (1)	41.45	-9.88 (2)	-27.90 (2)	182.39
18	2.144	15.03 (1)	22.40 (1)	49.05	-13.69 (2)	-37.60 (2)	174.75
19	1.438	3.50 (2)	10.20 (2)	191.76	-3.84 (1)	-5.65 (1)	47.32
20	1.542	9.02 (2)	21.20 (2)	134.93	-9.75 (1)	-10.47 (1)	7.45
21	2.141	13.49 (2)	40.00 (2)	196.43	-14.83 (1)	-22.21 (1)	49.81
22	1.975	25.02 (2)	68.60 (2)	174.20	-27.49 (1)	-40.90 (1)	48.75
23	1.975	29.82 (2)	82.10 (2)	175.29	-32.79 (1)	-48.92 (1)	49.23
Average				**120.73%**	**Average**		**131.91%**

TABLE III. COMPARISON OF SECTION REQUIRED AS PER SP-38 WITH NEW CODE V/S. SP-38 WITH OLD CODE

Member No.	Angle section		Tube section	
	SP-38 with IS 875 (Part-III):1964 & IS 800:1984	*SP-38 with IS 875 (Part-III):2015 & IS 800:2007*	*SP-38 with IS 875 (Part-III):1964 & IS 800:1984*	*SP-38 with IS 875 (Part-III):2015 & IS 800:2007*
1	2-50×50×6	2-75×75×6	88.9×3.25	114.3×3.6
2	2-50×50×6	2-75×75×6	88.9×3.25	114.3×3.6
3	2-50×50×6	2-75×75×6	88.9×3.25	114.3×3.6
4	2-50×50×6	2-75×75×6	88.9×3.25	88.9×3.2
5	2-40×40×6	2-50×50×6	88.9×3.25	88.9×3.2
6	2-40×40×6	2-50×50×6	76.1×3.25	88.9×3.2
7	2-40×40×6	2-40×40×6	76.1×3.25	48.3×2.9
8	2-40×40×6	2-40×40×6	76.1×3.25	48.3×2.9
9	2-40×40×6	2-40×40×6	76.1×3.25	48.3×2.9
10	2-40×40×6	2-40×40×6	76.1×3.25	48.3×2.9
11	2-40×40×6	2-40×40×6	76.1×3.25	48.3×2.9
12	1-40×40×6	1-40×40×6	76.1×3.25	26.9×3.2
13	1-40×40×6	1-40×40×6	76.1×3.25	26.9×3.2
14	1-60×60×6	1-65×65×6	76.1×3.25	42.4×2.6
15	1-40×40×6	1-40×40×6	26.9×2.65	26.9×3.2
16	2-50×50×6	2-55×55×6	26.9×2.65	60.3×2.9
17	1-40×40×6	1-45×45×6	33.7×2.65	33.7×2.6
18	1-60×60×6	1-75×75×6	48.3×2.9	42.4×3.2
19	1-40×40×6	1-45×45×6	26.9×2.65	26.9×3.2
20	1-40×40×6	1-75×75×6	76.1×3.25	42.4×2.6
21	1-50×50×6	1-75×75×6	33.7×2.65	60.3×2.9
22	2-40×40×6	2-50×50×6	42.4×2.65	60.3×2.9
23	2-40×40×6	2-55×55×6	48.3×2.9	60.3×3.6
Total weight of truss	**260.76 kg**	**334.5 kg**	**161.92 kg**	**185.9 kg**

Problem 2: Design 12m span lean to roof truss as shown in Fig.2 by considering following parameters and compare with SP-38:1987 results.

Permeability - Normal Slope - 1 in 3

Wind Zone - II Truss spacing- 4.5

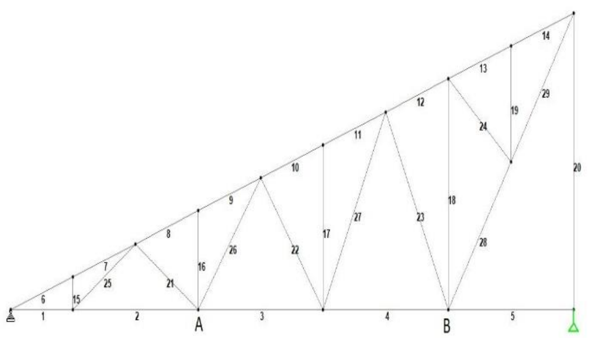

Fig. 2 Geometry of 12m span lean to roof truss ("A" and "B" show position of tie runner)

Table IV. Comparison of member axial forces of truss designed by SP-38 with new code and SP-38 with old code (Angle Section)

Member No.	Length (meter)	Compression force			Tension force		
		SP-38 with IS 875 (Part-III):1964 & IS 800:1984 (kN)	*SP-38 with IS 875 (Part-III):2015 & IS 800:2007 (kN)*	*Force increment %*	*SP-38 with IS 875 (Part-III):1964 & IS 800:1984 (kN)*	*SP-38 with IS 875 (Part-III):2015 & IS 800:2007 (kN)*	*Force increment %*
1	1.333	35.22 (2)	140.00 (2)	297.50	-54.74 (1)	-78.15 (1)	42.77
2	2.667	29.07 (2)	124.00 (2)	326.54	-48.39 (1)	-69.70 (1)	44.04
3	2.667	16.13 (2)	89.10 (2)	452.52	-34.56 (1)	-49.94 (1)	44.50
4	2.667	3.20 (2)	53.50 (2)	1569.79	-20.75 (1)	-29.96 (1)	44.42
5	2.667	16.17 (2)	0.08 (2)	-99.51	-0.03 (1)	-0.05 (1)	60.71
6	1.405	57.79 (1)	82.42 (1)	42.61	-38.05 (2)	-111.00 (2)	191.70
7	1.405	57.60 (1)	82.37 (1)	43.01	-39.51 (2)	-115.00 (2)	191.04
8	1.405	44.06 (1)	63.19 (1)	43.40	-28.40 (2)	-84.40 (2)	197.15
9	1.405	44.09 (1)	63.13 (1)	43.20	-30.13 (2)	-88.70 (2)	194.35
10	1.405	29.78 (1)	42.09 (1)	41.35	-18.46 (2)	-55.55 (2)	200.94
11	1.405	29.87 (1)	42.07 (1)	40.81	-20.25 (2)	-59.00 (2)	191.31
12	1.405	15.53 (1)	21.05 (1)	35.58	-8.54 (2)	-26.70 (2)	212.54
13	1.405	17.70 (1)	23.95 (1)	35.32	-12.28 (2)	-36.20 (2)	194.84
14	1.405	17.81 (1)	23.91 (1)	34.21	-14.10 (2)	-40.50 (2)	187.30
15	0.444	4.24 (1)	6.39 (1)	50.81	-4.00 (2)	-12.30 (2)	207.50
16	1.333	4.47 (1)	6.53 (1)	45.99	-4.18 (2)	-12.50 (2)	198.97
17	2.222	4.49 (1)	6.61 (1)	47.33	-4.19 (2)	-12.70 (2)	203.32
18	3.111	6.79 (1)	9.89 (1)	45.62	-6.35 (2)	-18.00 (2)	183.60
19	1.556	4.47 (1)	6.56 (1)	46.83	-4.18 (2)	-12.60 (2)	201.58
20	4	20.66 (1)	29.88 (1)	44.65	-19.32 (2)	-53.40 (2)	176.47
21	1.602	8.29 (1)	11.73 (1)	41.43	-7.78 (2)	-22.60 (2)	190.60
22	2.222	11.55 (1)	16.68 (1)	44.42	-10.81 (2)	-31.80 (2)	194.28
23	2.981	15.49 (1)	22.30 (1)	44.00	-14.49 (2)	-39.80 (2)	174.67
24	1.736	2.29 (2)	6.85 (2)	199.65	-2.44 (1)	-3.57 (1)	46.03
25	1.602	7.03 (2)	20.50 (2)	191.69	-7.35 (1)	-10.23 (1)	39.13
26	2.222	10.61 (2)	31.70 (2)	198.83	-11.34 (1)	-16.59 (1)	46.28
27	2.981	14.34 (2)	39.80 (2)	177.53	-15.33 (1)	-22.26 (1)	45.19
28	2.404	23.18 (2)	63.90 (2)	175.62	-24.79 (1)	-35.82 (1)	44.49
29	2.404	26.48 (2)	73.00 (2)	175.73	-28.31 (1)	-40.91 (1)	44.49
Average				**152.98%**	**Average**		**137.73%**

TABLE V COMPARISON OF MEMBER AXIAL FORCES OF TRUSS DESIGNED BY SP-38 WITH NEW CODE AND SP-38 WITH OLD CODE (TUBE SECTION)

Member No.	Length (meter)	Compression force			Tension force		
		SP-38 with IS 875 (Part-III):1964 & IS 800:1984 (kN)	***SP-38 with IS 875 (Part-III):2015 & IS 800:2007 (kN)***	***Force increment %***	***SP-38 with IS 875 (Part-III):1964 & IS 800:1984 (kN)***	***SP-38 with IS 875 (Part-III):2015 & IS 800:2007 (kN)***	***Force increment %***
1	1.333	35.22 (2)	135.00 (2)	283.30	-54.74 (1)	-75.14 (1)	37.26
2	2.667	29.07 (2)	123.00 (2)	323.10	-48.39 (1)	-69.05 (1)	42.70
3	2.667	16.13 (2)	89.10 (2)	452.52	-34.56 (1)	-49.91 (1)	44.40
4	2.667	3.20 (2)	53.50 (2)	1569.79	-20.75 (1)	-29.95 (1)	44.36
5	2.667	16.17 (2)	0.11 (2)	-99.32	-0.03 (1)	-0.07 (1)	132.14
6	1.405	57.79 (1)	79.29 (1)	37.20	-38.05 (2)	-106.00 (2)	178.56
7	1.405	57.60 (1)	79.19 (1)	37.47	-39.51 (2)	-11.00 (2)	-72.16
8	1.405	44.06 (1)	63.11 (1)	43.24	-28.40 (2)	-84.30 (2)	196.80
9	1.405	44.09 (1)	63.03 (1)	42.97	-30.13 (2)	-88.50 (2)	193.69
10	1.405	29.78 (1)	42.05 (1)	41.21	-18.46 (2)	-55.40 (2)	200.12
11	1.405	29.87 (1)	42.01 (1)	40.62	-20.25 (2)	-59.70 (2)	194.77
12	1.405	15.53 (1)	21.05 (1)	35.57	-8.54 (2)	-26.70 (2)	212.54
13	1.405	17.70 (1)	23.82 (1)	34.64	-12.28 (2)	-36.00 (2)	193.21
14	1.405	17.81 (1)	23.78 (1)	33.47	-14.10 (2)	-40.30 (2)	185.88
15	0.444	4.24 (1)	6.12 (1)	44.33	-4.00 (2)	-12.00 (2)	200.00
16	1.333	4.47 (1)	6.45 (1)	44.13	-4.18 (2)	-12.40 (2)	196.58
17	2.222	4.49 (1)	6.56 (1)	46.30	-4.19 (2)	-12.60 (2)	200.93
18	3.111	6.79 (1)	9.78 (1)	43.96	-6.35 (2)	-12.70 (2)	100.09
19	1.556	4.47 (1)	6.52 (1)	46.00	-4.18 (2)	-12.50 (2)	199.19
20	4	20.66 (1)	29.82 (1)	44.39	-19.32 (2)	-53.30 (2)	175.95
21	1.602	8.29 (1)	11.05 (1)	33.23	-7.78 (2)	-21.60 (2)	177.74
22	2.222	11.55 (1)	16.69 (1)	44.50	-10.81 (2)	-38.30 (2)	254.43
23	2.981	15.49 (1)	22.26 (1)	43.71	-14.49 (2)	-39.70 (2)	173.98
24	1.736	2.29 (2)	6.60 (2)	188.71	-2.44 (1)	-3.42 (1)	39.77
25	1.602	7.03 (2)	16.60 (2)	136.20	-7.35 (1)	-7.44 (1)	1.16
26	2.222	10.61 (2)	31.60 (2)	197.89	-11.34 (1)	-16.51 (1)	45.56
27	2.981	14.34 (2)	39.60 (2)	176.13	-15.33 (1)	-22.17 (1)	44.62
28	2.404	23.18 (2)	63.70 (2)	174.76	-24.79 (1)	-35.67 (1)	43.86
29	2.404	26.48 (2)	62.70 (2)	136.83	-28.31 (1)	-40.73 (1)	43.88
Average				**147.48%**	**Average**		**126.98%**

TABLE VI COMPARISON OF SECTION REQUIRED AS PER SP-38 WITH NEW CODE V/S. SP-38 WITH OLD CODE

Member No.	Angle Section		Tube Section	
	SP-38 with IS 875 (Part-III):1964 & IS 800:1984	***SP-38 with IS 875 (Part-III):2015 & IS 800:2007***	***SP-38 with IS 875 (Part-III):1964 & IS 800:1984***	***SP-38 with IS 875 (Part-III):2015 & IS 800:2007***
1	2-50×50×6	2-70×70×8	88.9×3.25	114.3×3.6
2	2-50×50×6	2-70×70×8	88.9×3.25	114.3×3.6
3	2-50×50×6	2-70×70×8	88.9×3.25	114.3×3.6
4	2-50×50×6	1-70×70×6	88.9×3.25	88.9×4
5	2-50×50×6	1-70×70×6	88.9×3.25	88.9×4
6	2-60×60×6	2-45×45×6	76.1×3.25	60.3×3.6
7	2-60×60×6	2-45×45×6	76.1×3.25	60.3×3.6
8	2-60×60×6	2-45×45×6	76.1×3.25	60.3×3.6
9	2-60×60×6	2-45×45×6	76.1×3.25	48.3×3.2
10	2-60×60×6	2-40×40×6	76.1×3.25	48.3×3.2
11	2-60×60×6	2-40×40×6	76.1×3.25	48.3×3.2
12	2-60×60×6	2-40×40×6	76.1×3.25	48.3×3.2
13	2-60×60×6	2-40×40×6	76.1×3.25	48.3×3.2
14	2-60×60×6	2-40×40×6	76.1×3.25	48.3×3.2
15	1-40×40×6	1-40×40×6	26.9×2.65	26.9×3.2
16	1-40×40×6	1-40×40×6	26.9×2.65	26.9×3.2
17	1-60×60×6	1-65×65×6	33.7×2.65	42.4×2.6
18	1-80×80×6	2-60×60×6	48.3×2.9	60.3×2.9
19	1-40×40×6	1-45×45×6	26.9×2.65	33.7×3.2
20	2-70×70×6	2-75×75×6	76.1×3.25	76.1×3.2
21	1-40×40×6	1-50×50×6	33.7×2.65	33.7×2.6
22	1-60×60×6	1-65×65×6	42.4×2.65	42.4×2.6
23	1-80×80×6	2-55×55×6	48.3×2.9	60.3×2.9
24	1-40×40×6	2-40×40×6	26.9×2.65	33.7×2.6
25	1-40×40×6	1-50×50×6	33.7×2.65	42.4×2.6
26	1-50×50×6	2-45×45×6	42.4×2.65	48.3×2.9
27	1-60×60×6	2-60×60×6	48.3×2.9	60.3×3.6
28	2-40×40×6	2-55×55×6	76.1×3.25	76.1×3.2
29	2-40×40×6	2-55×55×6	76.1×3.25	76.1×3.2
Total weight of Truss	**462.2 kg**	**517 kg**	**268.2 kg**	**287 .5 kg**

Note: "(1)" indicates axial force due to combination other than wind load

"(2)" indicates axial force due to combination of wind load

V. DISCUSSIONS

Due to change in load combination, axial force in members of truss designed by SP-38:1987 with IS 875 (Part-III):2015 & IS 800:2007 is different from axial force in members of truss designed by SP-38:1987 with IS 875 (Part-

III):1964 & IS 800:1984. Ultimately, weight of truss is increased.

Tables 1 & 2 represent axial forces of 9m spanned truss with angle section and tubular section, respectively. Similarly, the axial forces obtained for 12m spanned truss with angle sections and tubular section presented in Tables 4 & 5, respectively. The required section size for the 9m and 12m span truss members is given in Tables 3 and 6, respectively.

VI. CONCLUSIONS

- The compression force is increased by 1.53 times and tension force is increased by 1.38 times when 12m spanned truss is designed using angle section with IS 875 (Part-III):2015 & IS 800:2007. On other side compression force increased is by 1.47 times and tension force is increased by 1.27 times when same truss is designed with tube section.
- The compression force is increased by 1.26 times and tension force is increased by 1.11 times when 9m spanned truss is designed using angle section with IS 875 (Part-III):2015 & IS 800:2007. On the other hand, compression force is increased by 1.21 times and tension force is increased by 1.32 times when same truss is designed with tube section.
- When comparison is made between member axial forces of 9 m spanned truss designed by SP-38 with IS 875 (Part-III):1964 & IS 800:1984 with member axial forces of 9m spanned truss designed by SP-38 with IS 875 (Part-III):2015 & IS 800:2007 compared to SP-38:1987 with IS 875 (Part-III):1964 & IS 800:1984, it is observed that weight of 9m spanned truss with angle section is increased by 28.28% and with tubular section, weight is increased by 14.81%.
- When comparison is made between member axial forces of 12 m spanned truss designed by SP-38 with IS 875 (Part-III):1964 & IS 800:1984 with member axial forces of 12m spanned truss designed by SP-38 with IS 875 (Part-III):2015 & IS 800:2007 compared to SP-38:1987 with IS 875 (Part-III):1964 & IS 800:1984, it is observed that weight of 12m spanned truss with angle section is increased by 12.00% and with tubular section, weight is increased by 7.20%.

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