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Design of Tension and Compression member of Steel roof truss By IS:800-2007 Using Computer Program

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Abstract: Today most of the calculations are done by using computer program/software. So, that the solution becomes more reliable and accurate. In the field of steel structure, it is very difficult to calculate axial tensile as well as compressive force in steel structure manually.

In this work, computer program is made in Microsoft Excel, so that the solution becomes more accurate and faster. Designer can select appropriate Angle section using this program.

Keywords: IS: 800 -2007 (GENERAL CONSTRUCTION IN STEEL – CODE OF PRACTICE)

I. INTRODUCTION

A steel structure is a combination of various tension and compression members. In every steel structure, when it is loaded by external forces, tension and compression forces are developed in internal members of whole structure. Design load is a combination of various loads acting on the structure such as Dead load, Live load, Wind loads etc. A tension member is a structural member subjected to two equal and opposite outward forces. They are found in bridge and roof trusses, towers, bracing systems, cables, and various other applications. A member which carries an axial compression is known as a compression member.

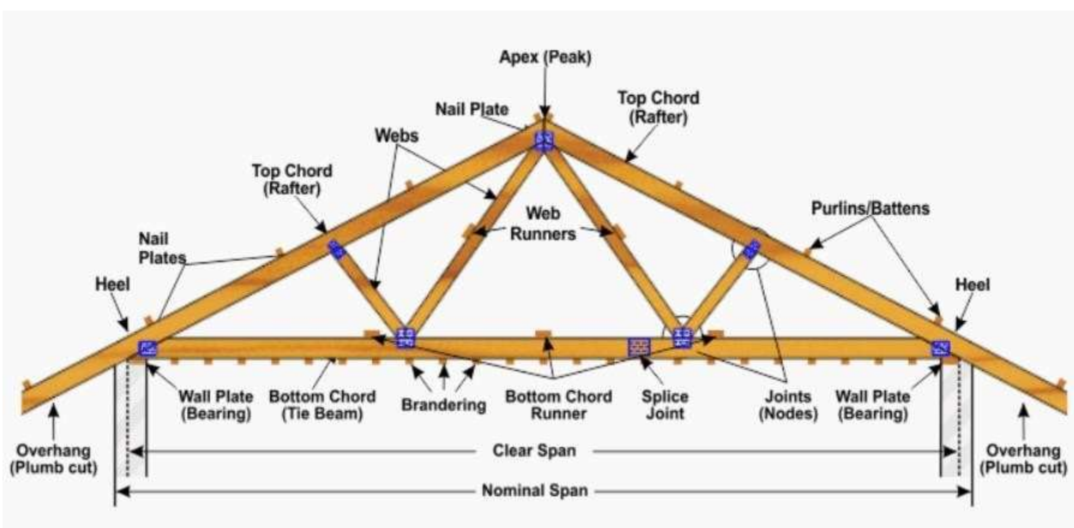


Figure 1. Typical Steel roof truss

Figure 1 shows typical steel roof truss showing all components. In this program, one can easily input the data for analysis of tension as well as compression members, and get final output in Microsoft excel.

II Important parameters of computer program

Physical properties of structural steel irrespective of its grade may be taken as: (Clause 2.2.4.1)

- Unit mass of steel, p = 7850 kg/m~
- Modulus of elasticity, E = 2.0 x 10^5 N/mm2 (MPa)
- Poisson ratio, p = 0.3
- Modulus of rigidity, G = 0.769 x 10^5 N/mm2 (MPa)
- Co-efficient of thermal expansion cx. = 12 x 10' / "c

III Computer Program Using IS: 800-2007

The following screenshots shows some important sheets of Design of tension and compression members

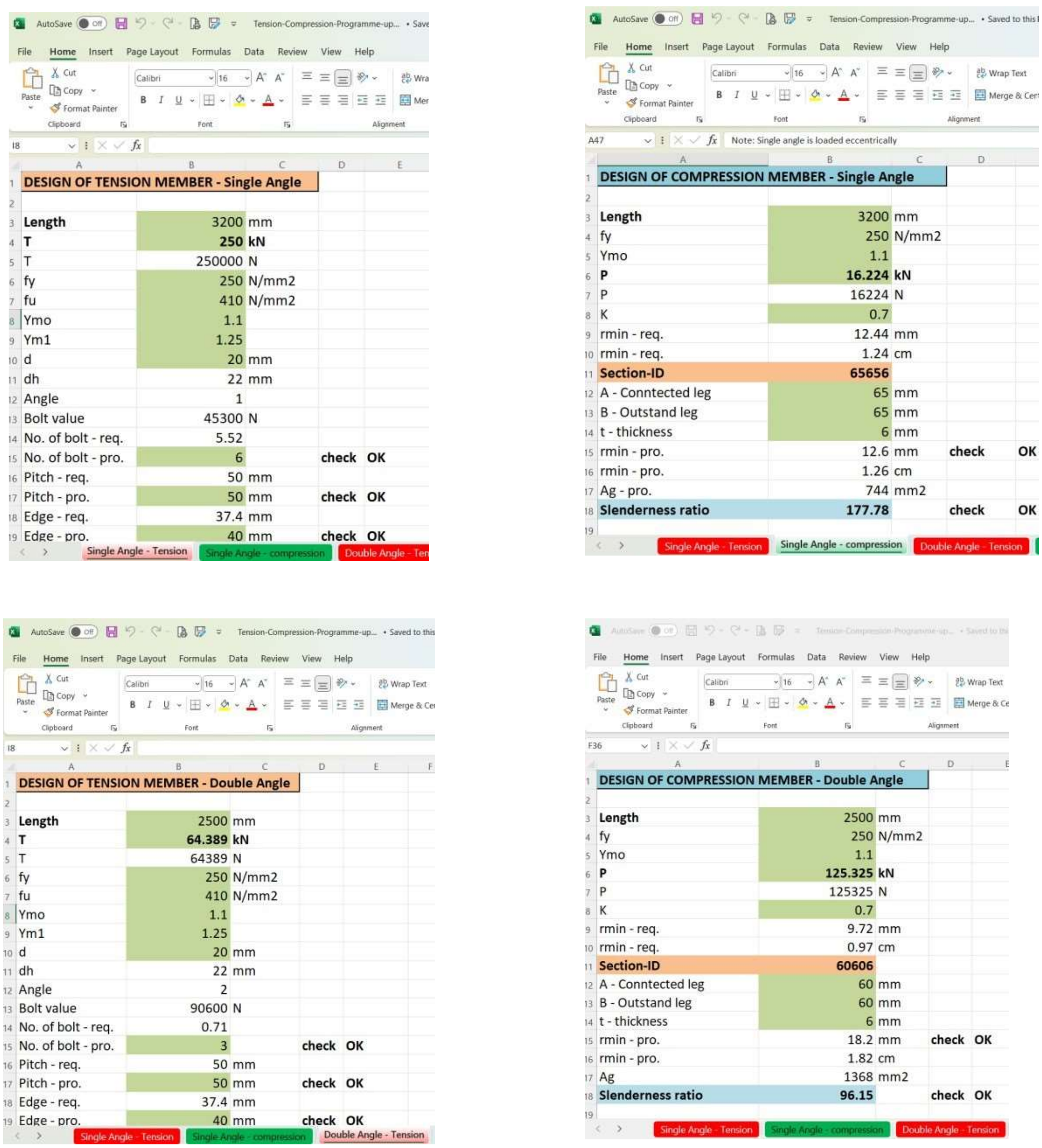
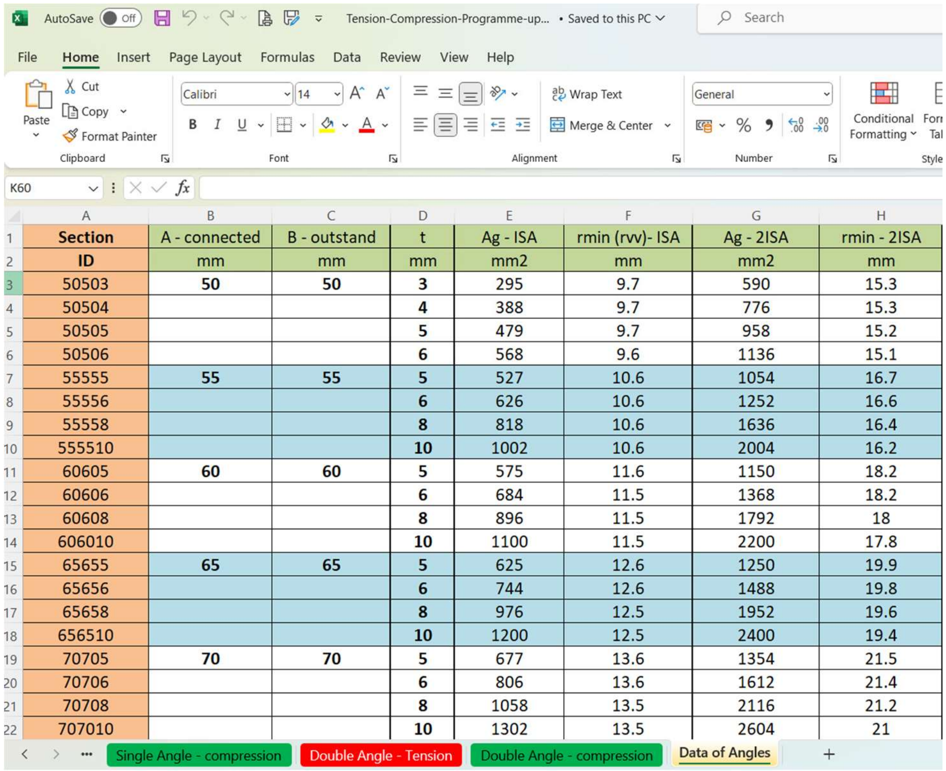


Figure 2. Screen shot of Design of Tension member and Compression member



Section	A - connected	B - outstand	t	Ag - ISA	rmin (rvv)- ISA	Ag - 2ISA	rmin - 2ISA
ID	mm	mm	mm	mm2	mm	mm2	mm
50503	50	50	3	295	9.7	590	15.3
50504			4	388	9.7	776	15.3
50505			5	479	9.7	958	15.2
50506			6	568	9.6	1136	15.1
55555	55	55	5	527	10.6	1054	16.7
55556			6	626	10.6	1252	16.6
55558			8	818	10.6	1636	16.4
555510			10	1002	10.6	2004	16.2
60605	60	60	5	575	11.6	1150	18.2
60606			6	684	11.5	1368	18.2
60608			8	896	11.5	1792	18
606010			10	1100	11.5	2200	17.8
65655	65	65	5	625	12.6	1250	19.9
65656			6	744	12.6	1488	19.8
65658			8	976	12.5	1952	19.6
656510			10	1200	12.5	2400	19.4
70705	70	70	5	677	13.6	1354	21.5
70706			6	806	13.6	1612	21.4
70708			8	1058	13.5	2116	21.2
707010			10	1302	13.5	2604	21

Figure 3. Section data for Tension and compression members

IV Input and output data for tension member (Single Angle section)

DESIGN OF TENSION MEMBER - Single Angle				
Length	3200	mm		
T	250	kN		
T	250000	N		
fy	250	N/mm^2		
fu	410	N/mm^2		
Ymo	1.1			
Ym1	1.25			
d	20	mm		
dh	22	mm		
Angle	1			
Bolt value	45300	N		
No. of bolt - req.	5.52			
No. of bolt - pro.	6		check	OK
Pitch - req.	50	mm		
Pitch - pro.	50	mm	check	OK
Edge - req.	37.4	mm		
Edge - pro.	40	mm	check	OK
Ag - req.	1100	mm^2		
Section -ID	757510			

A - connected leg	75	mm		
B - outstand leg	75	mm		
t - thickness	10	mm		
Ag - pro.	1402	mm^2	check	OK
rmin - req.	12.44	mm		
rmin - pro.	14.5	mm	check	OK
K	0.7			
Tdg	318.64	kN	check	OK
g	40	mm		
w	75	mm		
bs	105	mm		
Lc	250	mm		
Ago	700	mm^2		
Anc	480	mm^2		
Beta	1.254			
Beta-Lower range	0.7		check	OK
Beta-Upper range	1.443		check	OK
Tdn	341199.88	N		
Tdn	341.20	kN	check	OK
Avg	2900	mm^2		
Avn	1690	mm^2		
Atg	350	mm^2		
Atn	240	mm^2		
Tdb1	451385.48	N		
Tdb1	451.39	kN	check	OK
Tdb2	367587.02	N		
Tdb2	367.59	kN	check	OK
Td - strength	318.64	kN	check	OK
Slenderness ratio	154.48		check	OK
Note: Single angle is loaded eccentrically				
Note: Gusset plate thickness is 10 mm				

Table 1. Input and output data for tension member (Single Angle section)

V Input and output data for Compression member (Single Angle section)

DESIGN OF COMPRESSION MEMBER - Single Angle				
Length	3200	mm		
fy	250	N/mm^2		
Ymo	1.1			
P	**16.224**	**kN**		
P	16224	N		
K	0.7			
rmin - req.	12.44	mm		
rmin - req.	1.24	cm		
Section-ID	**65656**			
A - Conntected leg	65	mm		
B - Outstand leg	65	mm		
t - thickness	6	mm		
rmin - pro.	12.6	mm	check	OK
rmin - pro.	1.26	cm		
Ag - pro.	744	mm^2		
Slenderness ratio	**177.78**		check	OK
Section Classification				
Epsilon	1			
b/t	10.83333333		check	OK
d/t	10.83333333		check	OK
(b+d)/t	21.66666667		check	OK
Buckling class	semi compact			
Alpha - imperfaction factor	0.49		check	OK
No. of Bolts - pro. (Each end)	3			
End condition	hinged			
k1	0.7			
k2	0.6			
k3	5			
E	200000	N/mm^2		
Lamda (vv)	2.858			
Lamda (phi)	0.122			
Lamda - e	2.382			
Phi	3.873			
Stress Reduction factor	0.144			
fcd	32.82	N/mm^2		
Pd	24415.60	N		
Pd - strength	**24.42**	**kN**	check	OK
Note: Single angle is loaded eccentrically				
Note: Gusset plate thickness is 10 mm				

Table 2. Input and output data for compression member (Single Angle section)

* Note: All the symbols are used in this program are as per IS: 800-2007 (GENERAL CONSTRUCTION IN STEEL – CODE OF PRACTICE)

VI CONCLUSION

In this computer program, all guidelines as per IS: 800-2007 is included and it gives reliable and accurate results. It helps to designer to judge the proper selection of angle section for tension as well as compression members in roof truss. Moreover, instant results can be obtained by changing value of section as per requirements of design. At every stage of calculation, various checks are also done, so that designer can see proper selection of steel section.

VII REFERENCES

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