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DESIGN OF STRUCTURAL STEEL ELEMENTS-TENSION MEMBERS, COMPRESSION MEMBERS AND FLEXURAL MEMBERS

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Abstract— **Steel structures are arrangements of group of elements which are designed and to transfer force safely.Indian steel code IS 800-2007 has been used to design the steel elements.Limit State Method has been involved in design methodology.This process consists of number of equations and parameters ,which will result in complex and tedious design process.Design being trail and error process, the problems are repetitive in nature. Hence the method of adoption of excel spread sheet can reduce time and effort of engineer and designer considerably.**

Because of easy access ,spreadsheet is the best selection for designer,despite the availability of numerous design softwares course. Engineers can conveniently use the design tool to check the design stage of structural steel elements and to maintain balance between safety and economy.

Index terms- **single angle, double angle, welded connection, bolted connection, plates, beams.**

I. INTRODUCTION

Steel due its advantages has been used in various types of structures because of its high strength/weight ratio which makes steel table used in civil engineering works such as high rise building, transmission towers, soft soil bridges, and structures located in earthquake prone area.There exist a difference between steel structure and reinforced cement concrete elements .In case of reinforced cement concrete the designer has control over the shape but in design of steel ,designer is compelled to use standard rolled sections .There are two principal group of steel

Steel structures ,which are made of plates, such as tanks and chimneys. Secondly the framed structures, which are assemblies of tension ,compression and flexural members such as truss frames and rigid frames. The design of steel structures includes planning,proportioning of members and consideration of erection at site. Because of the above reason design has become an important aspect of structural engineering. Each elements of structure has its property and its own design constraint. Each component transfer load safely and to perform better as a structure.Column plays an important role in stress transfer.

The project focuses on and behaviour and design of tension members, compression member and flexural members and the importance of excelsheet as a tool.

II. LITERATURE REVIEW

- Allwood JM,Cullen JM[2010].With the rise in the demand of carbon dioxide,the target which is to be achieved will give 75% reduction in emission per kilogram of steel that is produced, but Allwood[1] report that improvement effeciciency has been reduced in steelmaking.Half of the steel is used in construction industry[2], of which 60% is used in buildings[3],so consumption of steel in building if reduced there exist reduction in carbon emission too.
- Hicks S [2007]. Success has been found in production improvement that Eurocodes described by Nethercot[4] as technically the most design standards, it helps engineers to design the structural steel by assuming value [5]
- IS 800:2007.This code is mainly used in the design of steel structures as well as the elements of steel structure.[6]

Flow of work

Procedure involved to develop the design work are:

• Progress of Spread Sheet which hold the design code for the selected section and data in Microsoft Excel .

• Particular steel section is selected from code and design is done using spread sheet.

• Execution of selected section design methodologies in the spread sheets.

Design factors:

Strength of member is governed by various factors such as

- Length of connection
- Type of connection
- Connection eccentricity
- Size and shape of fastener
- Net area of c/s of shear lag
- Load acting on the member

.

Modes of failure in Tension members are

1. Gross section yielding
2. Net section rupture
3. Block shear failure

The strength of tension members under different modes of failure, i.e.,design strength due to yielding of gross section, T_{dg}, rupture of critical section,T_{dn} and block shear T_{db} are determined. The design strength of a member

under axial tension, Td, is the least value of yielding of gross section, rupture of critical section and block shear .

Slenderness ratio is apart from strength requirement ,the tension members have to be checked for minimum stiffness by stipulating the limiting slenderness ratio.This is required to prevent undesirable lateral movement or vibration

Shear lag is the tensile force that get transferred from leg to other as tension stress. Tension stress wont be uniform throughout stress distribution become uniform far away from connection

Internal transfer of forces from one leg to other will be by shear, The phenomenon is reffered as shear lag

Lug Angles are short angles used to connect the gusset and the outstanding leg of the main member.they are normally provided when the tension member carries a very large load. Higher load results in a longer end connection which can be reduced by providing lug angle.

Tension members are the members where two tensile forces are acting at the ends of members. Here no eccentricity and bending stress are not developed in the connection Compression members are the straight members which are subjected to two equal and opposite compressive forces acting at its ends. Column is a best example of compression member.Stability of the structure plays an important role in the design.Structural analysis is based on stable condition between internal and external forces.

III. EQUATIONS

Equations which are used in the design steps are as follows:

$$Tdg=Ag*fy/Ymo \quad (1)$$

$$\beta=1.4-.76*w/t*fy/fu*bs/Lc \quad (2)$$

$$Tdn=0.9*fu*Anc/Ym1+\beta*Ago*fy/Ymo \quad (3)$$

$$Tdb1=Avg*fy/\ sqrt3*Ym0+.9*Atn*fu/Ym1 \quad (4)$$

$$Tdb2=.9*Avn*fu/sqrt3*Ym1 + Atg*fy/Ymo \quad (5)$$

$$An=b*t-n*(dh*t) \quad (6)$$

$$P=2.5d \quad (7)$$

$$e=1.5do \quad (8)$$

$$Fwd=fu/sqrt3*Ymw \quad (9)$$

$$Lw=Tu/Fwd*t \quad (10)$$

$$\chi = b-Cxx \quad (11)$$

$$t =0.7*s \quad (12)$$

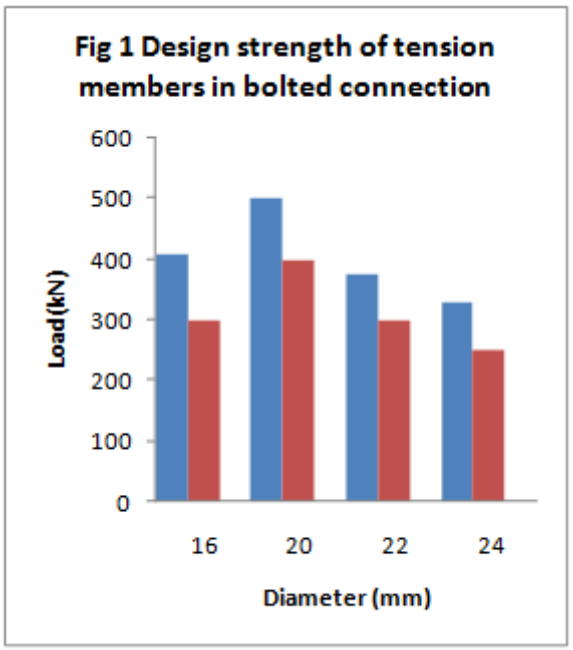
$$Pwd=Lw*t*fu/sqrt3*Ymw \quad (13)$$

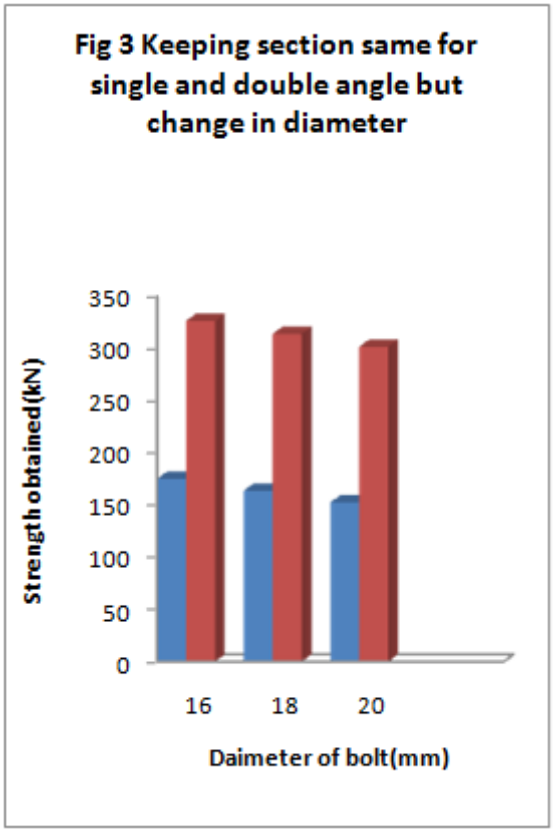
$$Anc=Tu*Ym1/0.8*fu \quad (14)$$

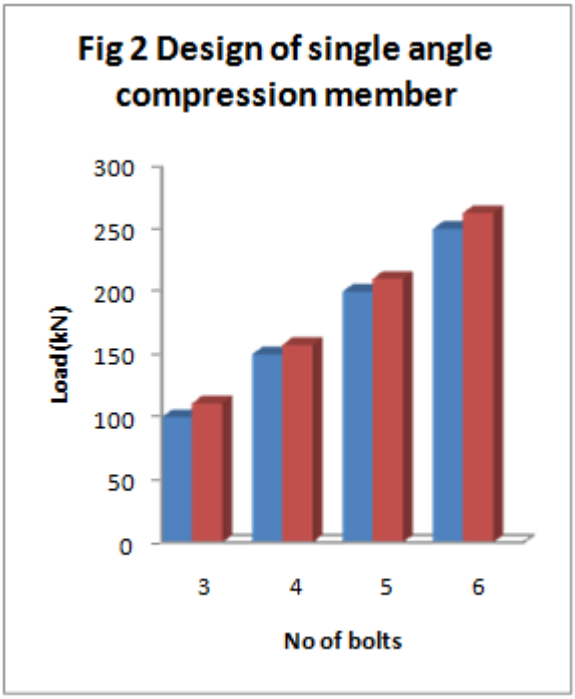
$$Vdpb=2.5*kb*d*t*fu/Ymb \quad (15)$$

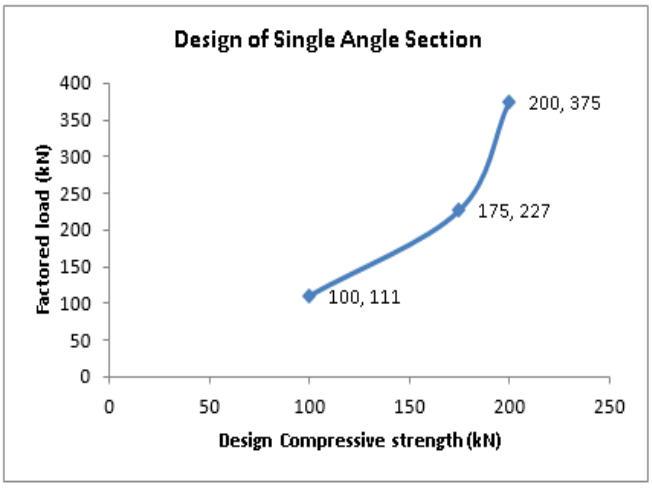
$$Ae=fu/fcd \quad (16)$$

IV. FIGURES









V. TABLES

Table 1.Design strength of Tension Members with bolted connection

DIAMETER(MM)	DESIGN STRENGTH(kN)	ASSUMED LOAD(kN)
16	410	300
20	500.00	400
22	375.00	300
24	330	250

Table 2 .Design strength of Single Angle in Compression Member

NO OF BOLTS (MM)	ASSUMED LOAD(kN)	DESIGN STRENGTH(kN)
3	100	111
4	150	158
5	200	210
6	250	263

Table 3.Design strength of angle section as Tension member

KEEPING SECTION SAME ,CHANGE IN DIAMETER			
SINGLE ANGLE		DOUBLE ANGLE	
DIAMETER OF BOLT SECTION(ISA 125X75X6)mm	STRENGTH OBTAINED(kN)	DIAMETER OF BOLT SECTION(2ISA 125X75X8)mm	STRENGTH GAINED(kN)
16	175	16	326
18	164	18	314
20	153	20	302

Table 4 Design of single angle compression members

Section(mm)	Daimeter(mm)	Pu(kN)	Pd(kN)
ISA 75*75*8	20	100	111
ISA125*75*10	20	175	227
ISA 110*110*10	20	200	375

VI. CONCLUSION

1. series of problem for single angle and double angle bolted connection , are analysed by keeping diameter of bolts same and design strength is found out.

2. A series of problem is studied for Single angle and double angle section bolted connection by keeping load same for different sections and observing the design strength

3. A set of problems for Single angle and double angle sections with bolted connection are worked out keeping the number of bolts same for different section and variation in the design strength is studied.

4. Similar set of problems is carried for welded connection as well and variation is studied.

5. Design force as well as design strength are tabulated and comparative study is done.

6.Similar sets of problems are carried out using the IS 800:2007 for Compression members and results are tabulated.

REFERENCES

[1] Allwood JM,Cullen JM,Milford RL.2010 option for achieving a 50% cut in industrial carbon emissions by 2050.Environ.Sci.Techno1.44,1888-1894

[2] 8 Bates W.1984 Historical structural steelwork handbook.London,UK.The British constructional steel work Association Ltd.

[3] Nethercot DA.2012 Modern codes of practice:wha t is their effect,their value & cost struct eng.Int.22,1761-1781.

[4]Hicks S.2007 strength & ductility of headed stud connectors welded in modern profiled steel sheeting .Struct Engineer 85,32-38

[5]BCSA 2006 A century of steel construction 1906-2006.London,UK:British Constructional steelwork Association

[6]IS 800:2007,Code of practice for general construction in steel,Bureau of Indian Standards New Delhi,2007

[7]Limit state design of steel structure by N. Subramanian and S.K. Duggal.