LEARN STEEL_2007

Limit State design of Steel as per IS 800: 2007

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LEARN STTEL_2007
IN 6 EASY STEPS

A Software for Limit State Design of Structural Steel
as per IS 800 : 2007

LEARN STEEL_2007 STEP BY STEP

INTRO & LIMITATIONS

- **Please take Print Out of Every Step, including this page before commencing Learn. Take a Yellow Marker Pen and Mark the Learning Process while Proceeding further. This is Essential for Learning.**
- **The software performs Limit State design of structural steel as per { IS } Indian Standard IS : 800 : 2007.**
- **It expected from user to perform Elastic 2D / 3D analysis of structures & obtain axial Load, Bending Moment, Shear force and lateral Sway of member before proceeding with limit state design.**
- **Deflection is calculated by program from the given span moment.**
- **Following 34 numbers of Programs are available:**

End / Gusset Plate Under Comp. or Tension ***
Angles Under Comp. or Tension ***
Angles : Flange In Bending Compression
Angle : Flange In Bending Tension
Angle Purlins
Single MC / MB Beam Section ***
Single MC / MB Column Section ***
2 ISMC Sections Toe to Toe ***
2 ISMC Sections Back to Back ***
2 ISMB Sections Side by Side ***
Gantry Girder
Built-up (MB + Flange Plates) ***
Box Angle Girder / Column ***
Plate Girder
Base Plate
Chequered Plate
Effective length of Column
Braced and Un_Braced Frames
Tubular {Circular} Section
Square Hollow Section
Rectangular Hollow Section
General : Equal Flange Section
General : Moment / Shear Connection
General : Shear Connection - Beam/Beam
Bolt Capacity
HSFG Bolt Capacity
Long Joint/Grip Shear Reduction
Prying Force

Lateral Restrain Lm
Pin Design
Vibration Frequency
Variation of Yield Stress with Temperature
Variation of E with Temperature
Plastic Analysis of Simple Beams

Programs Marked * are in Database Format. File Creation is compulsory for Programs with Database format. For Non Database format programs file creation / saving / editing / deleting is not available.**

- **Apart from the above LS design programs, standard shear and moment connections are also included with the software.**

- **Useful Information is included as under :**

Limiting Width to Thickness Ratio
Buckling Class of Sections & Imperfection Factors
Effective Length of Members
Sway & Non_Sway Frames
Coefficient of Friction
Partial safety Factors for Limit States
Deflection Limits
Test Loading
Durability
Corrosion Protection Methods
Tolerances
Plastic Analysis
Advantages & Disadvantages of Plastic Design

- **Minimum Computer RAM memory of 2 GB is recommended. Minimum Processor shall be Pentium 4 or equivalent. Minimum Hard Disk Capacity shall be 80 GB.**

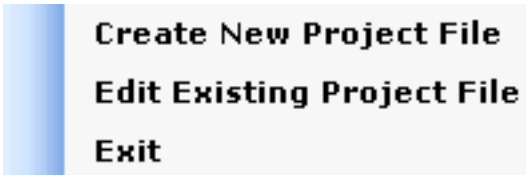
- **Use Laser OR Ink Jet Printer.**

LEARN STEEL_2007 STEP BY STEP

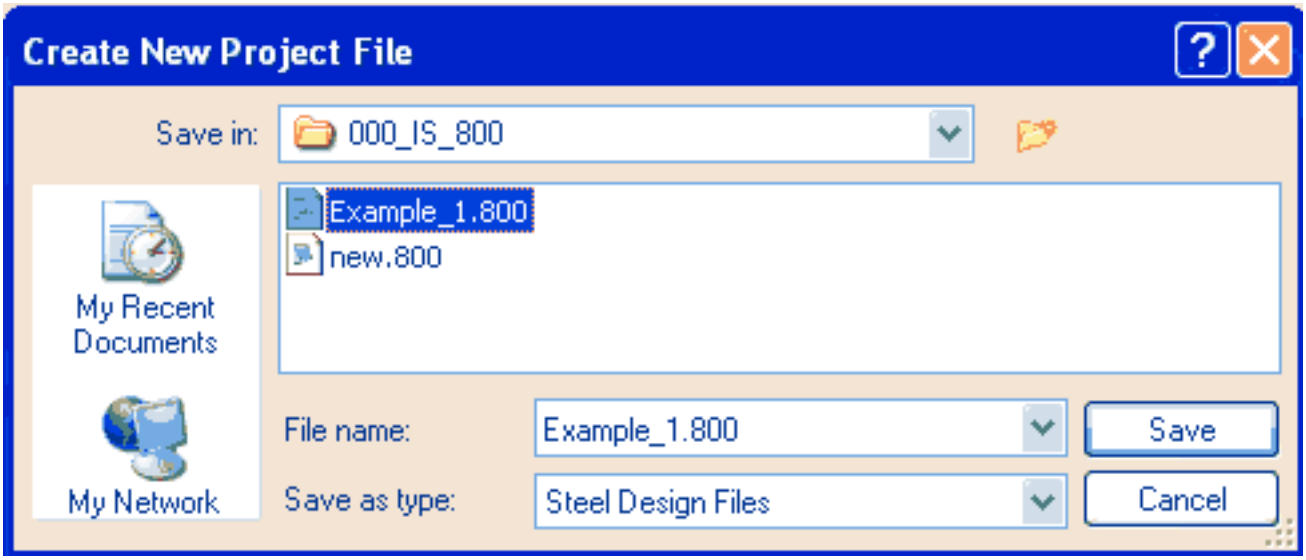
STEP NO. 1 : New Project (File) Creation

- **When Program starts, the graphics above Menu Bar is displayed. Consider the " Files Option ".**

  Click the " Files " option in the MENU bar. The following window will open.



- **You must create a separate Folder / Directory to store your files.**
  I have created a Directory called " 000_IS_800 " in D drive to store my Project files.
  Click " Create New Project File " option. A Save Window Dialog Box will open up.



- **Go to " 000_IS_800 " folder & give a file name to your project. I have given " Example_1.800 " as the name of my new project file. Click the save button. Following project window will open.**

Add Project Details :

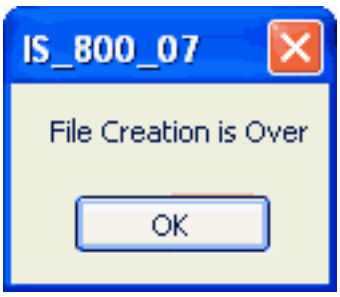
File Name : D:\000_IS_800\Example_1.800

Date : 07 April 2010

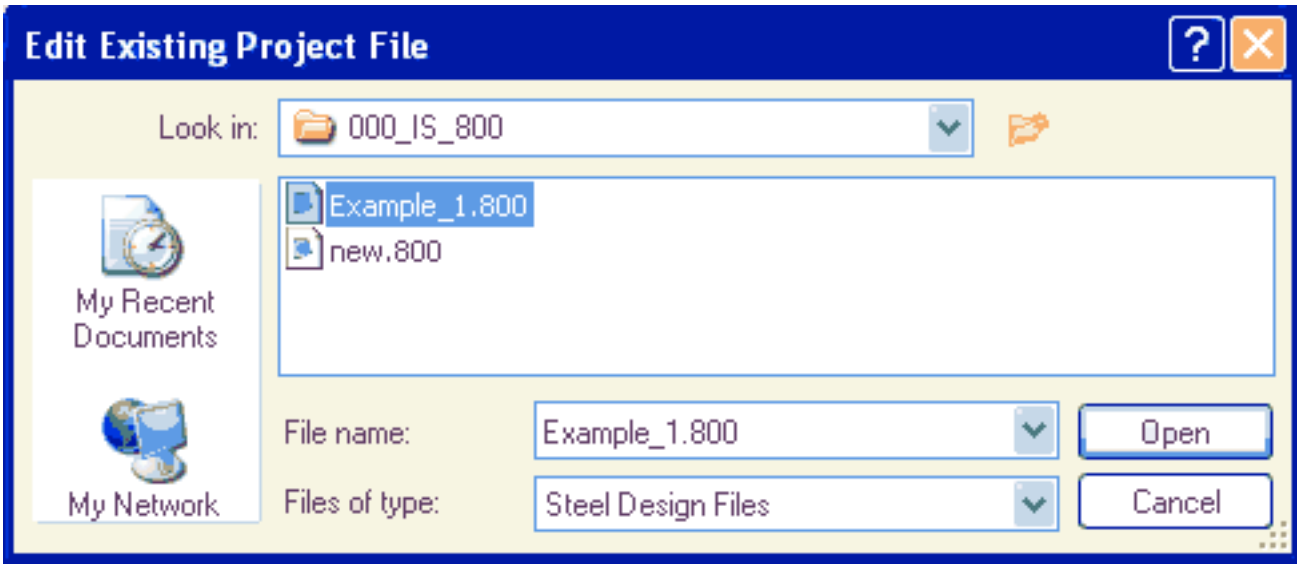
Organization	ABC Ltd.
Project	Caustic Soda Plant
Project #	8912
Building ID	Cell House
Floor #	12
Floor LVL.	36.0 M
Concrete Grade	M20
Yield Stress in Mpa	250
Ultimate Stress in Mpa	410
Steel Rate in Rs/ton	80000
Bolt Hole Type	Drilled

PRINT OK

- **Add the Relevant Project details & Click OK button, following message will appear.**
  Note that File Creation is compulsory for Programs with Database format. For Non Database format programs file creation / saving / editing / deleting is not available.



- **Project File created above can be edited by clicking Edit Existing Project File button, following File Open Dialog window will appear.**



- **Select " Example_1.800 " and Click Open button, the Project window will open again. A user can edit all the Fields.**

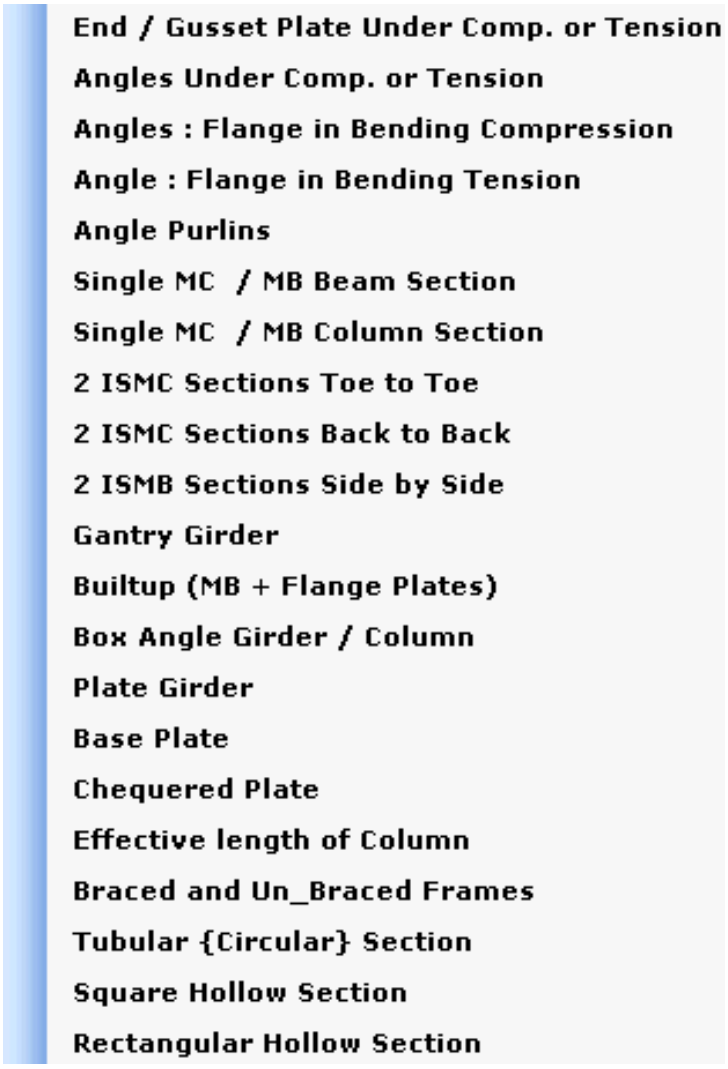
STEP NO. 1 IS OVER.

LEARN STEEL_2007 STEP BY STEP

STEP NO. 2 :

ADD / EDIT / DELETE : DESIGN OF ISMB / ISMC BEAMS

- **When Program starts, the graphics above Menu Bar is displayed. Click the " Designs_1" option.**
  The following window will open.



- **Following Programs are in Database Format. File saving / editing / deleting is available.**
  - **End / Gusset Plate Under Comp. or Tension**
  - **Angles Under Comp. or Tension**
  - **Single MC / MB Beam Section**
  - **Single MC / MB Column Section**
  - **2 ISMC Sections Toe to Toe**
  - **2 ISMC Sections Back to Back**
  - **2 ISMB Sections Side by Side**
  - **Built-up (MB + Flange Plates)**
  - **Box Angle Girder / Column**

Following ISMC / ISMB Sections are available for design.

- **MC 75, MC 100, MC 125, MC 150, MC 175, MC 200, MC 225, MC 250, MC 300, MC 350, MC 400**
- **MB 100, MB 125, MB 150, MB 175, MB 200, MB 225, MB 250, MB 300, MB 350, MB 400, MB 450, MB 500, MB 550, MB 600**

Following Equal Angle Sections are available under " Angles Under Comp. or Tension " option.

- **L20 20X3, L20 20X4, L25 25X3, L25 25X4, L25 25X5, L30 30X3, L30 30X4, L30 30X5 L35 35X3, L35 35X4, L35 35X5, L35 35X6, L40 40X3, L40 40X4, L40 40X5, L40 40X6 L45 45X3, L45 45X4, L45 45X5, L45 45X6, L50 50X3, L50 50X4, L50 50X5, L50 50X6 L55 55X5, L55 55X6, L55 55X8, L55 55X10, L60 60X5, L60 60X6, L60 60X8, L60 60X10 L65 65X5, L65 65X6, L65 65X8, L65X10, L70 70X5, L70 70X6, L70 70X8, L70 70X10 L75 75X5, L75 75X6, L75 75X8, L75 75X10, L80X6, L80 80X8, L80 80X10, L80 80X12 L90 90X6, L90 90X8, L90 90X10, L90 90X12, L100 100X6, L100 100X8, L100 100X10 L100 100X12, L110 110X8, L110 110X10, L110 110X12, L110 110X16, L130 130X8 L130 130X10, L130 130X12, L130 130X16, L150 150X10, L150 150X12, L150X16 L150 150X20, L200 200X12, L200 200X16, L200 200X20, L200 200X25**

Following Un-Equal Angle Sections are available under " Angles Under Comp. or Tension " option.

- **L30 20X3, L30 20X4, L30 20X5, L40 25X3, L40 25X4, L40 25X5, L40 25X6, L45 30X3 L45 30X4, L45 30X5, L45 30X6, L50 30X3, L50 30X4, L50 30X5, L50 30X6, L60 40X5 L60 40X6, L60 40X8, L65 45X5, L65 45X6, L65 45X8, L70 45X5, L70 45X6, L70 45X8 L70 45X10, L75 50X5, L75 50X6, L75 50X8, L75 50X10, L80 50X5, L80 50X6, L80 50X8 L80 50X10, L90 60X6, L90 60X8, L90 60X10, L90 60X12, L100 65X6, L100 65X8 L100 65X10, L100 75X6, L100 75X8, L100 75X10, L100 75X12, L125 75X6, L125 75X8 L125 75X10, L125 95X6, L125 95X8, L125 95X10, L125 95X12, L150 75X8, L150 75X10 L150 75X12, L150 115X8, L150 115X10, L150 115X12, L150 115X16, L200 100X10 L200 100X12, L200 100X16, L200 150X10,**

The design format of all the above programs are similar.

Let us take the example of " Single MC / MB Beam Section" by clicking this option. File open window will appear, select the " Example_1.800 " File. A new window will appear.

PART DISPLAY OF ADD / EDIT / DELETE : DESIGN OF ISMB / ISMC BEAMS

ID	Section	Lzz	Lyy	Span	L/R	Defl.	Type	Axial	MZZ	LHS_Y	RHS_Y	MYY
B1	MC 150	3000	1000	3000	250	L/360	UDL	5	20	10	10	0

Record No. : 1 of 1

Member ID B1 | ISMC / ISMB Section MC 150 | Effective Length in MM @ Z-Z Axis 3000

Span (Length) in MM 3000 | Allowable SR 250 | Allowable Deflection L/360

Factored Axial Load in KN 5 | Factored MZZ in KN-M 20 | Factored LHS Shear YY in KN 10

Factored MYY in KN-M 0 | LHS Shear ZZ in KN 0 | Factored RHS Shear ZZ in KN 0

Prev | Next | Last | 1 st | Copy | Paste | Copy All | Read Me

Update | Go To Rec | Remove | Add Record | Clear | OK

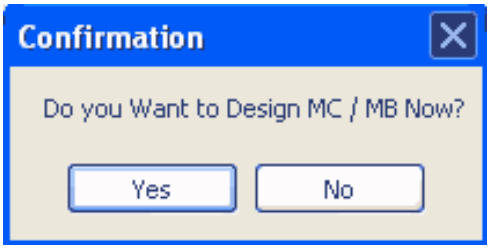
- **Always Click " Add Record " Button, before adding any record.**
  I have added one record as shown above. Following Parameters are added.

Member ID = B1
ISMC / ISMB Section = MC 150
Effective Length in MM @ Z-Z Axis = 3000
Effective Length in MM @ Y-Y Axis = 1000
Span (Length) in MM = 3000
Allowable Slenderness Ratio = 250
Allowable Deflection = L / 360
Loading Type = UDL
Factored Axial Load in KN = 5
Factored MZZ in KN-M = 20
Factored LHS Shear YY in KN = 10
Factored RHS Shear YY in KN = 10

Factored MYY in KN-M = 0.0
LHS Shear ZZ in KN = 0.0
RHS Shear ZZ in KN
LL / (DL + LL) Ratio = 0.50

- **Use Add Button to Append Record. Remove Button will delete the selected record. Copy Button will Copy the selected record & Paste Button will paste over the selected record. Copy All will copy the selected record to all the records. Prev, Next, Last & 1st buttons will select the Prev, Next, Last & 1st record respectively. Go to Rec button will take you the required record. Clear Button will clear all the written text. Read Me button will display salient feature of this option. OK button will save & exit this option.**

- **Click OK button, following window will appear.**



- **Click Yes, if you want to design. Click No, if you want to exit the option.**
  Following Window will open displaying complete step by step design if you click Yes option.

```
Design of Structural Steel MC / MB Beam Sections as per IS : 800_2007
--------------------------------------------------------------------------------

File Name : D:\000_IS_800\Example_1.800
Date : 07 April 2010

Organization : ABC Ltd.
Project : Caustic Soda Plant
Project # : 8912
Building ID : Cell House
Floor # : 12
Floor Level : 36.0 M
Concrete Grade : M20
Yield Stress in Mpa : 250
Ultimate Stress in Mpa : 410
Steel Rate in Rs/ton : 80000
Bolt Hole Type : Drilled
~~~~~~~~~~~~~~~~~~~~~~~~

XXXXXXXXXXXXXXXXX
Member ID : B1
XXXXXXXXXXXXXXXXX
ISMB / ISMC Section : MC 150
Effective Length in MM @ Z-Z Axis : LZZ : 3000
Effective Length in MM @ Y-Y Axis : LYY : 1000
Span (or Length) in MM : 3000
Permissible Slenderness Ratio - L/R : 250
Allowable Deflection : L/360
Loading Type : UDL
Factored Axial Load in KN : 5
Factored MZZ in KN-M : 20
Factored LHS Shear YY in KN : 10
Factored RHS Shear YY in KN : 10
```

Factored MYY in KN-M : 0
Factored LHS Shear ZZ in KN : 0
Factored RHS Shear ZZ in KN : 0
LL / (DL + LL) Ratio : 0.50
****
Designation : MC 150
Wt in N / M : 164
Area in MM2 : 2088
ISMC Height in MM : 150
Flange Width in MM : 75
Web Thickness in MM : 5.4
Flange Thickness in MM : 9
CY in MM : 22.2
IZZ in CM4 : 779.4
IYY in CM4 : 102.30
rz in MM : 61.1
ry in MM : 22.1
Zz in CM3 : 103.9
Zy in CM3 : 19.4
Zp in CM3 : 119.82
Shape Factor : 1.1533

Section Class is : Plastic
b/tf = 8.33
d/tw = 20.74
Modulus of Rigidity G = 76923.08
Torsional Constant {it} in MM4 = 43850.81
Beta = 0.5
Warping Constant {iw} in MM6 = 5.084566E+09
Mcr in KN-M = 186.81
Beta_B = 1
Lambda_LT = 0.4
Phi_LT = 0.63
X_LT = 0.9
Extreme Fiber Bending Comp. Stress {fcr} in N/MM2 = 1559.11
Design Bending Compressive Stress {fbd} in N/MM2 = 204.55
M_ZZ of Section in KN-M = 24.51
Max. M_ZZ Capcity in KN-M = 28.34
ZPY in CM3 = 37.88
M_YY of Section in KN-M = 8.61
Vertical Shear Strength of Section in KN = 106.29
Horizontal Shear Strength of Section in KN = 177.15
Factored Shear is Less than 0.6 x Shear Str. of Section
Design Compressive Stress for Web in N/MM2 = 183.04
Shear Capacity of Web Under Buckling in KN = 172.98
Shear Capacity of Web Under Bearing in KN = 181.02
Bolt Shear Capacity in KN = 116.81
Bolt Bearing Capacity in KN = 100.22
Bolt Capacity in KN = 100.22
Bolt diameter in MM = 16
Bolt Hole diameter in MM = 18
Bolt Numbers = 4
Shear Connection Plate Size in MM = 120 x 135
Min. Bolt Pitch / Gauge Distance in MM = 40
Min. Bolt Edge in MM = 40
Min. Bolt End Distance in MM = 24
Avg in MM2 = 777.6
Avn in MM2 = 631.8
Atg in MM2 = 432
Atn in MM2 = 383.4
Block Shear Strength <1> in KN = 215.22
Block Shear Strength <2> in KN = 205.87
Block Shear Strength in KN {Tensile Cap of Section} = 205.87
Tensile Cap. of Sec based on Gross Area in KN = 474.55
Tensile Strength of Bolts / Section in KN = 172.13
All Fillet Welds are 6 MM thick.

Permissible Fillet Weld Stress in N/MM2 = 157.81
Welded Shear Cap. of End Plate in KN = 159.07
Tensile / Compr. Cap of Fillet Weld in KN = 159.07
End Moment Connection Cap. in KN-M = 37.78
T & B Flange Plate Size in MM = 125 x 130 x 10
SR_ZZ = 49.1
SR_YY = 45.25
Governing SR = 49.1
Euler Bucking Stress in N/MM2 ZZ = 818.99
Non Dimensional Effective SR Lambda_ZZ = 0.55
Value of PHI_ZZ = 0.74
Stress Reduction Factor ZZ = 0.81
Design Compressive Stress {fcd_ZZ) in N/MM2 = 184.09
Compressive Strength of Section_ZZ in KN = 384.38
Euler Bucking Stress_YY in N/MM2 = 964.28
Non Dimensional Effective SR Lambda_YY = 0.51
Value of PHI_YY = 0.71
Stress Reduction Factor YY = 0.83
Design Compressive Stress {fcd_YY) in N/MM2 = 188.64
Compressive Strength of Section_YY in KN = 393.88
Beam Deflection in MM = 1.5

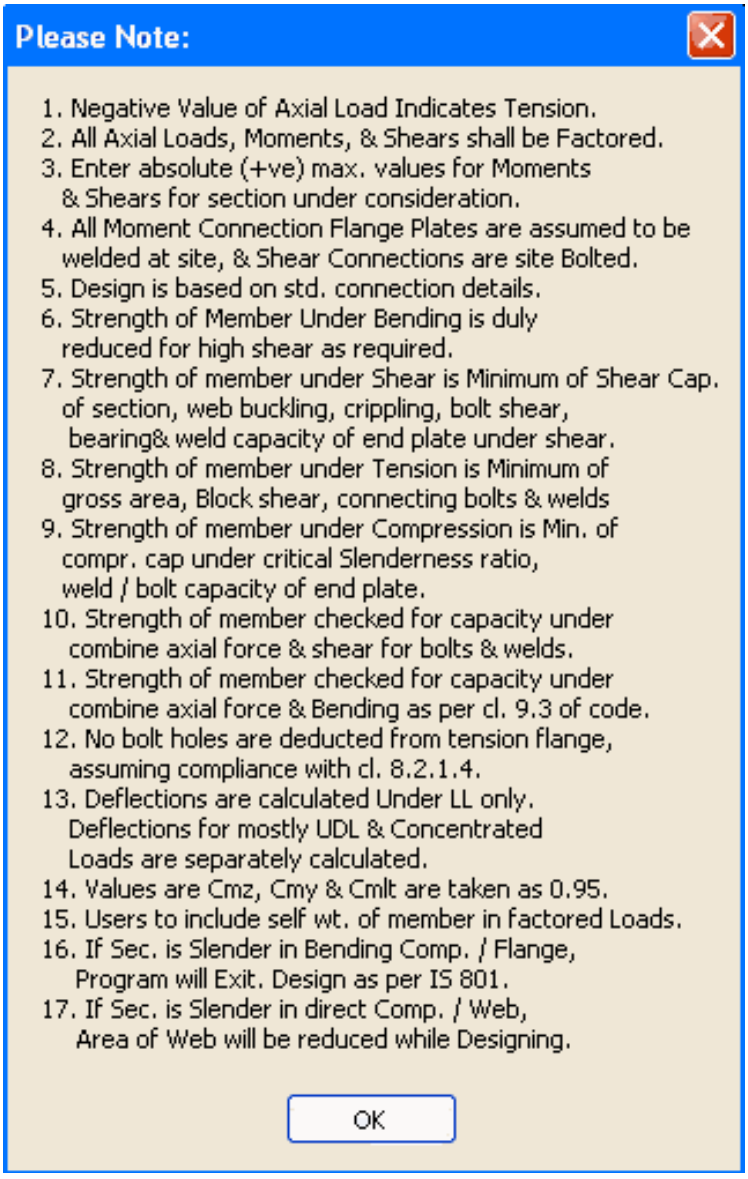
****** SUMMARY ******
Alpha1 = 1
Alpha2 = 2
n = 0.05
mndy = 8.61
mndz = 24.51
Beam is Safe, Ratio < 1 :: Ratio = 0.67 ::: Refer Section Strength : Clause 9.3.1.1
Ky = 1.04
KLT = 1
ny = 0.05
Lambda_Y = 45.25
Lambda_LT = 0.4
Cmy, Cmlt = 0.95
Beam Safe, Ratio < 1 :: Ratio = 0.86 ::: Refer Member Strength : Clause 9.3.2.2
Kz = 1.04
Ky = 1.04
nz = 0.05
Lambda_Z = 49.1
Cmy, Cmz = 0.95
Beam Safe, Ratio < 1 :: Ratio = 0.86 ::: Refer Member Strength : Clause 9.3.2.2

< < < < < Section is Safe > > > > >

Weight of Section in Kg = 49.2
Cost of Steel in Rs = 3936

^^
Total Weight of Steel in Kg = 49.2
Total Cost of Steel in Rs = 3936
For Details of Shear & Moment Connections refer Standard Details Option.
A designer can use shear connection of type beam to beam or beam to column.
The minimum of 2 values are used for design purpose.
Std. Moment capacity of connection is >= Gross moment cap. of section.
All bolts are Hexagon head Black Bolts Grade 4.6 as per IS 1364 (1).
Welding shall be as per IS 816 & IS 9595 as applicable.

- **Notice " Print " and " Copy Text " Buttons at bottom of page.**
  By clicking " Copy Text" button the complete designed is Copied to clipboard, User can now Paste to any Word Editor using Ctr V keys on the keyboard.
  Now Click " Read Me " Button. Following message is displayed pertaining to this particular option.



- **The Read Me option is available for every database enabled programs. Complete design philosophy of current design option is discussed as displayed above. It is suggested that a user shall go through the " Read Me " option before proceeding with the design.**
- **Step No. 2 is Over, Proceed to step no. 3.**

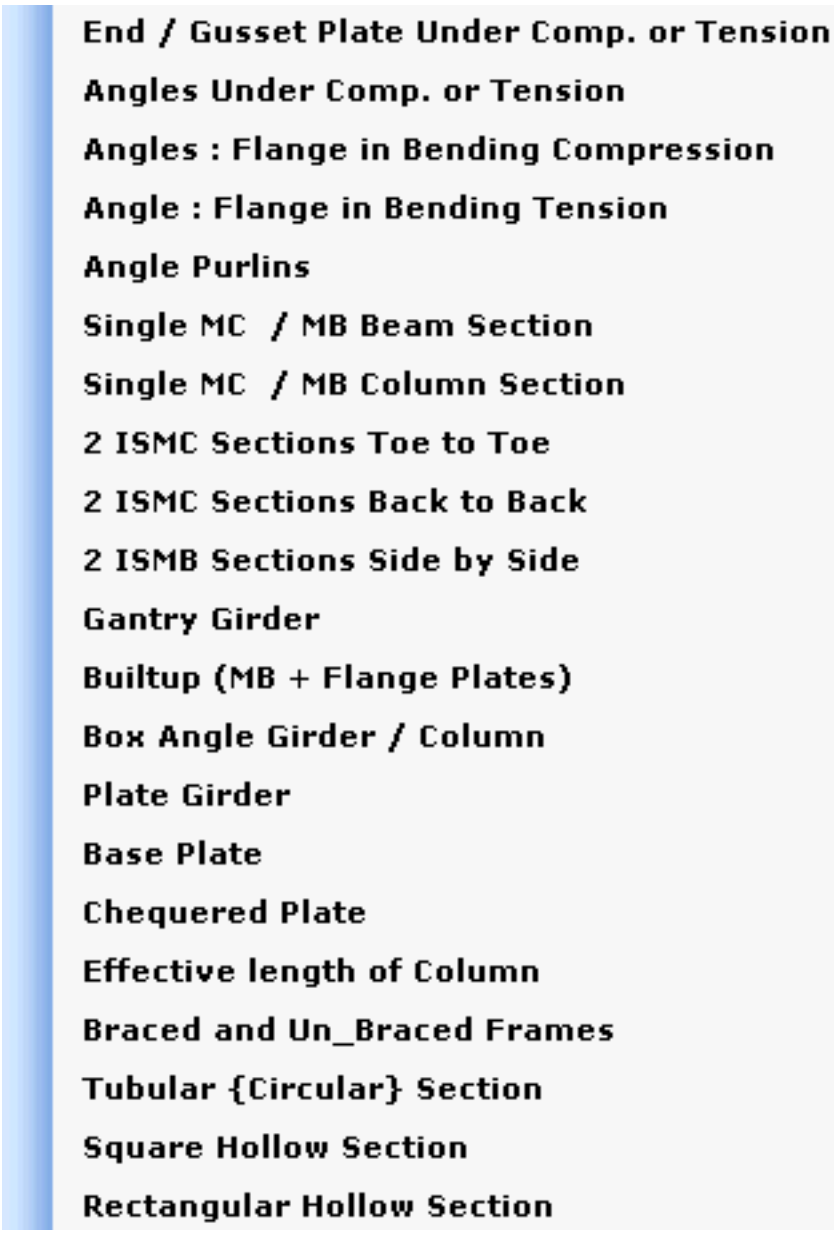
STEP NO. 2 IS OVER.

LEARN STEEL_2007 STEP BY STEP

STEP NO. 3 : Non Database Programs

Files | Designs_1 | Designs_2 | Standard Details | Useful Info | Utilities | Learn

- **When Program starts, the graphics above Menu Bar is displayed. Click the " Designs_1" option.**
  The following window will open.



- **Now Click the " Designs_2 " option. The following window will open.**

- **Following Programs Non Database Format. There is no File Creation. For Non Database format programs file saving / editing / deleting is not available.**

Angles : Flange In Bending Compression
Angle : Flange In Bending Tension
Angle Purlins
Gantry Girder
Plate Girder
Base Plate
Chequered Plate
Effective length of Column
Braced and Un_Braced Frames
Tubular {Circular} Section
Square Hollow Section
Rectangular Hollow Section
General : Equal Flange Section
General : Moment / Shear Connection
General : Shear Connection - Beam/Beam
Bolt Capacity
HSFG Bolt Capacity
Long Joint/Grip Shear Reduction
Prying Force
Lateral Restrain Lm
Pin Design
Vibration Frequency
Variation of Yield Stress with Temperature
Variation of E with Temperature

Plastic Analysis of Simple Beams

**In Step no. 2, we have gone through a typical database program, now we will consider a typical
non database program of Plate Girder. Click the Following Link.**

Plate Girder

- **A user has to simply Enter Values of the following parameters:**

SPAN OF Plate Girder (M)

Effective Length of its Compression Flange (M)

Factored Vertical Bending Moment (KN-M)

Factored Horizontal Bending Moment (KN-M)

Factored Near End Shear Force (SF) (KN)

Factored Far End Shear Force (SF) (KN)

Factored Longitudinal Compressive / Tensile (+/-) Force (KN)

Permissible Deflection Ratio

Depth of Girder (MM)

Thickness of Web (MM)

Select Angle

Select ISMC

Width of top & bottom Flange Plates (MM)

Thickness of Flange Plates (MM)

LL / (DL + LL) Ratio

Yield Stress (Fy) in N / MM2

Permissible Slenderness Ratio {L / R}

Net Bearing Width available to Girder at Support in MM

- **After Entering the Values, click Design Button, to see the result.**

Step No. 3 is Over, Proceed to step no. 4.

STEP NO. 3 IS OVER.

LEARN STEEL_2007 STEP BY STEP

STEP NO. 4 : Standard Details

Files | Designs_1 | Designs_2 | Standard Details | Useful Info | Utilities | Learn

- **When Program starts, the graphics above Menu Bar is displayed.**

  Click the " Standard Details " Link as under.

- Standard Details

- **The Standard details are used for designing single ISMC / ISMB beams. Hence design of these members also include their respective connections.**
- **However we have included General Programs for :**

  - **Design of Moment & Shear Connection between Column & Beam.**
  - **Design of Shear Connection between Main & Secondary Beam.**

  For Splice Details refer our SUPER CIVIL CD software.

- **Next Step is for Useful Information.**

STEP NO. 4 IS OVER.

LEARN STEEL_2007 STEP BY STEP

STEP NO. 5 : Useful Info

Files | Designs_1 | Designs_2 | Standard Details | Useful Info | Utilities | Learn

- **When Program starts, the graphics above Menu Bar is displayed.**

  Click the " Useful Info " option in the MENU bar.
  The following information are included in STEEL_2007 software.

- Useful Information :
  - **Limiting Width to Thickness Ratio.**
  - **Buckling Class of Sections & Imperfection Factors.**
  - **Effective Length of Members.**
  - **Sway & Non_Sway Frames.**
  - **Coefficient of Friction.**
  - **Partial safety Factors for Limit States.**
  - **Deflection Limits.**
  - **Test Loading.**
  - **Durability.**
  - **Corrosion Protection Methods.**
  - **Tolerances.**
  - **Plastic Analysis.**
  - **Advantages & Disadvantages of Plastic Design.**

REFERENCES

- **Following Codes, Books & Softwares are referred while developing this software.**
  - **IS 800 : 2007**
  - **IS 800 : 1984**
  - **SP 6(6) : 1972**
  - **BS 5950 - 1 : 2000**
  - **INSDAG STEEL e_BOOK**
  - **Design of Steel Structures by N. Subramanian.**
  - **Plastic Methods of Structural Analysis by B. G. Neal.**
  - **Design of Steel Structures by S. Ramamrutham.**
  - **Super Civil CD software.**
- **Next Step is for Utilities.**

STEP NO. 5 IS OVER.

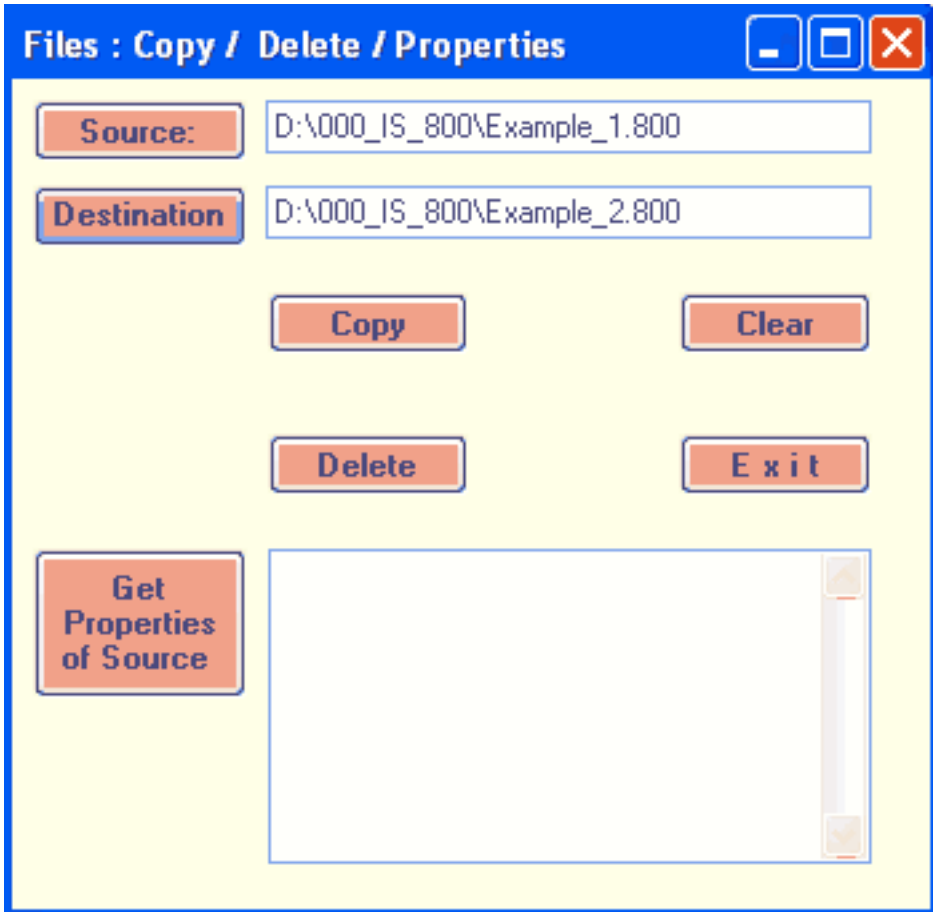
LEARN STEEL_2007 STEP BY STEP

STEP NO. 6 : UTILITIES

Files | Designs_1 | Designs_2 | Standard Details | Useful Info | Utilities | Learn

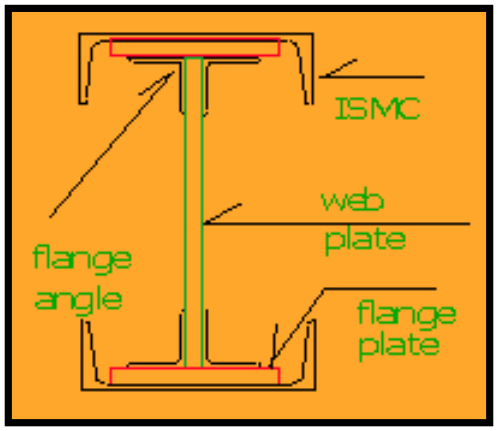
- **When Program starts, the graphics above Menu Bar is displayed.**

  Click Utilities Option. Following Widow Opens up. This option is for Copying & Deleting of STEEL_2007 Files. Indicate Source & Destination File for Copying & Indicate only Source File for Deleting all STEEL_2007 Files. In Order to view properties of a File, Browse for the file name by clicking on Source button & Click on " Get Properties of Source " button.



- Learning over, Proceed to Practice LS Design.

STEP NO. 6 IS OVER.



Design Of Plate Girder As Per IS : 800 - 2007

This is a front End, Actual program is available with the software.

SPAN OF Plate Girder (M)	6
Effective Length of its Compression Flange (M)	
Factored Vertical Bending Moment (KN-M)	4275
Factored Horizontal Bending Moment (KN-M)	
Factored Near End Shear Force (SF) (KN)	877.5
Factored Far End Shear Force (SF) (KN)	472.5
Factored Longitudinal Compressive / Tensile (+/-) Force (KN)	
Permissible Deflection Ratio	SPAN / 360
Depth of Girder (MM)	1380
Thickness of Web (MM)	20
Select Angle	Not Required
Select ISMC	Not Required
Width of top & bottom Flange Plates (MM)	350
Thickness of Flange Plates (MM)	40

LL / (DL + LL) Ratio	0.50
Yield Stress (Fy) in N / MM2	250
Permissible Slenderness Ratio {L / R}	300
Net Bearing Width available to Girder at Support in MM	150

Design LIMITATIONS Clear <<

When Design Button is clicked, following Design Results will be displayed.

Design of Plate Girder Section

Span Plate Girder (M) = 6
Effective Length of its Compression Flange (M) = 0
Overall Depth Of Plate Girder (mm) = 1380
Reduced Web Depth due to Slenderness = 840
Overall Width Of Plate Girder (mm) = 350
Web Thickness (mm) = 20
SELECTED Angle Section = Not Required
SELECTED ISMC = Not Required
Width of Each Top & Bottom FLANGE PLATE (mm) = 350
Thickness of Top & Btm FLANGE PLATE (mm) = 40
Weight Of Compound Section in Kg = 2110.08
Area of Section (cm2) = 448
IZZ Of Compound Section (cm4) = 1623460
Zz Of Compound Section (cm3) = 23528.4
RZZ Of Compound Section (cm) = 60.19
IYY Of Compound Section (cm4) = 28670
Zy Of Compound Section (cm3) = 1638.28
RYY Of Compound Section (cm) = 7.99
Zz_Plastic Of Compound Section (cm3) = 27210
Zy_Plastic Of Compound Section (cm3) = 2580
Shape Factor Z_Z = 1.15
Shape Factor Y_Y = 1.57
Vertical Shear Force (KN) = 877.5
Logitudinal Force (KN) = 0
Vertical BM in Gatry Girder (KN-M) = 4275
Horozontal BM in Gatry Girder (KN-M) = 0
Permissible Deflection (mm) = 16.66
Actual Deflection (mm) = 0.43
Depth Of Neutral Axis (mm) = 690
Beta = 1
C1 = 1.248
alpha = 0.49
PHI = 0.45
X_LT = 1

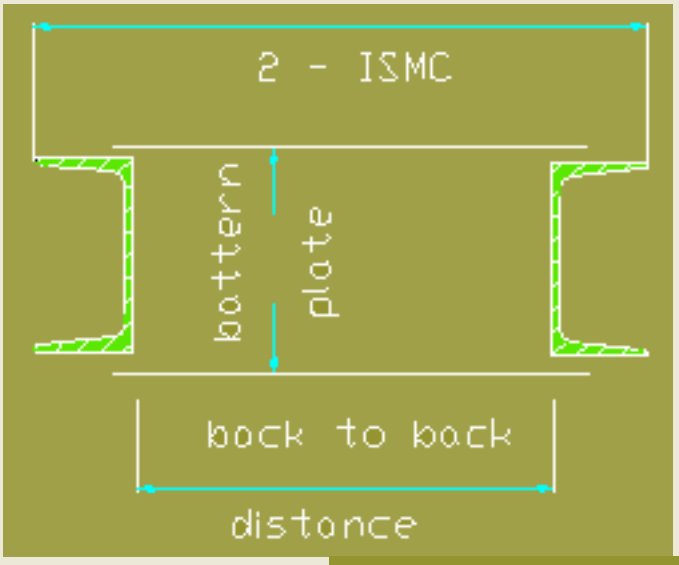
Mcr in KN-M = 473324994004763130
Design Bending Compressive Stress {fbd} in N/MM2 = 227.27
M_ZZ of Section in KN-M = 6184.09
M_YY of Section in KN-M = 586.36
Vertical Shear Strength of Section in KN = 2047.02
Vertical Shear Strength Restricted to 60 %.
Horizontal Shear Strength of Section in KN = 3674.15
Design Compressive Stress for Web in N/MM2 = 12.09
Shear Capacity of Web Under Buckling in KN = 193.49
Shear Capacity of Web Under Bearing / Crippling in KN = 1136.36
Shear Capacity of Stiffner in KN = 1990.9
SR_ZZ = 9.96
SR_YY = 0
Governing SR = 9.96
Euler Bucking Stress in N/MM2_ZZ = 19874.83
Non Dimensional Effective SR Lambda_ZZ = 0.11
Value of PHI_ZZ = 0.48
Stress Reduction Factor ZZ = 1.04
Design Compressive Stress {fcd_ZZ) in N/MM2 = 227.27
Compressive Strength of Section_ZZ in KN = 10181.81
Euler Bucking Stress in N/MM2_YY = 12635488476785716
Non Dimensional Effective SR Lambda_YY = 0
Value of PHI_YY = 0.45
Stress Reduction Factor YY = 1.1
Design Compressive Stress {fcd_YY) in N/MM2 = 227.27
Compressive Strength of Section_YY in KN = 10181.81
Tensile Strength of Section in KN = 10181.81

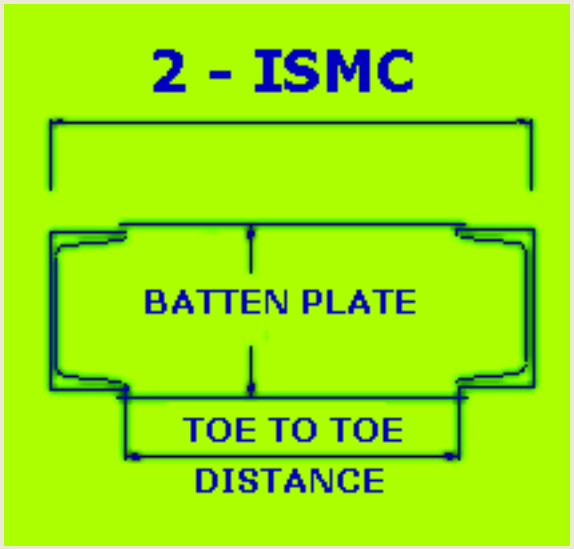
n = 0
mndy = 586.36
mndz = 6184.09
Beam is Safe, Ratio < 1 ::
Ratio = 0.47 ::: Refer Section Strength : Clause 9.3.1.1

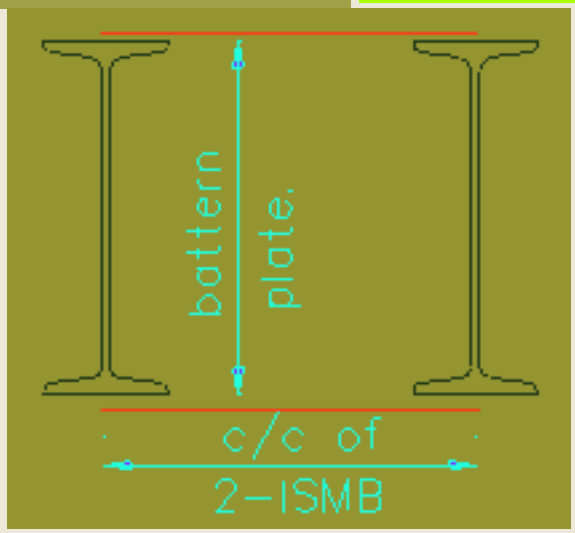
Provide Stiffners 165 x 12 on both sides of Flange.
Stiffners shall be provided at both Supports and below Concentrated Loads.

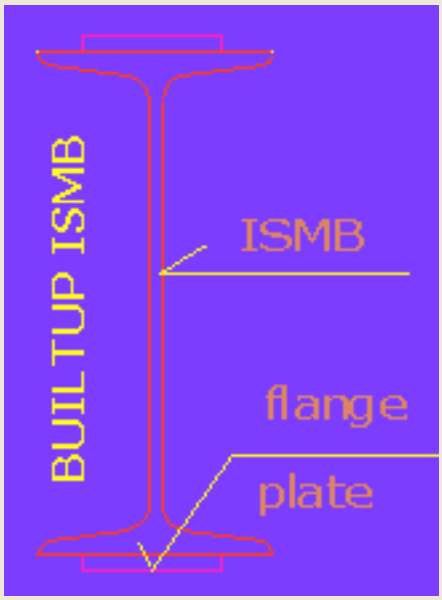
% % % % % Section is Safe % % % % %

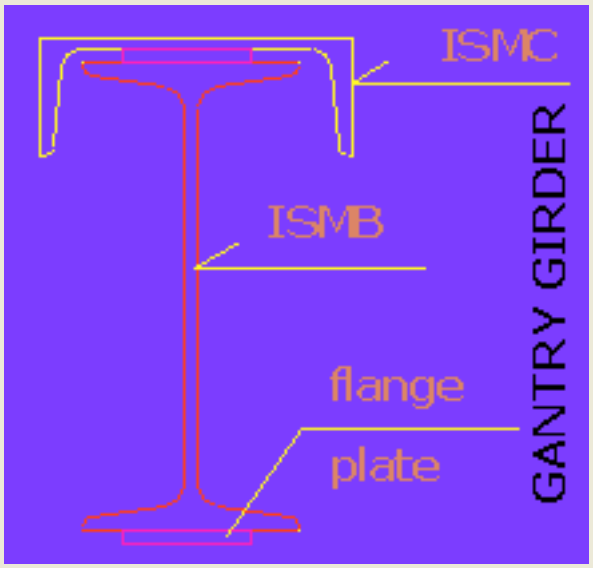
BUILT-UP SECTIONS

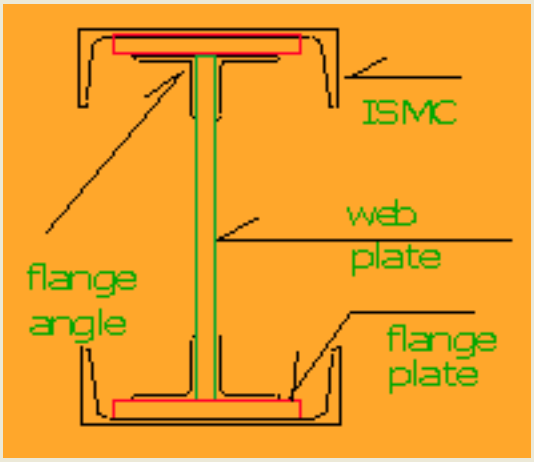


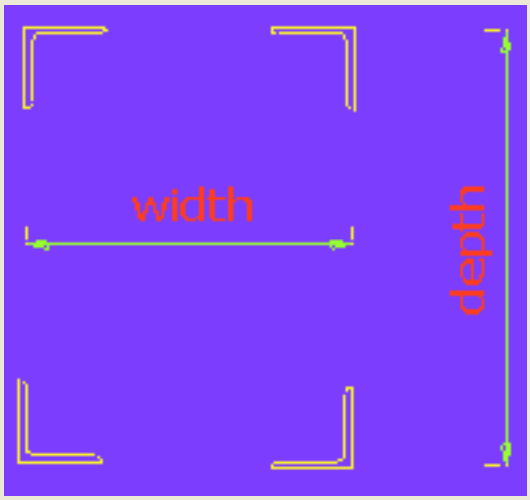












FOLLOWING STANDARD STRUCTURAL STEEL DETAILS ARE INCLUDED IN STEEL_2007

- GENERAL NOTES - STRUCTURAL STEEL
- SUBSTITUTION OF STEEL SECTIONS
- SHEAR CONNECTION DETAILS - BETWEEN BEAM TO BEAM
- MOMENT CONNECTION DETAILS - RC COLUMN TO BOX BEAM FRAMING FROM ALL SIDES
- MOMENT CONNECTION DETAILS - BOX COLUMN TO BOX BEAM FRAMING FROM ONE SIDE
- MOMENT CONNECTION DETAILS - PERMISSIBLE CONNECTIONS
- MOMENT CONN. DETAILS - BOX COL. TO BOX MEMBERS, FRAMING FROM ALL SIDES FOR CONTINUOUS COL.
- MOMENT CONN. DETAILS - BOX COL. TO BOX MEMB. MB, MC MEMB. FRAMING FROM ALL SIDES FOR END COL.

- MOMENT CONNECTION DETAILS - BOX COL. TO MB MEMB. FRAMING FROM ALL SIDES FOR CONTINUOUS COL.
- MOMENT CONNECTION DETAILS - BOX COL. TO MC MEMB. FRAMING FROM ALL SIDES FOR CONTINUOUS COL.
- SHEAR CONNECTION DETAILS - BOX COLUMN TO MC MEMBERS FRAMING FROM ALL SIDES
- SHEAR CONNECTION DETAILS - BOX COLUMN TO MB MEMBERS FRAMING FROM ALL SIDES
- MOMENT CONNECTION DETAILS - MB COL. TO BOX MEMB. FRAMING FROM BOTH SIDES FOR CONTINUOUS COL.
- MOMENT CONNECTION DETAILS - MB COL. TO BOX/MB/MC MEMB. FRAMING FROM BOTH SIDES FOR END COL.
- MOMENT CONNECTION DETAILS - MB COLUMN TO MC MEMBERS, FRAMING FROM BOTH SIDES
- MOMENT CONNECTION DETAILS - MB COLUMN TO MB MEMBERS, FRAMING FROM BOTH SIDES
- SHEAR CONNECTION DETAILS - MB COLUMN TO MB MEMBERS, FRAMING FROM ALL SIDES
- SHEAR CONNECTION DETAILS - MB COLUMN TO MC MEMBERS, FRAMING FROM ALL SIDES
- SHEAR CONNECTION SCHEDULE - BETWEEN RC BEAM / COLUMN TO STEEL BEAM
- TYP DETAILS OF WELD LENGTH FOR BRACING MEMBERS

Design Of Plate Girder : Program Info./Limitations

Structural steel design is as per Indian Standard No.IS:800-2007.

The plate girder compound section consists of two angles each placed at top & bottom, flange plates at top and bottom of angles, and ISMC section placed at top and bottom of flange plates. All Webs are assumed as un-stiffened. Gap between web plate and top flange angles is assumed as 10 mm.

Actual deflection value is increased by 10 % , to account for any concentrated load.

Only following ANGLE and ISMC members are used in design.

40 x 40 x 6	45 x 45 x 6	50 x 50 x 6	65 x 65 x 6	65 x 65 x 8	65x 65 x 10
75 x 75 x 6	75 x 75 x 8	75 x 75 x 10	80 x 80 x 6	80 x 80 x 8	90 x 90 x 6
90 x 90 x 8	90 x 90 x 10	90 x 90 x 12	100 x 100 x 6	100 x 100 x 8	100 x 100 x 10
100 x 100 x 12	130 x 130 x 10	130 x 130 x 12	150 x 150 x 12	200 x 200 x 16	200 x 200 x 20
MC 75	MC 100	MC 125	MC 150	MC 175	MC 200
MC 250	MC 300	MC 400			

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OPTIMIZE STEEL - A Software for Optimization of Steel Sections from Existing Fabrication Drawing

AutoQty - A Software for Automatic Quantity & Cost Estimation from AutoCAD Drawings