



Tutorial
AISC 360-10

Simcenter 3D

14 Jan 2021
version 2020.0.2

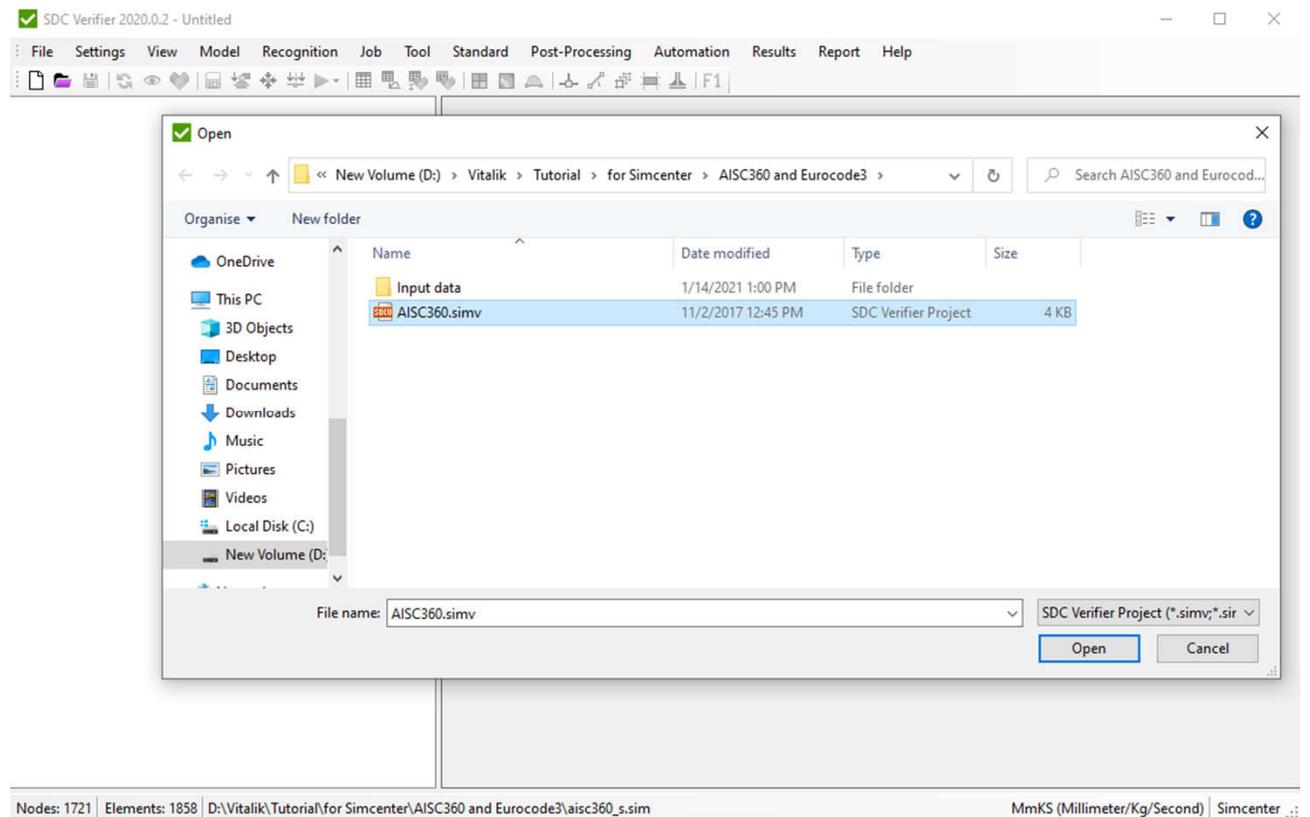
- ▶ In this tutorial, AISC 360-10 Beam Design Checks are reviewed in details.
- ▶ A beam model structure has been used as a start FEM model.
- ▶ Beam member finder was used to recognize beam member dimensions.
- ▶ Report was automatically generated in SDC Verifier Report to represent beam checks results according AISC 360-10 standard.

Open Project

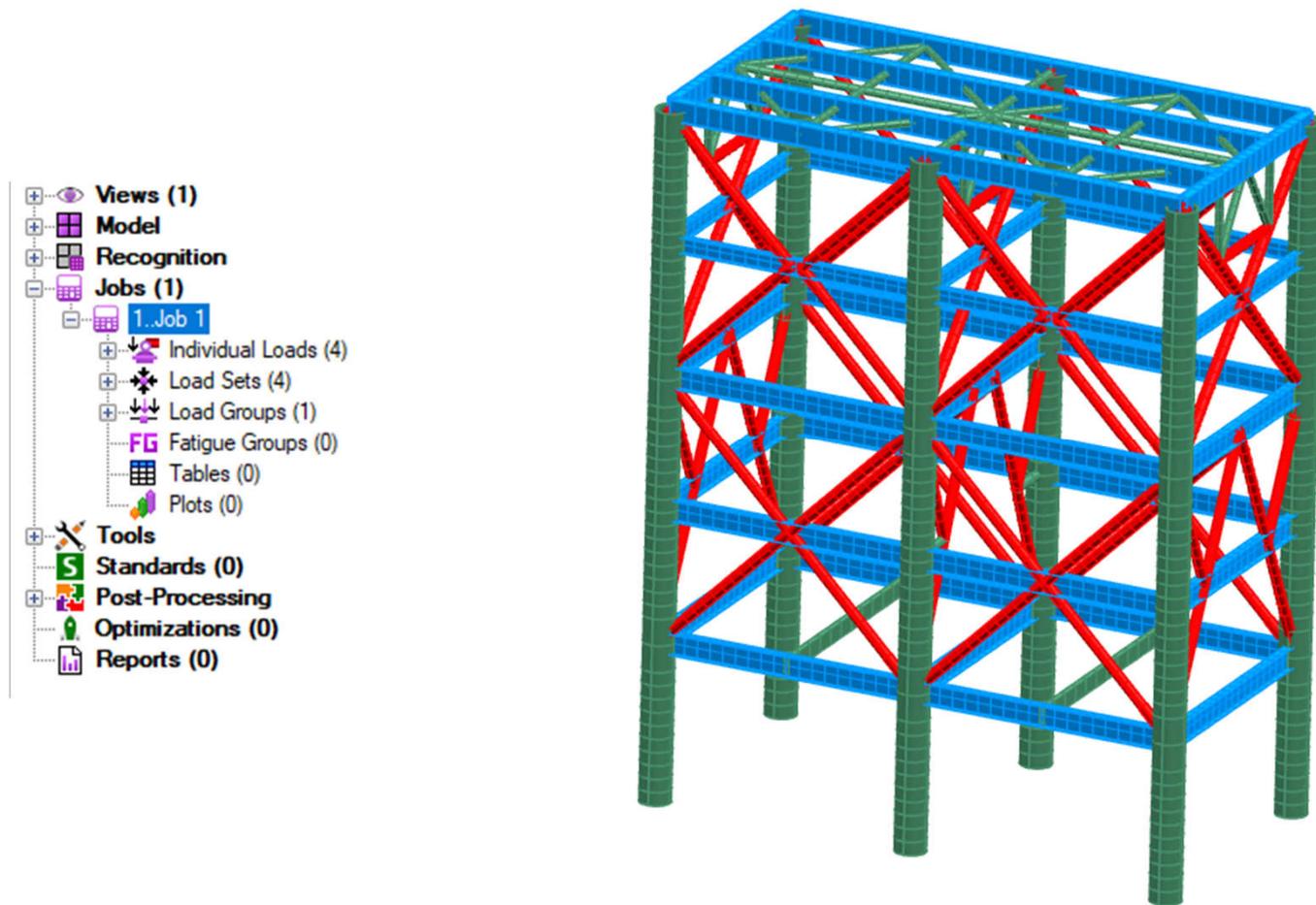
1 Launch **SDC Verifier** 

2 Execute *File - Open Project*.

3 Project: **AISC360.simv**



Predefined project



This tutorial uses project with predefined boundary condition, load combinations and load group. The model contains only beam elements of the following types: I-Beam, Circular and Rectangular Tubes

Explanation of Joints

Joint – location where different beam members connect. They are used to recognize beam member length by Beam Member Finder Tool.

There are 6 types of Joints:

1D Joint – 2 beam members that lie on the curve but with different properties;

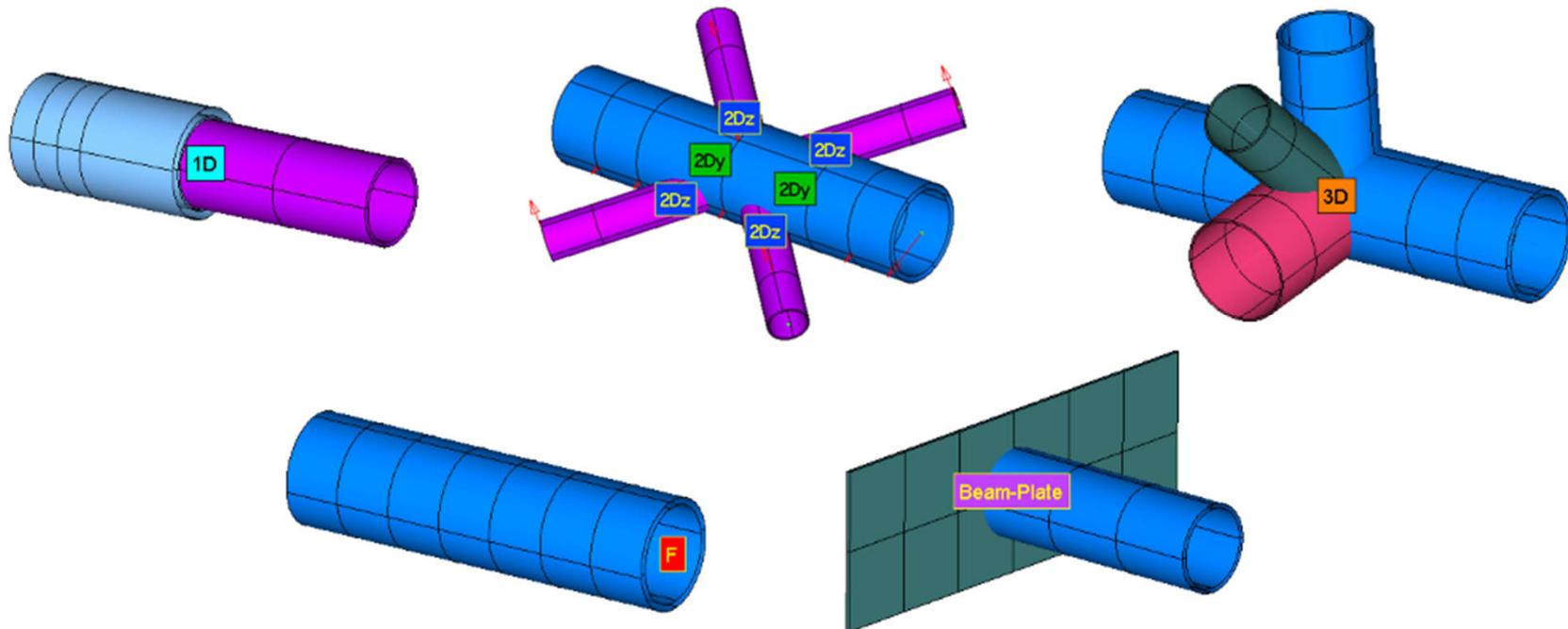
2D Joint – beam members connected in one plane;

3D Joint – beam members connected in space;

Free Joint – node which belongs only to one element (free);

Beam-Plate Joint – beam member connected to plates (perpendicularly);

User Defined;

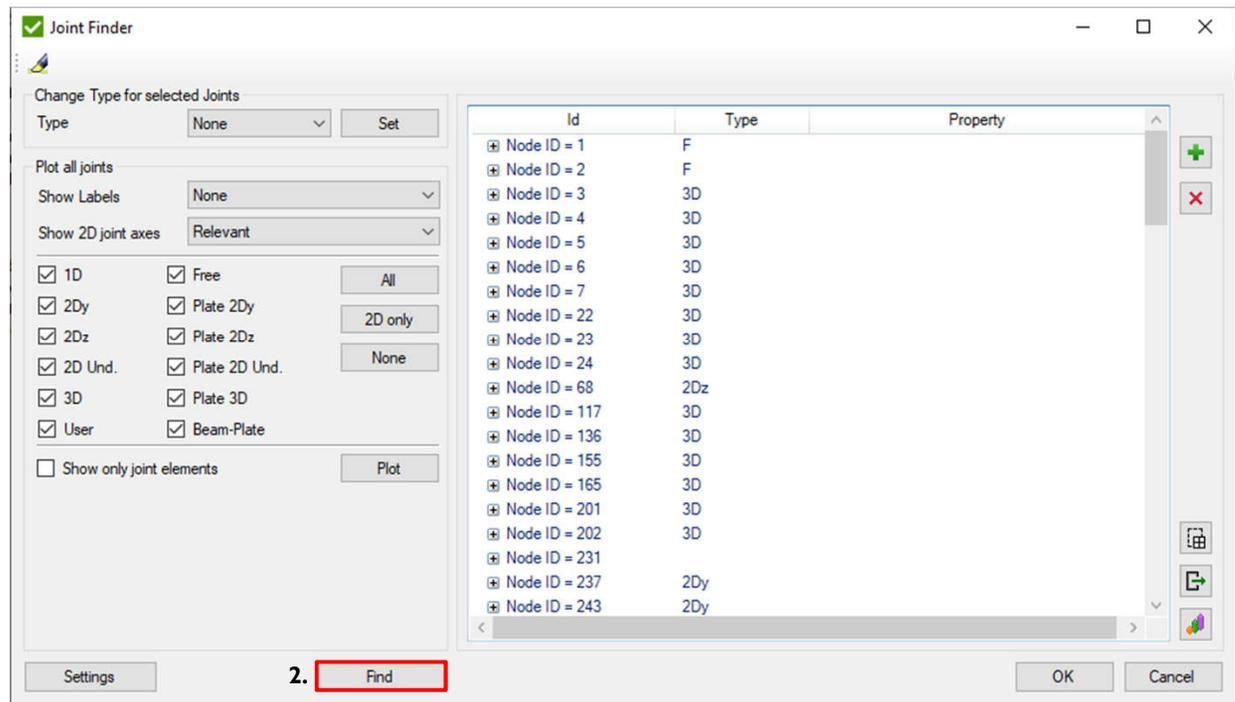
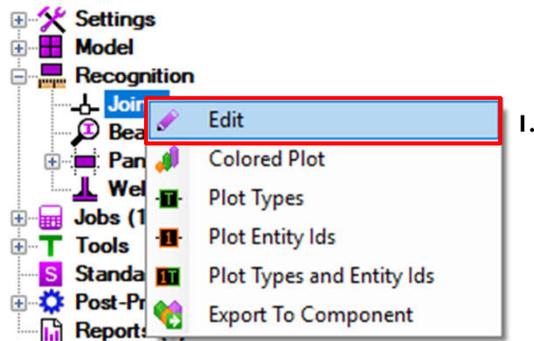


Joint Recognition

1 Execute *Edit* from *Joints* context menu

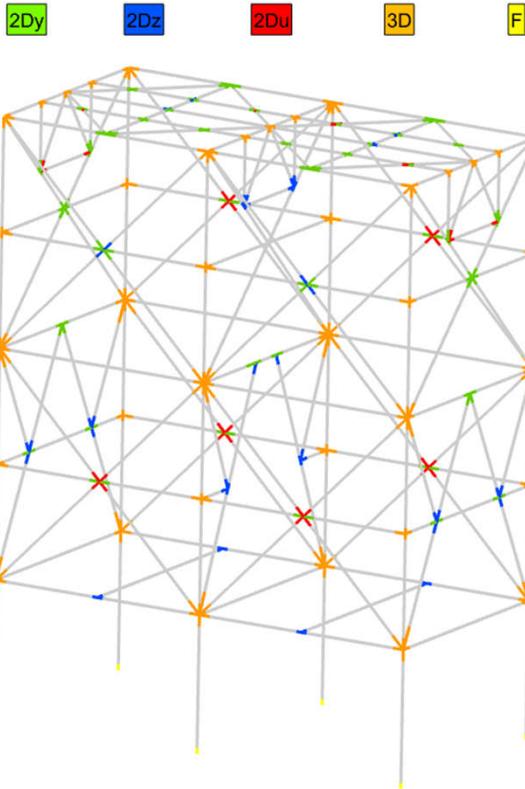
2 Press *Find*.

When performing the joint recognition there are 3 options for existing joints. Default option: Keep only modified– remove all joints except edited by user. Keep all existing options should be used when additional elements were added to the model



Joints Plot

- 1 Select All Joints (Ctrl+A).
- 2 Press
- 3 Press OK



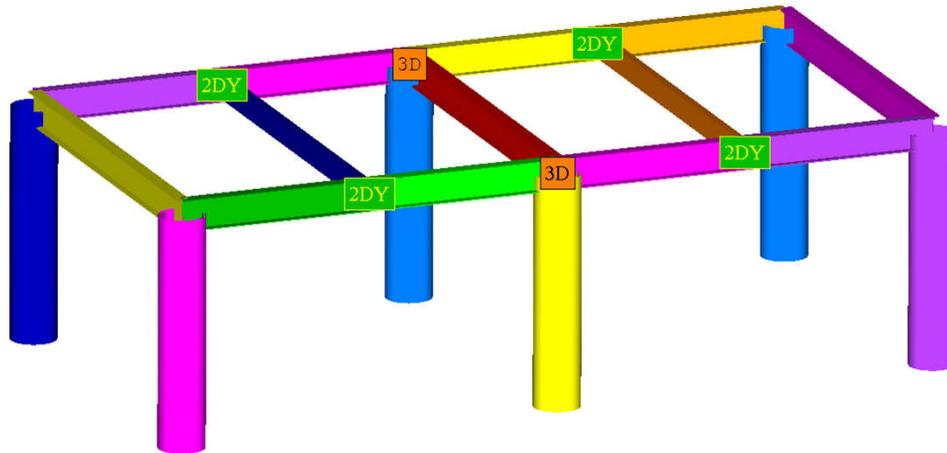
Id	Type	Property
Node ID = 1	F	
Node ID = 2	F	
Node ID = 3	3D	
Node ID = 4	3D	
Node ID = 5	3D	
Node ID = 6	3D	
Node ID = 7	3D	
Node ID = 22	3D	
Node ID = 23	3D	
Node ID = 24	3D	
Node ID = 68	2Dy	
Node ID = 117	3D	
Node ID = 136	3D	
Node ID = 155	3D	
Node ID = 165	3D	
Node ID = 201	3D	
Node ID = 202	3D	
Node ID = 231	2Dy	
Node ID = 237	2Dy	
Node ID = 243	2Dy	

Modify Joint Type:

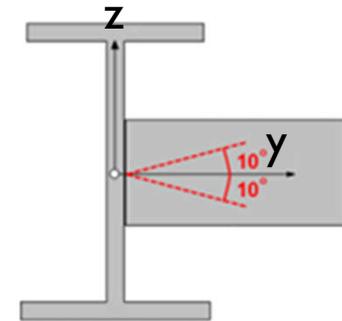
Change Type for selected Joints
Type: None Set

Beam Member Lengths in 2 directions

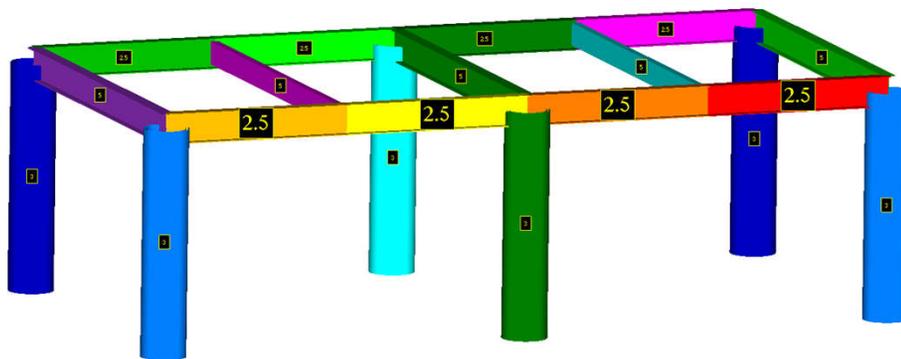
Beam Member Finder recognizes beam members and (buckling) lengths for different directions (Y, Z and Torsional).



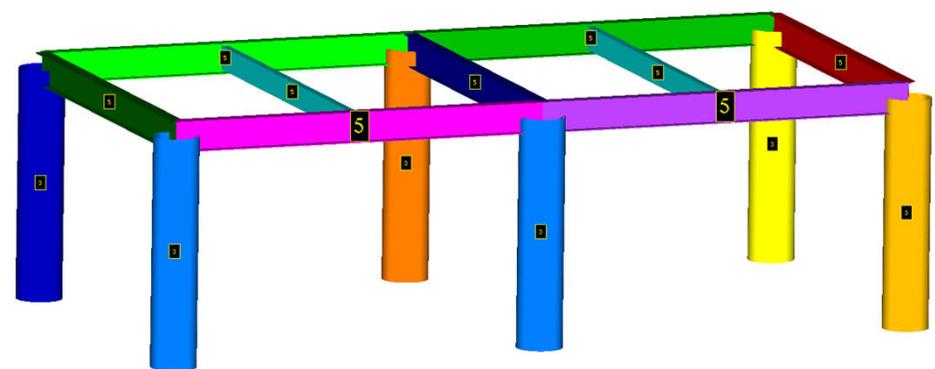
2DY
Joint



Length Y – 4 Beam Members with $L = 2.5$



Length Z – 2 Beam Members with $L = 5$

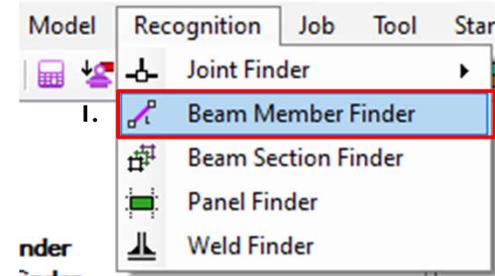


Recognize Length

1 Execute *Recognition – Beam Member Finder*

2 Break Joint Options:
Length Y – 2DY, 3D, Plate 2DY, Plate 3D
Length Z – 2DZ, 3D, Plate 2DZ, Plate 3D
Length Y – 2DY, 2DZ, 2D Und, 3D

3 Press *Find*.



2.

The 'Beam Member Finder' dialog box is shown. The 'Break Joint Options' section is highlighted with a red box. It contains the following options:

- 1D
- 2DY
- 2DZ
- 2D Und.
- 3D
- Beam-Plate
- Set K=0.01 for members fixed by plates
- User
- Plate 2DY
- Plate 2DZ
- Plate 2D Und.
- Plate 3D

Below the options, there are input fields for 'Length [m]', 'Length Factor', and 'Cm Type' (set to 'A'). A 'Find' button is highlighted with a red box at the bottom of the dialog.

ID	Title	Elements	Length [m]	Length Factor	Cm Type	Modified	Joint - NodeID [Joint Type]
1	Beam Member 1 (Y)	47	13				1107[3D] 155[3D] 1104[3D] 4[3D]
2	Beam Member 2 (Y)	47	13				1109[3D] 136[3D] 1108[3D] 117[3D]
3	Beam Member 3 (Y)	47	13				2225[3D] 1273[3D] 2222[3D] 1122[3D]
4	Beam Member 4 (Y)	47	13				2227[3D] 1254[3D] 2226[3D] 1235[3D]
5	Beam Member 5 (Y)	47	13				22[3D] 1105[3D] 165[3D] 1106[3D]
6	Beam Member 6 (Y)	47	13				1110[3D] 202[3D] 1111[3D] 201[3D]
7	Beam Member 7 (Y)	32	10				1090[2Dz] 22[3D] 2208[2Dz]
8	Beam Member 8 (Y)	16	5	1	A		
9	Beam Member 9 (Y)	32	10				1103[2Dz] 201[3D] 2221[2Dz]
10	Beam Member 10 (Y)	16	5	1	A		
11	Beam Member 11 (Y)	16	5	1	A		
12	Beam Member 12 (Y)	12	5	1	A		
13	Beam Member 13 (Y)	12	5	1	A		
14	Beam Member 14 (Y)	45	14.144				1090[2Dy] 1105[3D] 2232[2Dy]
15	Beam Member 15 (Y)	23	7.072				1090[2Dy]
16	Beam Member 16 (Y)	22	7.072				1114[2Dy]
17	Beam Member 17 (Y)	45	14.144				1114[2Dy] 1105[3D] 2208[2Dy]
18	Beam Member 18 (Y)	6	2	1	A		
19	Beam Member 19 (Y)	45	14.144				1115[2Dy] 1110[3D] 1538[1D] 1539[1D] 1540[1D]
20	Beam Member 20 (Y)	22	7.072				1115[2Dy]
21	Beam Member 21 (Y)	23	7.072				2208[2Dy]
22	Beam Member 22 (Y)	22	7.072				2232[2Dy]
23	Beam Member 23 (Y)	6	2	1	A		
24	Beam Member 24 (Y)	6	2	1	A		
25	Beam Member 25 (Y)	45	14.144				2233[2Dy] 1110[3D] 420[1D] 421[1D] 422[1D] 4...
26	Beam Member 26 (Y)	22	7.072				2232[2Dy]

3.

Beam Member Finder interface

Break Options define what joints are used to split beam members

Change Length/Factor for selected beam members

Cm Type is used in API 2A, ISO 19902 and Norsok N004 standards

Colored Plot of members with labels (ID, Length, Factor or Cm Type).

- Plot selected members
- Plot Members ID labels
- Plot Full Members ID labels
- Plot Length labels
- Plot Cm Type labels
- Plot Length Factor labels
- Plot Joints for Selected Members
- Plot Members Y and Z axes

Beam Member – straight line. If it contains joints it is split on sub members

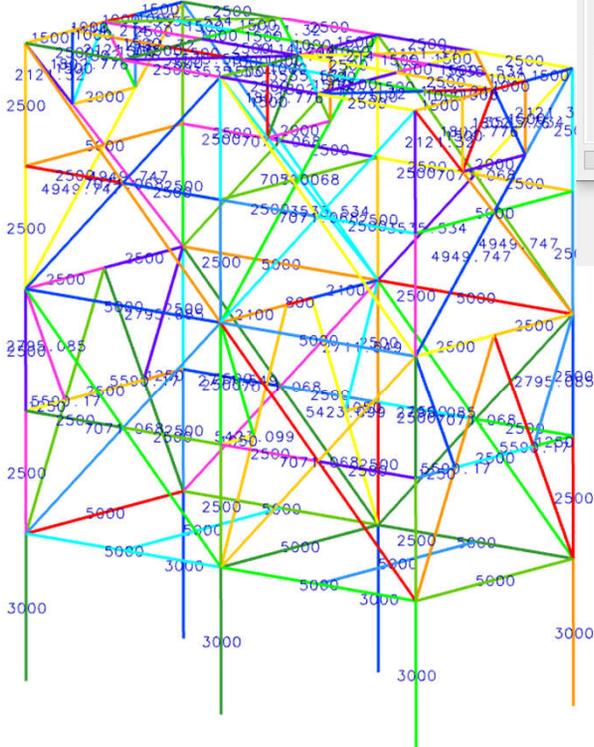
ID	Title	Elements	Length	Length Factor	Cm Type	Joint - NodeID [Joint Type]
9	Beam Member 9	32	10000			1103[2Dz] 201[3D] 2221[2Dz]
9.1	Sub Member 9.1	8	2500	1	A	
9.2	Sub Member 9.2	8	2500	1	A	
9.3	Sub Member 9.3	8	2500	1	A	
9.4	Sub Member 9.4	8	2500	1	A	



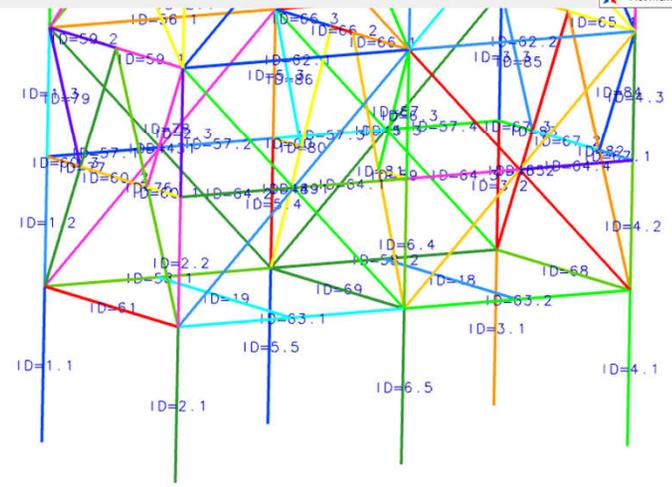
Beam Member's Length Plot

- 1 Select All Beam Members (Ctrl+A)
- 2 Press and Plot Length labels to display Length Plot
- 3 Press OK

ID	Title	Elements	Length [m]	Length Factor	Cm Type	Modified	Joint - NodeID [Joint Type]
1	Beam Member 1 (Y)	47	13				1107(3D) 155(3D) 1104(3D) 4(3D)
2	Beam Member 2 (Y)	47	13				1108(3D) 136(3D) 1108(3D) 117(3D)
3	Beam Member 3 (Y)	47	13				2223(3D) 127(3D) 2222(3D) 112(3D)
4	Beam Member 4 (Y)	47	13				2223(3D) 1264(3D) 2223(3D) 1226(3D)
5	Beam Member 5 (Y)	47	13				22(3D) 1105(3D) 165(3D) 1106(3D)
6	Beam Member 6 (Y)	47	13				1110(3D) 202(3D) 1111(3D) 201(3D)
7	Beam Member 7 (Y)	32	10				1090(2D) 22(3D) 2208(2D)
8	Beam Member 8 (Y)	16	5	1	A		
9	Beam Member 9 (Y)	32	10				1103(2D) 201(3D) 2221(2D)
10	Beam Member 10 (Y)	16	5	1	A		
11	Beam Member 11 (Y)	16	5	1	A		
12	Beam Member 12 (Y)	12	5	1	A		
13	Beam Member 13 (Y)	12	5	1	A		
14	Beam Member 14 (Y)	45	14.144				1090(2D) 1105(3D) 2232(2D)
15	Beam Member 15 (Y)	23	7.072				1090(2D)
16	Beam Member 16 (Y)	22	7.072				1114(2D)
17	Beam Member 17 (Y)	45	14.144				1114(2D) 1105(3D) 2208(2D)
18	Beam Member 18 (Y)	6	2	1	A		
19	Beam Member 19 (Y)	45	14.144				1115(2D) 1110(3D) 1538(1D) 1539(1D) 1540(1D)
20	Beam Member 20 (Y)	22	7.072				1115(2D)
21	Beam Member 21 (Y)	23	7.072				2208(2D)
22	Beam Member 22 (Y)	22	7.072				2232(2D)
23	Beam Member 23 (Y)	6	2	1	A		
24	Beam Member 24 (Y)	6	2	1	A		
25	Beam Member 25 (Y)	45	14.144				2233(2D) 1110(3D) 420(1D) 421(1D) 422(1D) 423(1D)
26	Beam Member 26 (Y)	22	7.072				2233(2D)



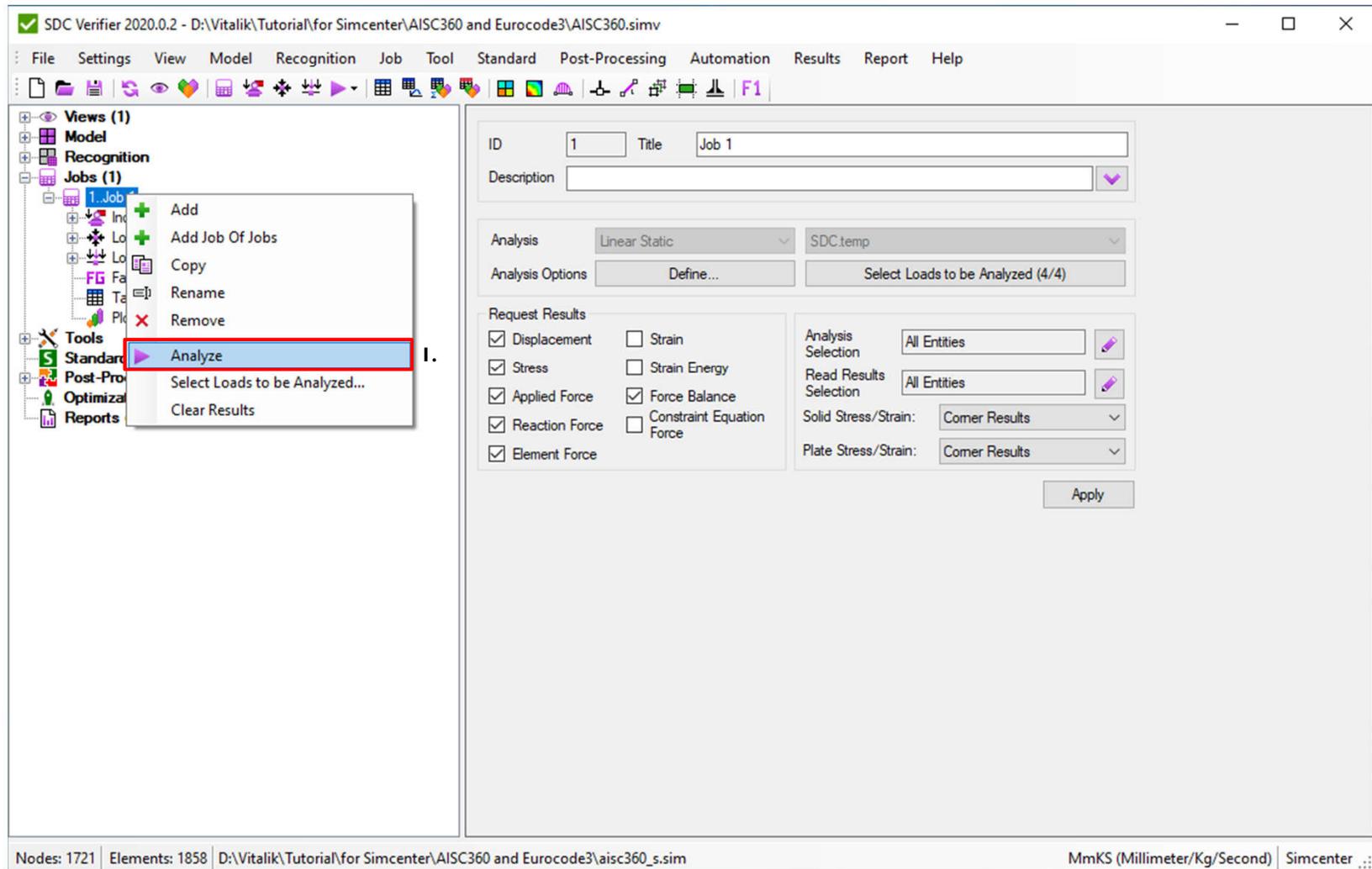
Also it is possible to display beam members IDs by pressing

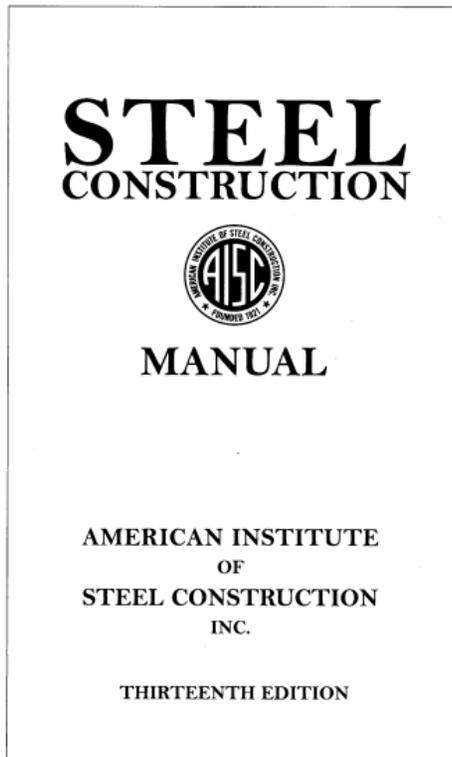


Analyze Job

1

Execute ► **Analyze** from Job1 context menu





ANSI/AISC 360-10 - an American national standard "Specification for Structural Steel Buildings", released on June 22, 2010. Checks are performed according to the provisions for load and resistance factor design (LRFD) and allowable strength design (ASD). The standard implements checks for design of members for tension, compression, bending, shear and combined.

Specification for Structural Steel Buildings

March 9, 2005

Supersedes the *Load and Resistance Factor Design Specification for Structural Steel Buildings* dated December 27, 1999, the *Specification for Structural Steel Buildings—Allowable Stress Design and Plastic Design* dated June 1, 1989, including Supplement No. 1, the *Specification for Allowable Stress Design of Single-Angle Members* dated June 1, 1989, the *Load and Resistance Factor Design Specification for Single-Angle Members* dated November 10, 2000, and the *Load and Resistance Factor Design Specification for the Design of Steel Hollow Structural Sections* dated November 10, 2000, and all previous versions of these specifications.

Approved by the AISC Committee on Specifications and issued by the AISC Board of Directors



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LRFD vs ASD

It is possible to check a design according to load and resistance factor design (LRFD) or allowable strength design (ASD). The difference between 2 designs is in load combinations and resistance factors:

Resistance Factors		Resistance Factors	
<input checked="" type="radio"/> LRFD	<input type="radio"/> ASD	<input type="radio"/> LRFD	<input checked="" type="radio"/> ASD
Tension (F _t)	0.9	Tension (F _t)	0.6
Tensile Rupture (F _{tr})	0.75	Tensile Rupture (F _{tr})	0.5
Compression (F _c)	0.9	Compression (F _c)	0.6
Shear (F _v)	0.9	Shear (F _v)	0.6
Bending (F _b)	0.9	Bending (F _b)	0.6

Design for Strength Using Load and Resistance Factor Design (LRFD)

Design will be performed in accordance with Equation B3-1:

$$R_u \leq \phi R_n \text{ (B3-1),}$$

where:

R_u = required strength using LRFD load combinations;

R_n = nominal strength, specified in Chapters B through K;

ϕ = resistance factor, specified in Chapters B through K;

ϕR_n = design strength.

Design for Strength Using Allowable Strength Design (ASD)

Design will be performed in accordance with Equation B3-2:

$$R_a \leq R_n / \Omega \text{ (B3-2),}$$

where:

R_a = required strength using ASD load combinations;

R_n = nominal strength, specified in Chapters B through K;

Ω = safety factor, specified in Chapters B through K;

R_n / Ω = allowable strength.

According to the standard Design Strength is multiplied by LRFD factor and divided by ASD factor.

For tensile yielding in the gross section:

$$P_n = F_y A_g \quad \text{(D2-1)}$$

$$\phi_t = 0.90 \text{ (LRFD)} \quad \Omega_t = 1.67 \text{ (ASD)}$$

In SDC Verifier multiplication is always used ASD factor is converted to $1 / S_f$ (ASD). For example: tensile resistance factor (F_{t}) = $1 / 1.67 = 0.6$.

Add AISC360-10 standard

- 1 Execute **Standards => Add => AISC360-10** from context menu
- 2 Resistance Factors: **LRFD**

The screenshot shows the 'Standards' menu with 'Add' selected, leading to a list of standards. 'AISC 360-10 Members (14th, 2010)' is highlighted. Below, the dialog box for this standard is open, showing the 'Resistance Factors' dropdown set to 'LRFD'.

Standards

- ABS
- AISC
- API
- ASME VIII (2010)
- DIN 15018 (1984)
- DNV
- DVS 1608 and 1612

AISC 360-10 Members (14th, 2010)

ID: 1 Title: AISC 360-10 Members (14th, 2010)
Alias: Standard1
Description: [Empty]

Settings

Resistance Factors: 2. **LRFD**

Section Build Type: [Empty]

Calculate Cb (based on moment diagram, Chapter F1)
 User defined Cb: Defined

Stiffener Distance (Chapter G2.1): Defined

Net Area (Chapter D2.2): Defined

Shear Lag Factor (Table D3.1): Defined

Calculate asymmetric shapes as symmetric

Use API 2A RP for tubular shapes

Materials with Yield and Tensile = 0 1

Second order effects (APPENDIX 8)

Take into account second-order effects (B1 multiplier)

Use Cm = 1 (conservative)
 Calculate Cm: case a = 0.6 - 0.4 * M1 / M2, case b = 1.0

Not subject to transverse loading (case a) when Shear Force < 0.1 Percent of Axial Force

Torsion

Include Torsion check

Warping is neglected for the torsion check. Additional assessment is therefore required for open sections flagged with a UC=1234. SDC returns this error UC code for open sections with an UF.torsion exceeding: 0.3

Preview Not Supported Elements [OK] [Cancel]

Section Build Type

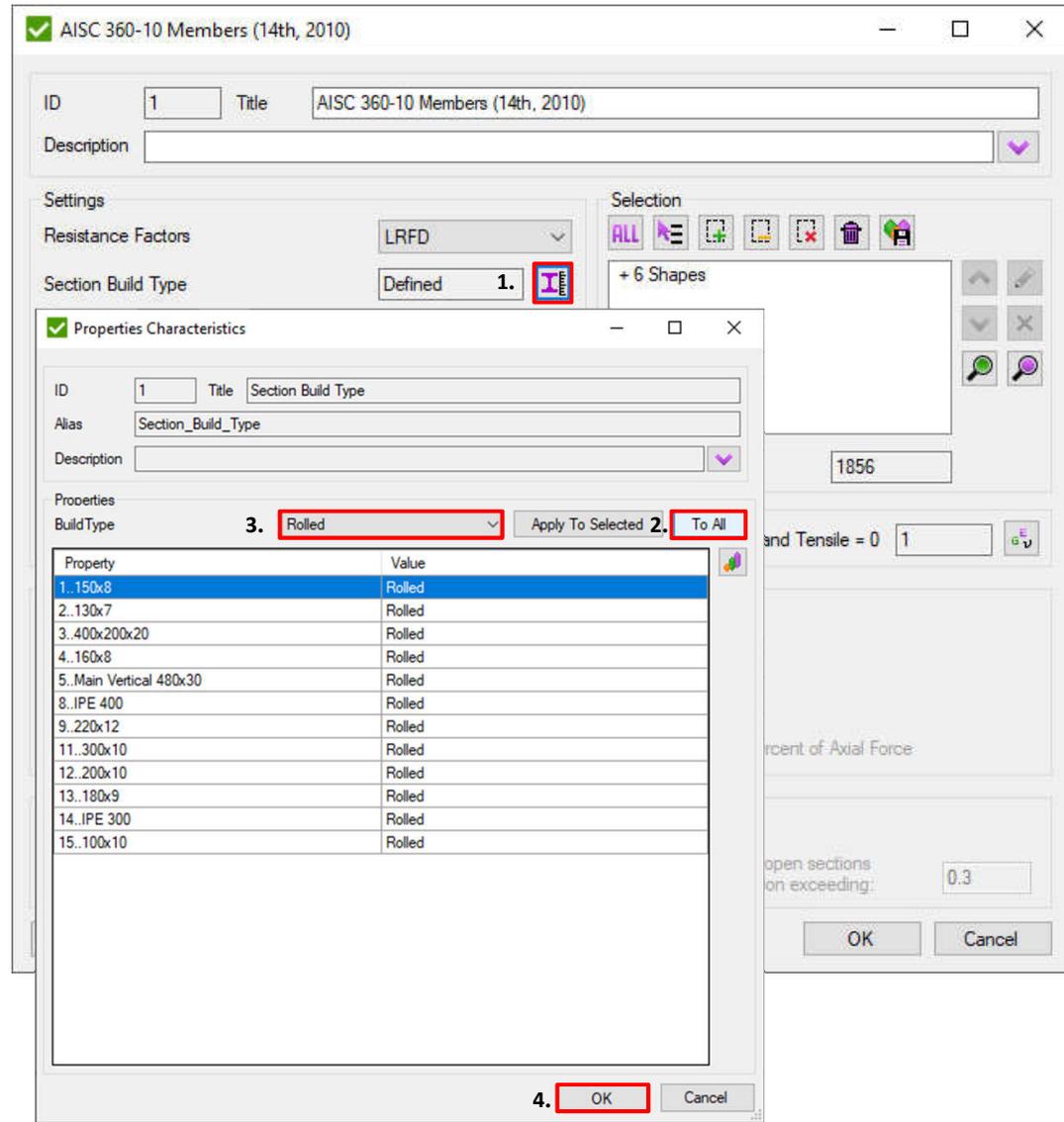
1 Press  for Section Build Type

2 Build Type: **Rolled**

3 Select *To All*

4 Press *OK*

Go to the next slide to Continue

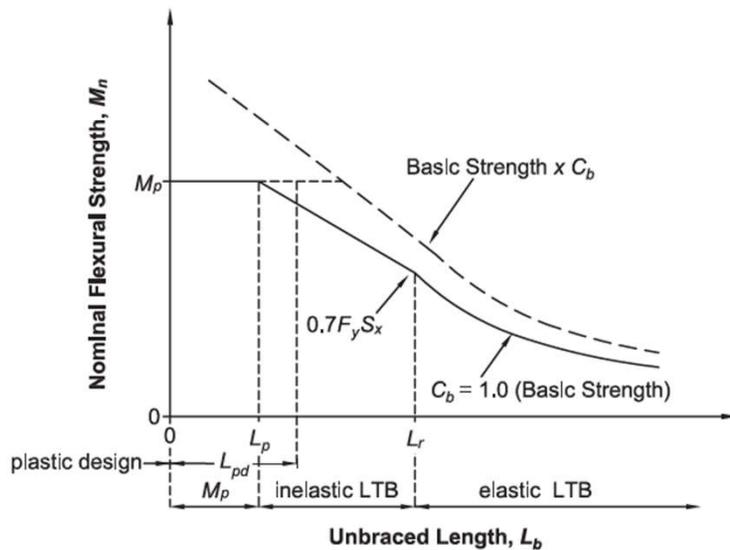


The screenshot shows the 'Properties Characteristics' dialog box for 'AISC 360-10 Members'. The 'BuildType' is set to 'Rolled' and 'Apply To Selected' is set to 'To All'. The 'OK' button is highlighted.

Property	Value
1..150x8	Rolled
2..130x7	Rolled
3..400x200x20	Rolled
4..160x8	Rolled
5..Main Vertical 480x30	Rolled
8..IPE 400	Rolled
9..220x12	Rolled
11..300x10	Rolled
12..200x10	Rolled
13..180x9	Rolled
14..IPE 300	Rolled
15..100x10	Rolled

Lateral-torsional buckling factor (C_b)

SDC Verifier follows conservative approach and uses $C_b = 1.0$. C_b is implemented as a characteristic which can be modified. For the details see Chapter F “Design of members for Flexure”, F1 General Provisions



AISC 360-10 Members (14th, 2010)

ID: 1 Title: AISC 360-10 Members (14th, 2010)
Alias: Standard1
Description: [dropdown]

Settings

Resistance Factors: LRFD
Section Build Type: Defined
 Calculate C_b (based on moment diagram, Chapter F1)
 User defined C_b : Defined
Stiffener Distance (Chapter G2.1): Defined
Net Area (Chapter D2.2): Defined
Shear Lag Factor (Table D3.1): Defined
 Calculate asymmetric shapes as symmetric

Selection

+ 11 Shapes
Elements: 1856

Use API 2A RP for tubular shapes
Materials with Yield and Tensile = 0

Second order effects (APPENDIX 8)
 Take into account second-order effects (B1 multiplier)
 Use $C_m = 1$ (conservative)
 Calculate C_m : case a = $0.6 - 0.4 \cdot M_1 / M_2$, case b = 1.0
Not subject to transverse loading (case a) when Shear Force < 0.1 Percent of Axial Force

Torsion
 Include Torsion check
Warping is neglected for the torsion check. Additional assessment is therefore required for open sections flagged with a UC=1234. SDC returns this error UC code for open sections with an UF.torsion exceeding: 0.3

Preview Not Supported Elements OK Cancel

Define Material Characteristics

- 1 Press to set the material yield stress and tensile strength
- 2 Select All Materials (Ctrl+A)
- 3 Tensile Strength: **360e+6**
- 4 Yield Stress: **240e+6**
- 5 Press *Set*
- 6 Press *OK*
- 7 Press *OK*

Material Fatigue Parameters

Materials	Tensile Strength [KPa]	Yield Stress [KPa]
1. AISI 4340 Steel	360000	240000
2. AISI 4130 Steel	360000	240000

Properties:
 Tensile Strength [KPa]: 360e6
 Yield Stress [KPa]: 240e6
 Set
 OK Cancel

Standard is created

It is possible to modify Safety Factors in Constants section.

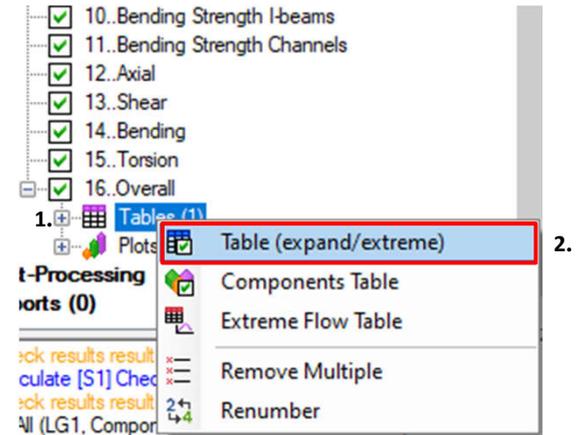
Standard contains 16 checks:
 1 - Beam member characteristics;
 2-6 - calculation dimensions and factors for 5 different shapes;
 7-11 – strength for different shapes ;
 12 – tension and compression check;
 13 – additional shear check;
 14 – additional bending check;
 15 – torsion check;
 16 - All Checks together with combined.

Id	Title (Alias)	Value	Description
1	CalculateCb	1	Set 1 to calculate Cb based on formula (F1-1). Set 0 to use r
2	SecondOrderEffect	0	Set 1 to take into account second order analysis effect (App
3	PercentOfAxial	0.1	if shear force is lower than percent of axial force than memb
4	CalculateCm	1	Cm will be calculated only when second analysis order effec
5	IncludeTorsionCheck	0	Include torsion check with neglected warping?
6	F_t	0.9	Tension Resistance Factor
7	F_c	0.9	Compression Resistance Factor
8	F_v	0.9	Shear Resistance Factor
9	F_b	0.9	Shear Resistance Factor
10	F_tr	0.75	Tensile Rupture Resistance Factor
11	F_vl	1	Shear rolled IBeam Resistance Factor
12	F_tor	0.9	Torsional Resistance Factor
13	Alpha	1	LRFD force level adjustment factor. Used in (A-8-1)
14	UFTorsionLimit	0.3	Additional assessment on torsion is required for open sectio
15	UFTorsionCode	1234	Code is used for Torsional Utilization Factor when it is highe
16	rolled	1	
17	built_up	2	
18	nonslender	3	
19	slender	4	
20	NotSupported	12345678	
21	compact	5	
22	noncompact	6	

- Standards (1)
 - 1..AISC 360-10 Members (14th, 2010)
 - Input
 - π Constants (22)
 - Types (2)
 - Characteristic (5)
 - Classifications (0)
 - Standard Tables (0)
 - Checks (16)
 - 1..Beam Characteristics
 - 2..Circular Tube
 - 3..Rectangular Tube
 - 4..Bars
 - 5..Section C
 - 6..Section I
 - 7..Axial Strength
 - 8..Shear Strength
 - 9..Bending Strength Bars
 - 10..Bending Strength I-beams
 - 11..Bending Strength Channels
 - 12..Axial
 - 13..Shear
 - 14..Bending
 - 15..Torsion
 - 16..Overall

Preview Table Results

- 1 Select Tables
- 2 Execute Table (expand/extreme) in context menu
- 3 Select Extreme Options - Detailed
- 4 Press Fill Table
- 5 Press Ok

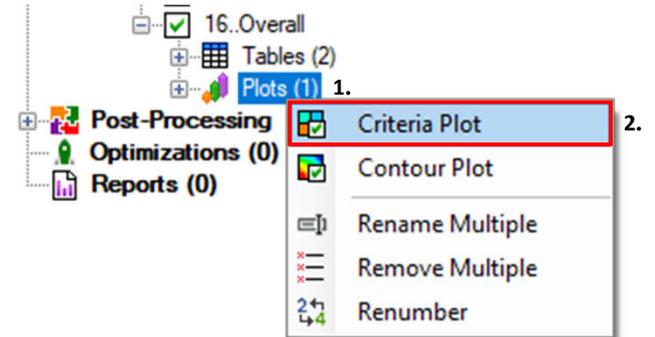


A screenshot of the 'Custom Check Table' dialog box. The dialog has several sections: 'Options', 'Extreme Options', 'Filter by', 'Sort by', and 'Selection'. The 'Extreme Options' section has 'Detailed (extreme locations - element and load for Load Groups)' selected, highlighted with a red box and labeled '3.'. The 'Filter by' section has 'Parameter' set to 'None' and 'Value >' set to '1'. The 'Sort by' section has 'Parameter' set to 'None' and 'Order' set to 'Ascending'. The 'Selection' section shows 'Component 1, AISC360 selection (s1)'. The 'Elements' field shows '1856'. At the bottom, there is a 'Fill Table' button highlighted with a red box and labeled '4.', and an 'OK' button highlighted with a red box and labeled '5.'. The main table displays results for 'Minimum', 'Maximum', and 'Absolute' values across various parameters.

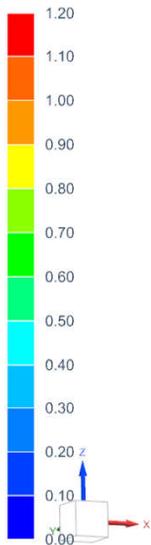
	Extreme	UF Axial	UF Bending Major	UF Bending Minor	UF Shear	UF Axial and Bending	UF Over
Minimum							
Value		0.00	0.00	0.00	0.00	0.00	
Element ID		59	1528	1134	1877	1180	
Load		LS3	LS2	LS2	LS4	LS2	
Maximum							
Value		0.32	0.65	1.82	0.22	1.82	
Element ID		955	171	1854	1125	1854	
Load		LS3	LS3	LS3	LS3	LS4	
Absolute							
Value		0.32	0.65	1.82	0.22	1.82	
Element ID		955	171	1854	1125	1854	
Load		LS3	LS3	LS3	LS3	LS4	

Utilization Factor Plot

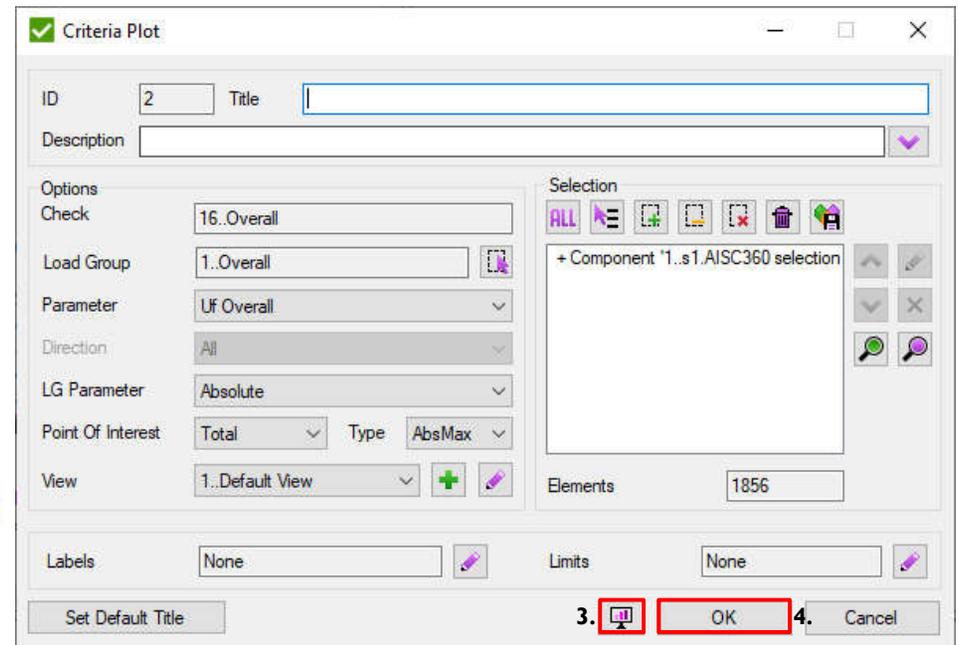
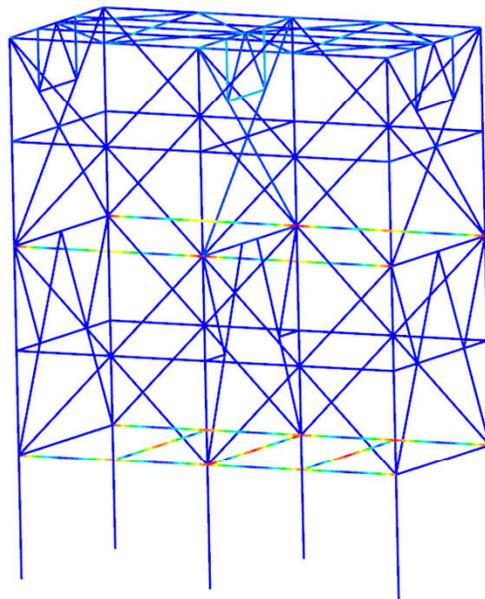
- 1 Select *Plots*
- 2 Execute *Criteria Plot* in context menu
- 3 Press  to preview Plot
- 4 Press *Ok*



aisc360_s : Job 1 Linear Result
 SdcData, Static Step 1
 Member - Element-Nodal, Unaveraged, Scalar
 Formula Used : SdcExpression
 Min : 0.00, Max : 1.82, Units = Unitless

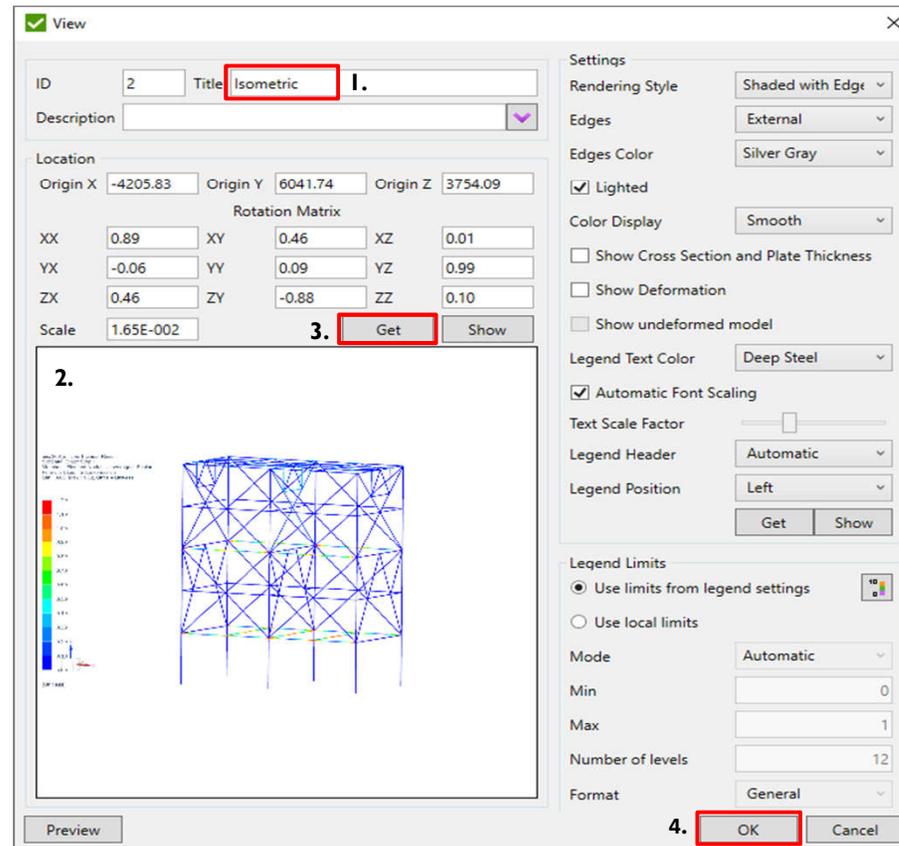


[Unitless]



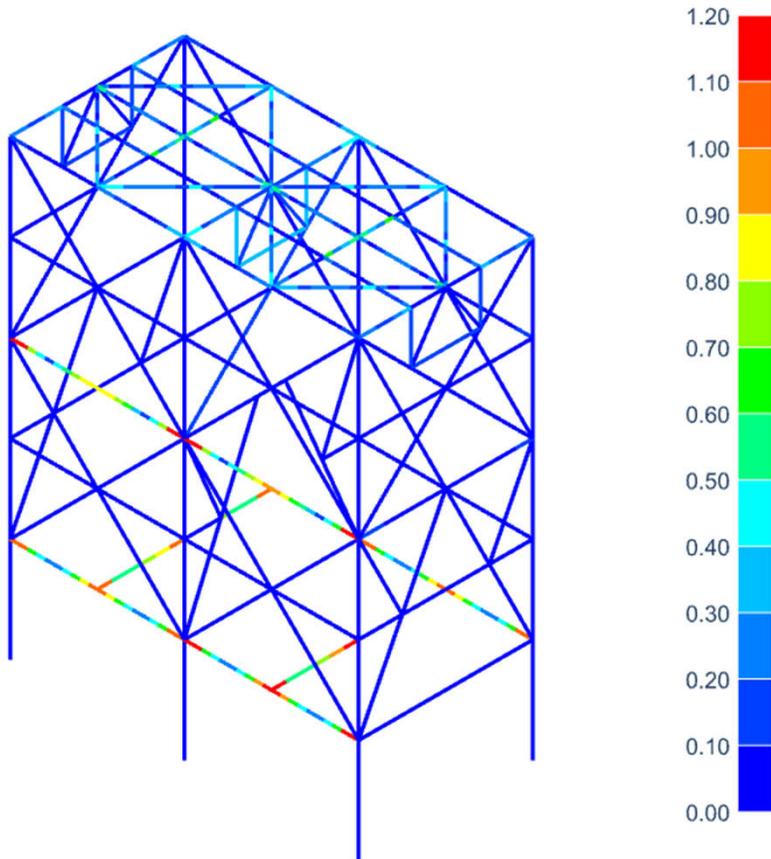
Plot. Create View

- 1 Title: **Isometric**
- 2 Orient model in Simcenter as shown on the picture
- 3 Press *Get*
- 4 Press *OK*



Display Plot

1 Press  to display plot

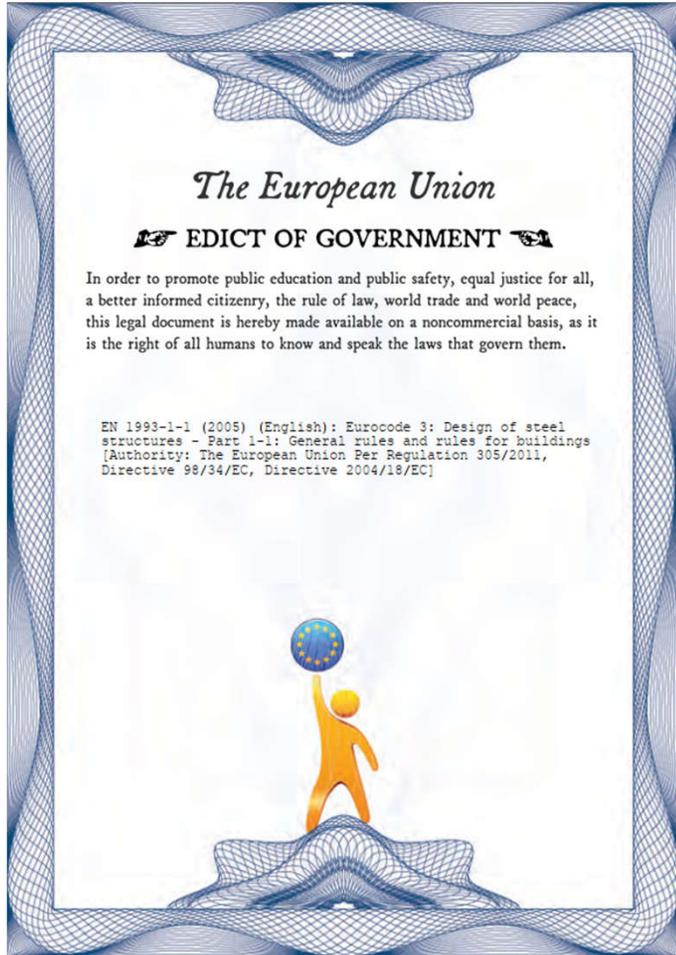


The Criteria Plot dialog box is shown with the following settings:

- ID: 5
- Title: [Empty]
- Description: [Empty]
- Check: 13..Overall
- Load Group: 1..Overall
- Options: Parameter: Uf Overall, Direction: All, LG Parameter: Absolute, Point Of Interest: Value, Type: AbsMax
- View: 2..Isometric
- Selection: ALL, + Component '3..s1.AISC360 select'
- Elements: 1856
- Limits: Type: None, Minimum: 0, Maximum: 0
- Absolute Value

The magnifying glass icon in the bottom right corner is highlighted with a red box.

Eurocode3



Eurocode 3: Design of steel structures - Part 1-1: General rules and rules for buildings



Description of Eurocode3 (EN1993-1-1, 2005)

Gm0 - resistance of cross-sections whatever the class is;
Gm1 - resistance of members to instability assessed by member checks;
Gm2 - resistance of cross-sections in tension to fracture.
 $\lambda_{LT,0}$ – plateau length of the lateral torsional buckling curves for rolled sections;
 β - correction factor for the lateral torsional buckling curves for rolled sections;
 η - is used in the shear area calculations.

Note: All parameters may be taken from the National Annex

The screenshot shows the 'Eurocode3 Members (EN 1993-1-1, 2005)' dialog box. The 'Factors' section is highlighted with a red box and contains the following values: Partial Factor Gm0: 1.0, Partial Factor Gm1: 1.0, Partial Factor Gm2: 1.25, Lambda LT,0: 0.4, Beta: 0.75, and Eta: 1.2. The 'Fabrication Type' section is also highlighted with a red box and contains fields for Fabrication Type, Manufacture Method, Fillet, Section Net Area, and Material Type. The 'Lengths for Torsional-Flexural and Lateral Torsional Buckling' section has radio buttons for 'LT = max(Ly, Lz)', 'L LT = length in strong axis (Ly or Lz)', and 'Use Torsional Length from Beam Member Finder'. The 'Lateral Torsional Buckling Method' section is highlighted with a red box and has radio buttons for 'General Case (6.3.2.2)', 'For rolled sections or equivalent welded sections (6.3.2.3)', and 'Worst of (6.3.2.2) and (6.3.2.3)'. There are also checkboxes for 'Calculate according to Table 6.6', 'Set Kc = 1 for all members', and 'Calculate asymmetric shapes as symmetric'. The 'Materials with Yield and Tensile' field is set to 0. The 'Selection' field shows '104 Properties'. The dialog has 'OK' and 'Cancel' buttons at the bottom right.

Fabrication Type: Rolled/Welded;
Manufacture Type: Hot Finished/Cold Formed
Fillets has to be defined in the characteristic (they are missing in the model);
Section Net Area - for fasteners with holes net area has to be defined;
Material Type - the buckling curve (Table 6.2) depends on the material type.

It is possible to choose the calculation method for Lateral Torsional Buckling: General Case (chapter 6.3.2.2), For rolled sections or equivalent welded sections (chapter 6.3.2.3) or the worst of two (min reduction factor is used from 2 methods):

Description of Eurocode3 (EN1993-1-1, 2005) (Continue)

A correction Factor K_c can be calculated using the Cm Tool for each member. Also it is possible to set the K_c equal to 1.

Table 6.6: The Correction Factor:

Moment distribution	k_c
$\psi = 1$	1.0
$-1 \leq \psi \leq 1$	$\frac{1}{1.33 - 0.33\psi}$
	0.94
	0.90
	0.91

The following cases are NOT recognized and are skipped:

	0,86
	0,77
	0,82

Member Length for Torsional and Torsional-Flexural Buckling Check (LT) by default is max among L_y and L_z lengths. For lateral torsional buckling (L LT) is length in strong axis.

It is possible to use Torsional Length from Beam Member Finder. In this case it can be modified manually by user.

ID	Title	Elements	Length [m]	Length Factor	Cm Type	Modified
1	Beam Member 1 (T)	47	13			
1.1	Beam Member 1.1 (T)	11	3	1	A	
1.2	Beam Member 1.2 (T)	9	2.5	1	A	
1.3	Beam Member 1.3 (T)	9	2.5	1	A	

Eurocode3. Fabrication Type

1 Execute *Standards-Add-Eurocode3-Eurocode3 Members*

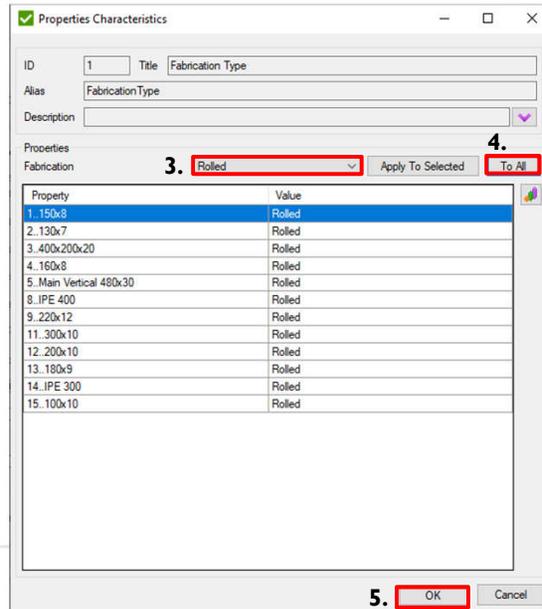
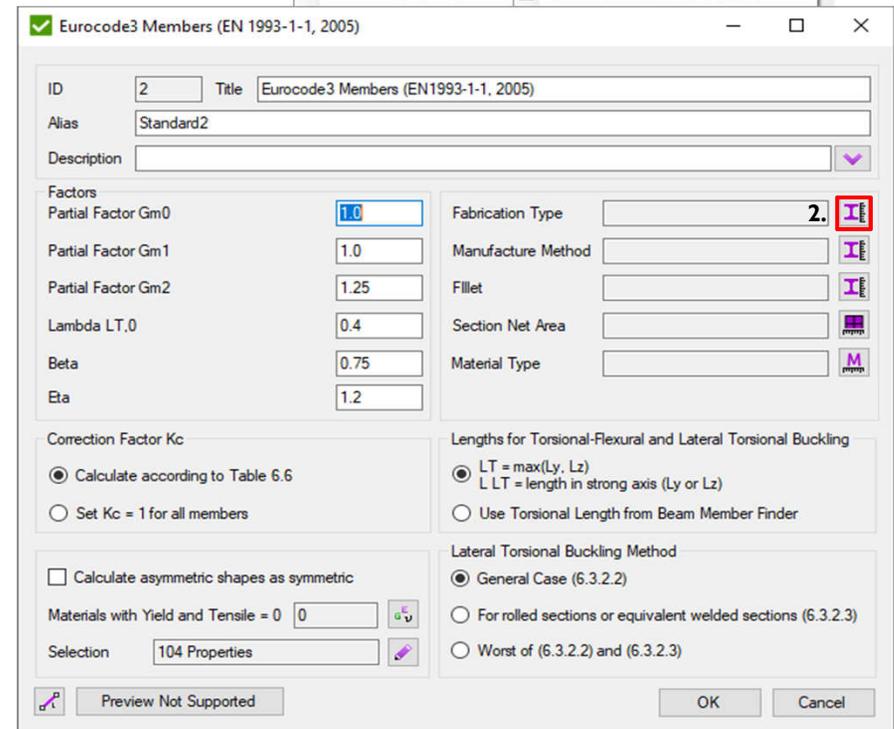
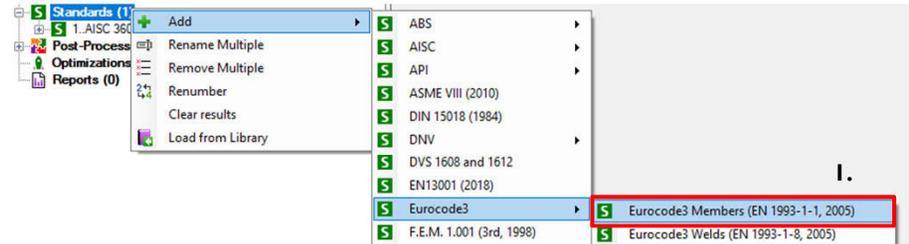
2 Press to set *Fabrication Type*

3 Execute - **Rolled**

4 Press *To All*

5 Press *Ok*

Go to the next slide to Continue



Eurocode3. Manufacture Method

- 1 Press **I** to set *Manufacture Method*
 - 2 Execute – *Hot Finished*
 - 3 Press *To All*
 - 4 Press *Ok*
- Go to the next slide to Continue

Eurocode3 Members (EN 1993-1-1, 2005)

ID: 2 Title: Eurocode3 Members (EN1993-1-1, 2005)
Alias: Standard2
Description: [dropdown]
Factors: Partial Factor Gm0: 1.0 Partial Factor Gm1: 1.0
Fabrication Type: Defined
Manufacture Method: [dropdown]
Net Area: [dropdown]
Type: [dropdown]

Properties Characteristics

ID: 2 Title: Manufacture Method
Alias: Hollow
Description: [dropdown]
Properties: Hollow Manufacturing Method: **Hot Finished** Apply To Selected: **To All**

Property	Value
1..150x8	Hot Finished
2..130x7	Hot Finished
3..400x200x20	Hot Finished
4..160x8	Hot Finished
5..Main Vertical 480x30	Hot Finished
8..IPE 400	Hot Finished
9..220x12	Hot Finished
11..300x10	Hot Finished
12..200x10	Hot Finished
13..180x9	Hot Finished
14..IPE 300	Hot Finished
15..100x10	Hot Finished

OK Cancel

1.

Eurocode3. Fillet

1 Press to set *Fillet*

2 Properties Value - **0**

3 Press *To All*

4 Press *Ok*

Repeat Steps 1-4 for *Section Net Area*

Go to the next slide to Continue

The screenshot shows two overlapping dialog boxes from the SDC Verifier software. The top dialog is titled "Eurocode3 Members (EN 1993-1-1, 2005)" and contains fields for ID (2), Title (Eurocode3 Members (EN1993-1-1, 2005)), Alias (Standard2), and Description. It also has sections for Factors (Partial Factor Gm0 and Gm1, both set to 1.0), Fabrication Type (Defined), and Manufacture Method (Defined). The bottom dialog is titled "Properties Characteristics" and is for a property named "Fillet" (ID 3). It shows a table of values for various cross-sections, with the value for "1..CrossSection:5" highlighted as 0. The "Value" field is set to 0, and the "Apply To" dropdown is set to "To All". The "OK" button is highlighted.

Property	Value
1..CrossSection:5	0
2..CrossSection:11	0
3..CrossSection:8	0
4..CrossSection:9	0
5..CrossSection:6	0
6..CrossSection:7	0
7..CrossSection:12	0
8..CrossSection:13	0
9..CrossSection:14	0
10..CrossSection:15	0
11..CrossSection:16	0
12..CrossSection:17	0
13..CrossSection:18	0
14..CrossSection:19	0
15..CrossSection:20	0
16..CrossSection:21	0
17..CrossSection:22	0
18..CrossSection:23	0
19..CrossSection:24	0
20..CrossSection:25	0
21..CrossSection:26	0

Eurocode3. Material Type

- 1 Press  to set *Material Type*
- 2 Execute – *S235_S275_S355_S420*
- 3 Press *To All*
- 4 Press *Ok*
- 5 Press *Ok*

Eurocode3 Members (EN 1993-1-1, 2005)

ID: 2 Title: Eurocode3 Members (EN1993-1-1, 2005)
Alias: Standard2
Description: [Empty]
Factors: Partial Factor Gm0: 1.0, Partial Factor Gm1: 1.0
Fabrication Type: Defined
Manufacture Method: Defined
Fillet: Defined
Section Net Area: Defined
Material Type: [Empty]

Materials Characteristics

ID: 1 Title: Material Type
Alias: Material Type
Description: [Empty]

Materials
Material Type: **2. S235_S275_S355_S420** Apply To Selected: **3. To All**

Material	Value
1..Structural Steel	S235_S275_S355_S420

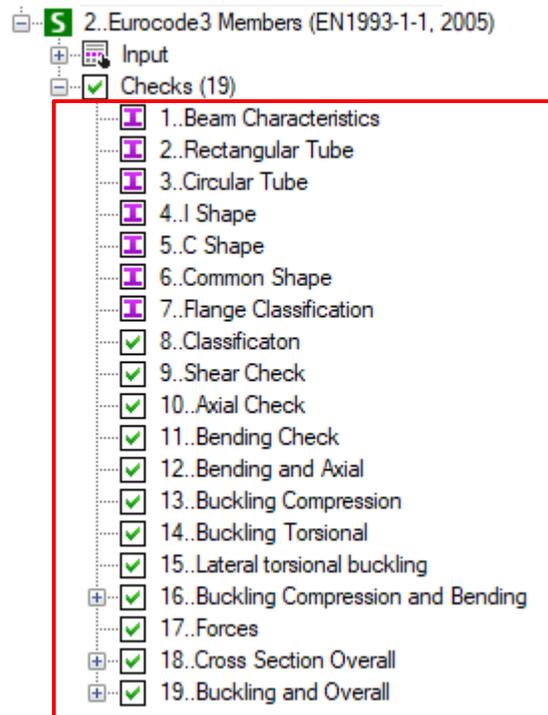
Lengths for Torsional-Flexural and Lateral Torsional Buckling
 LT = max(Ly, Lz)
L LT = length in strong axis (Ly or Lz)
 Use Torsional Length from Beam Member Finder

Lateral Torsional Buckling Method
 General Case (6.3.2.2)
 For rolled sections or equivalent welded sections (6.3.2.3)
 Worst of (6.3.2.2) and (6.3.2.3)

5. OK Cancel

4. OK Cancel

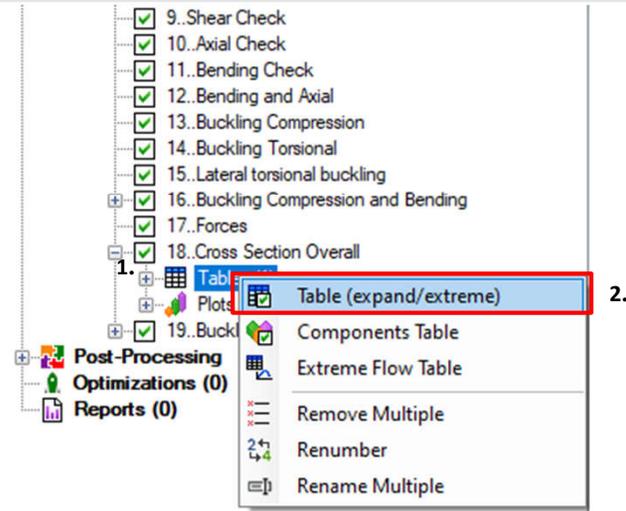
Standard is created



Standard contains 19 checks:
1 - Beam member characteristics;
2-7 - calculation dimensions and factors for 5 different shapes;
8 – cross section resistance;
9 – shear strength check;
10 – tension and compression strength check;
11 – bending strength check;
12 – bending, tension and compression strength check;
13-15 – buckling strength checks ;
16 – additional buckling compression and bending check;
17 – forces;
18 - cross section overall strength check;
19 – buckling and overall strength check.

Preview Table Results

- 1 Select Tables
- 2 Execute Table (expand/extreme) in context menu
- 3 Select Extreme Options - Detailed
- 4 Press Fill Table
- 5 Press Ok



Custom Check Table

ID: 2 Title: []

Description: []

Options

Check: 18..Cross Section Overall

Load Group: 1..Overall

Table Type: Extreme (worst result on selection)

Table Structure: Direction over Parameters

Direction: All

Extreme Options

Detailed (extreme locations - element and load for Load Groups)

Short (only extremes)

Filter by

Parameter: None

Value >: 1

Sort by

Parameter: None

Order: Ascending

Selection

+ Component '2..Eurocode3 Shapes (s2)'

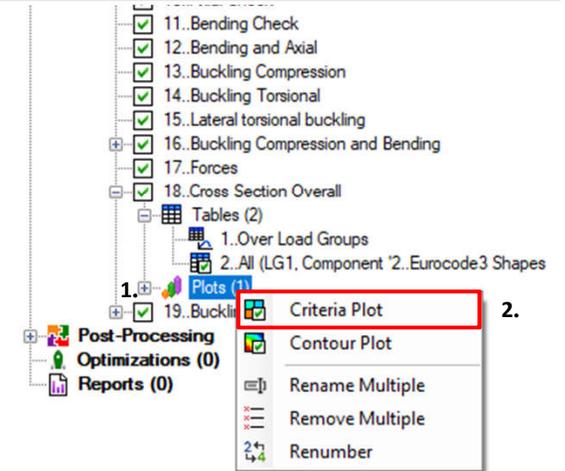
Elements: 1856

Set Default Title

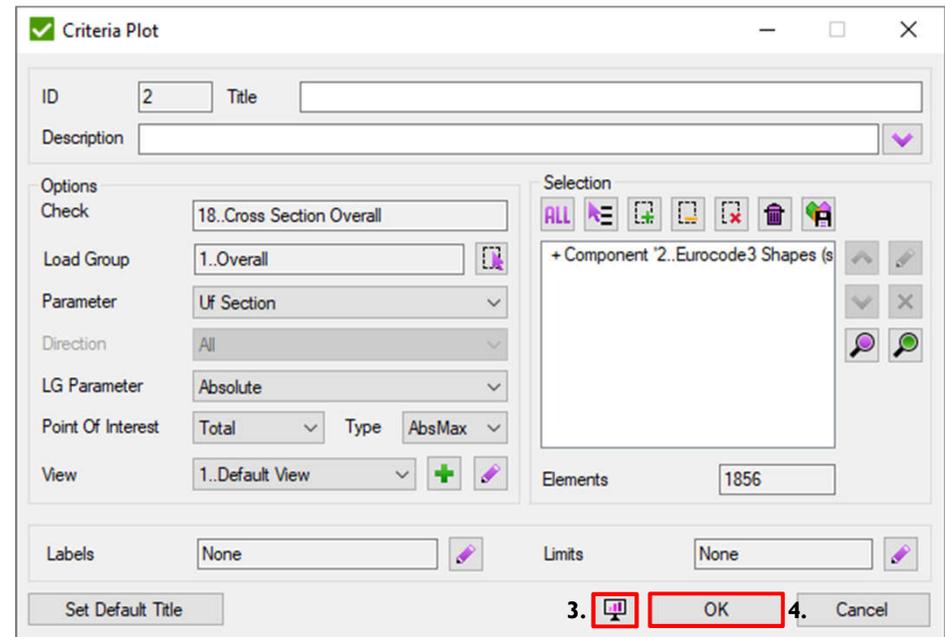
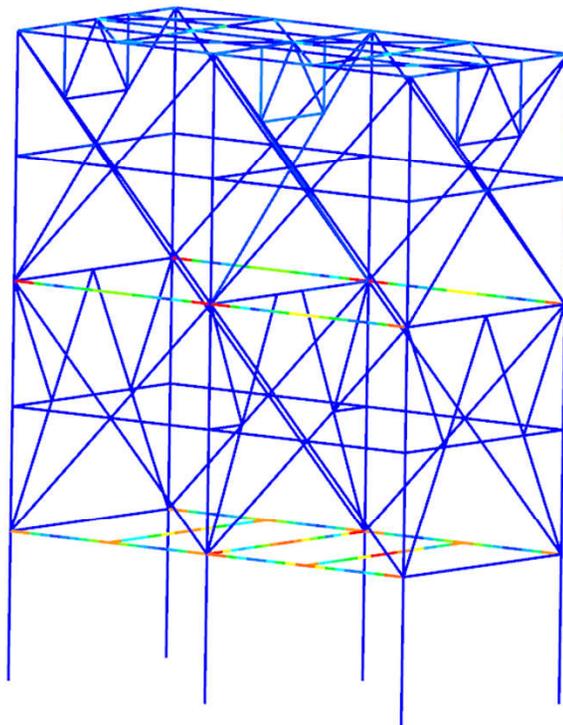
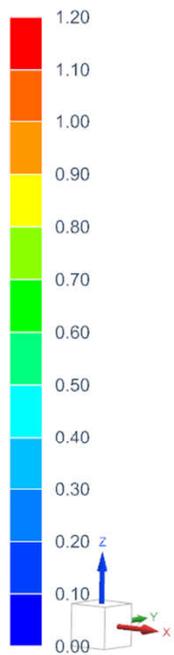
Extreme	Uf Axial	Uf ShearY	Uf ShearZ	Uf BendY	Uf BendZ	Uf Comb
Minimum						
Value	0.00	0.00	0.00	0.00	0.00	0.00
Element ID	59	1140	1401	1528	1251	265
Load	LS3	LS4	LS3	LS2	LS2	LS1
Maximum						
Value	0.28	0.16	0.16	0.58	1.63	1.63
Element ID	955	171	1125	1125	1854	1854
Load	LS3	LS3	LS3	LS3	LS3	LS3
Absolute						
Value	0.28	0.16	0.16	0.58	1.63	1.63
Element ID	955	171	1125	1125	1854	1854
Load	LS3	LS3	LS3	LS3	LS3	LS3

Utilization Factor Plot

- 1 Select Plots
- 2 Execute *Criteria Plot* in context menu
- 3 Press  to preview Plot
- 4 Press *Ok*



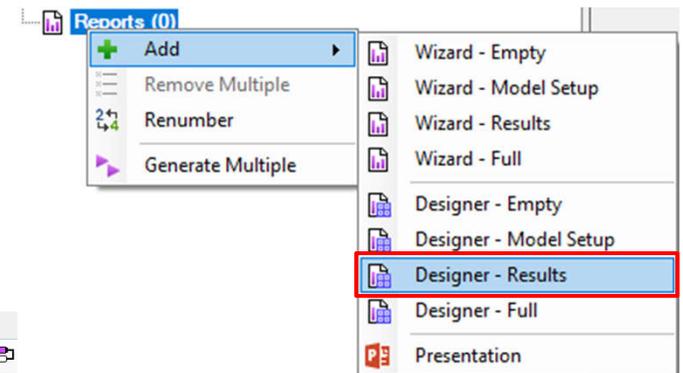
aisc360_s : Job 1 Linear Result
 SdcData, Static Step 1
 Members - Elemental, Scalar
 Formula Used : SdcExpression
 Min : 0.00, Max : 1.63, Units = Unitless



[Unitless]

Create Predefined Report

- 1 Execute *Reports - Add - Designer-Results*.
- 2 Press to generate report
- 3 When report is generated press



1.

Results report includes an overview of the displacements and stresses for all loads and standards with all predefined tables and plots

The screenshot shows the 'Report Designer' software interface. The 'Generate' button in the 'Post Processing' tab is highlighted with a red box. A 'Results' report preview is shown on the right, including a table of displacement data for 'Individual Load *1..Gravity - step #1'.

Results
1..Static Structural
Individual Loads
 In this paragraph the influence of the different separate loads is described.
Individual Load *1..Gravity - step #1'
 Displacement (IL1, All Entities)

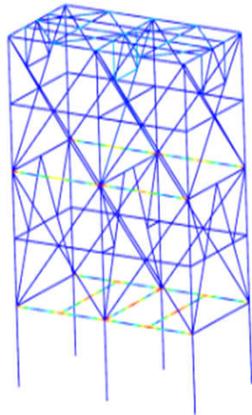
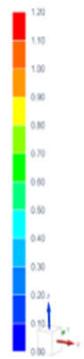
Individual Load	1..Gravity - step #1	Selection Category		All Entities Displacement					
Type	Extreme	Ux (m)	Uy (m)	Uz (m)	Usun (m)	Rx	Ry	Rz	Rsum
Minimum	0.00	0.00	0.00	0.00	0.00	-0.01	-0.01	0.00	0.00
Maximum	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01
Absolute	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01

Generating item... (8 of 72)
 Usun (IL1, All Entities, v1) generating...
 Remaining time: 0 minutes, 55 seconds
 11 %
 Stop

Generated Report

1..Abs Uf Overall (LG1, Component '1..AISC360 selection (s1)', v1)

aisc360_s - Job 1 Linear Result
 SolData: State Step 1
 Member - Element Result, Unaveraged, Stoker
 Formula Used: StdExpression
 Min: 0.05, Max: 1.92, Units = Unitless

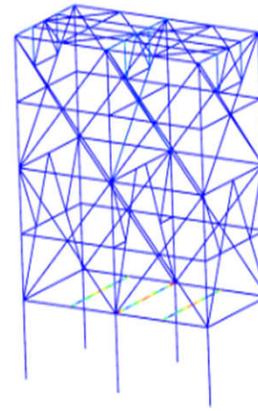
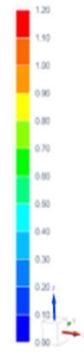


[m]None

Check	[S1] 16..Overall	Load Group	LG1..Overall
Parameter	Absolute Uf Overall	Selection	Component '1..AISC360 selection (s1)'
View	1..Default View	Data Conversion	No Averaging

1..Abs Uf Combined (LG1, Component '2..Eurocode3 Shapes (s2)', v1)

aisc360_s - Job 1 Linear Result
 SolData: State Step 1
 Member - Element Result, Unaveraged, Stoker
 Formula Used: StdExpression
 Min: 0.05, Max: 1.67, Units = Unitless



[m]None

Check	[S2] 16..Buckling Compression and Bending Load Group	Load Group	LG1..Overall
Parameter	Absolute Uf Combined	Selection	Component '2..Eurocode3 Shapes (s2)'
View	1..Default View	Data Conversion	No Averaging

AISC 360 - 10

Eurocode3