



Tutorial

# AISC 360-10 and Eurocode3

Updated on: January 17th 2024

Tested with: SDC Verifier 2023 R2

Simcenter3D 2306

SDC Verifier is a powerful Simcenter add-on that helps verify structures according to standards and generates full calculations reports.

- In this tutorial, AISC 360-10 Members (14th, 2010) & Eurocode3 Members (EN 1993-1-1, 2005) are added;
- 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;
- The functionality of SDC Verifier Report Designer can be checked via the link to a separate tutorial (Slide 31).

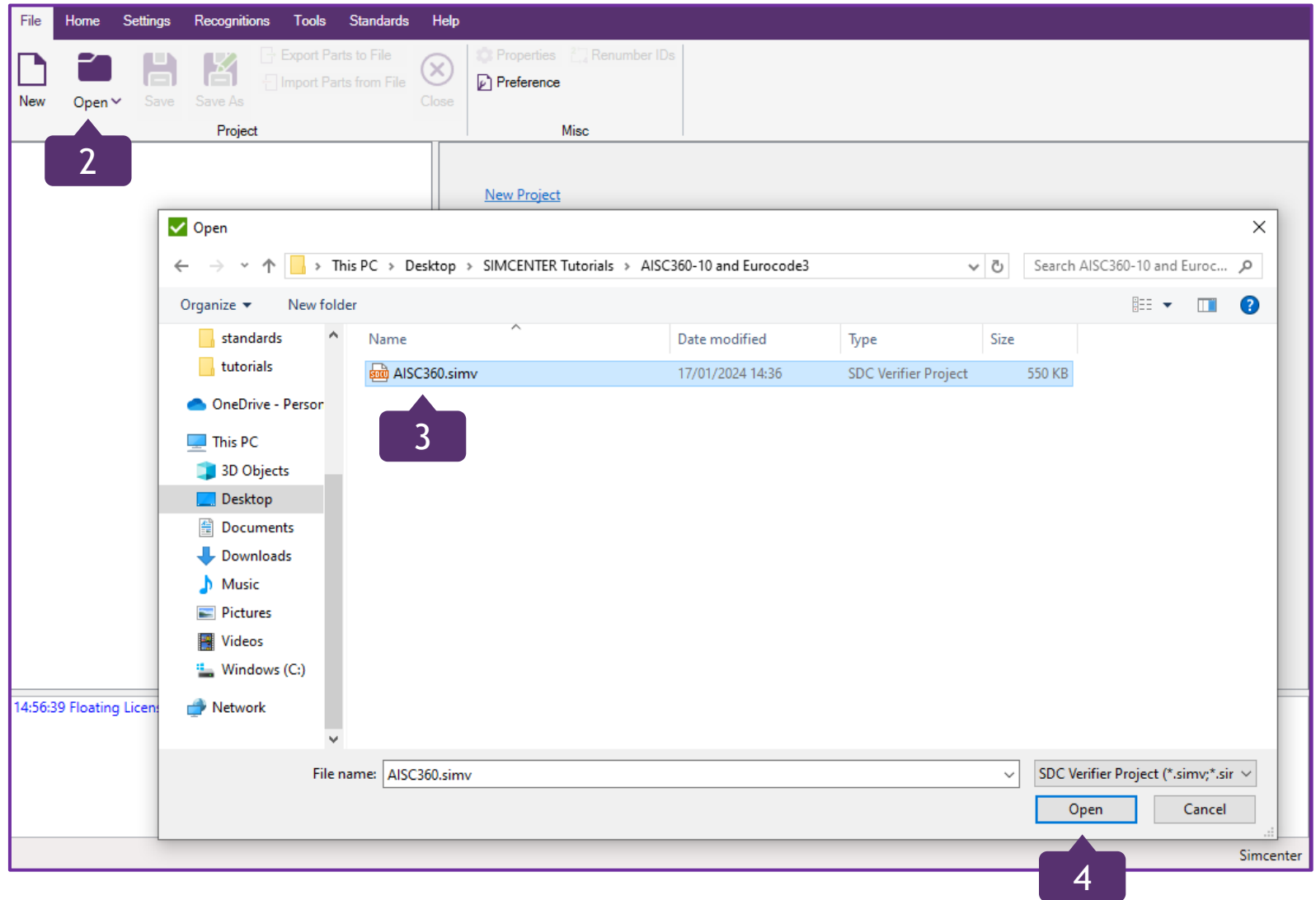
# Open the Starter Model

1 Launch SDC Verifier for Simcenter 3D

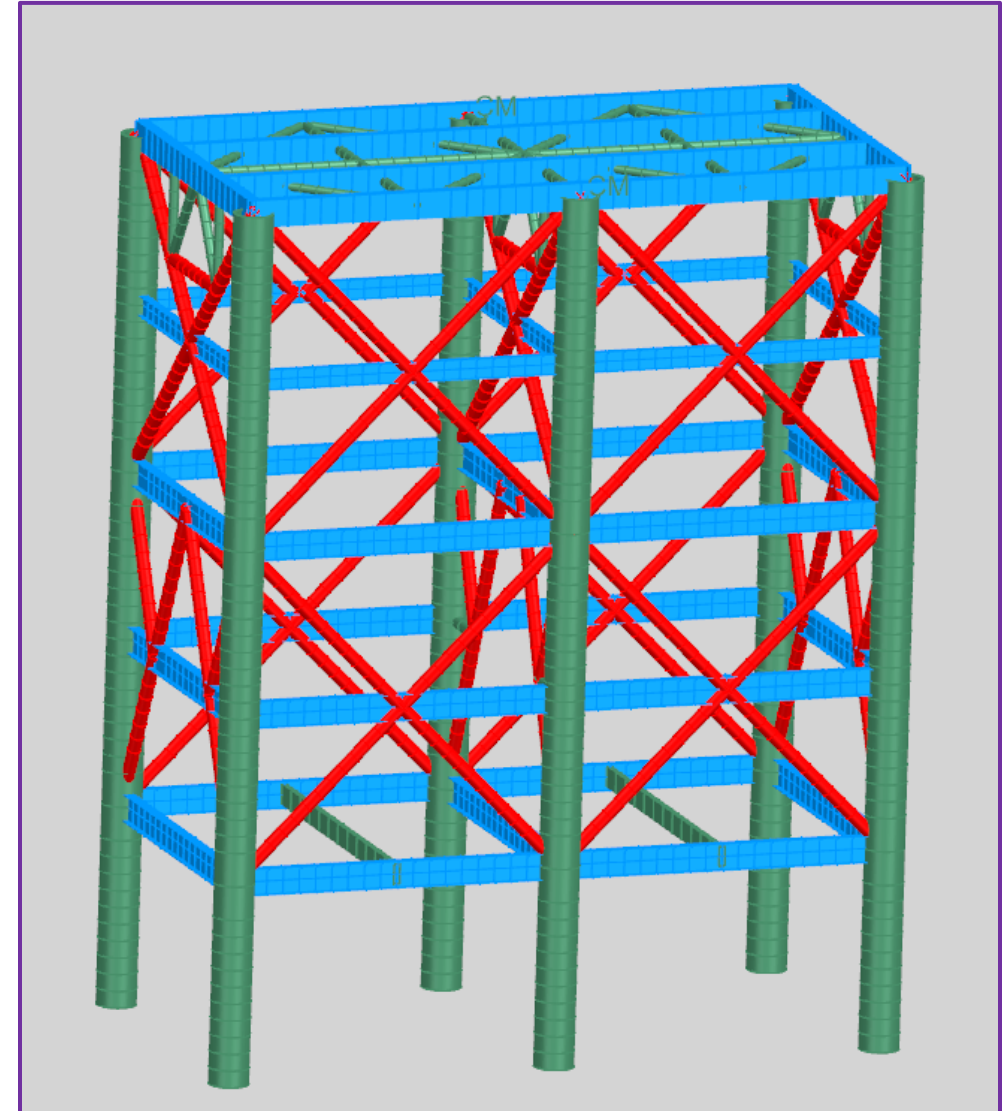
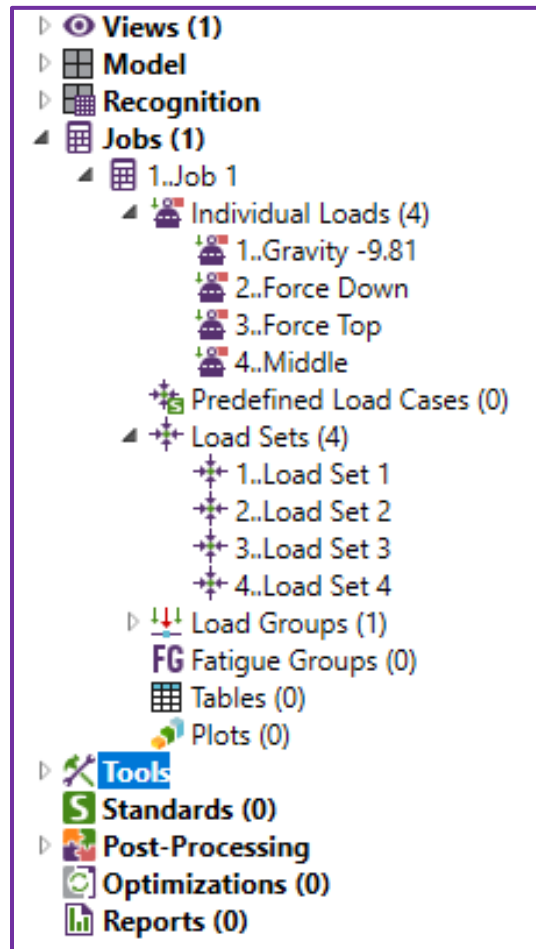
2 In *File* section, press *Open*

3 Select a project *AISC360.simv*

4 Press *Open*



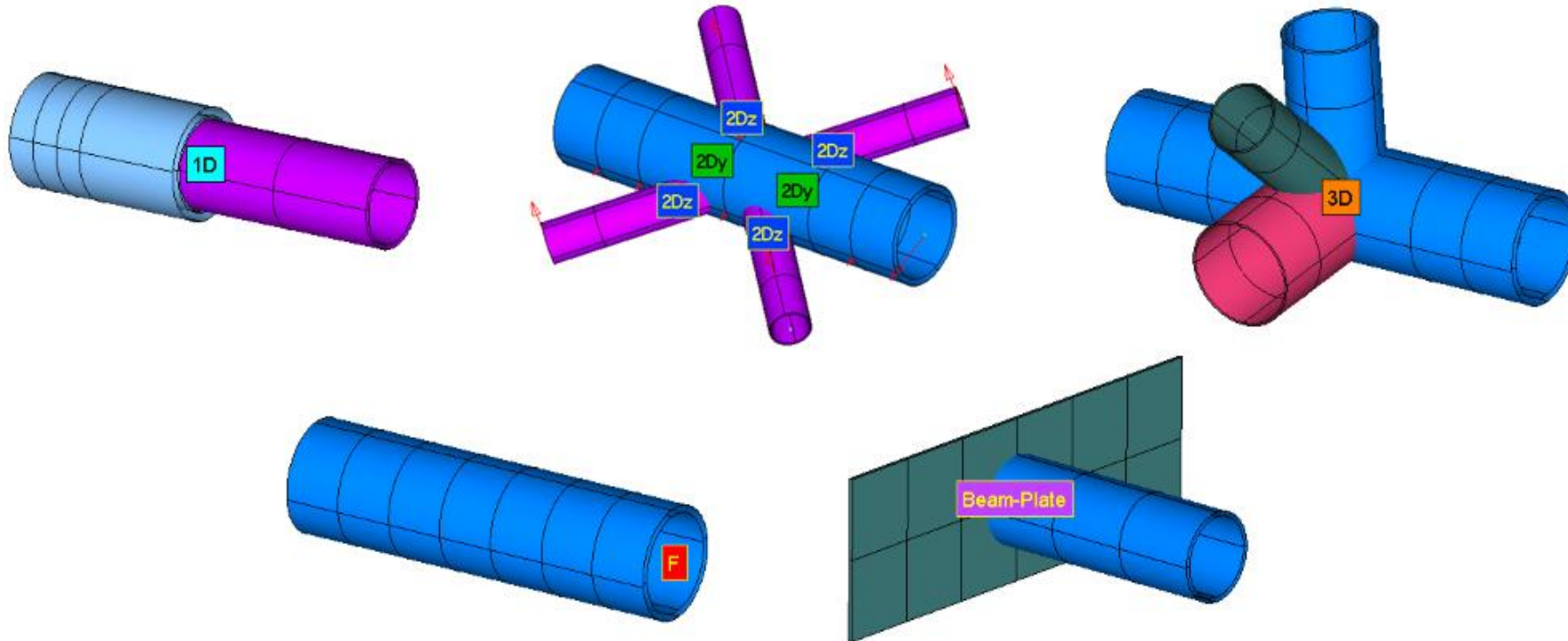
This tutorial presents the project with predefined Boundary Conditions, Load Combinations and Load Group.  
The model contains only beam elements of the following types: I-Beam, Circular and Rectangular Tubes.



Joint is a 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 - a node which belongs only to one element (free);
- Beam-Plate Joint - a beam member connected to plates (perpendicularly);
- User Defined;



- 1 In the *Model Tree*, expand *Recognition* and select *Joint Finder*
- 2 Execute right click on *Joint Finder* and select *Edit*
- 3 Press *Find*
- 4 Press *OK*

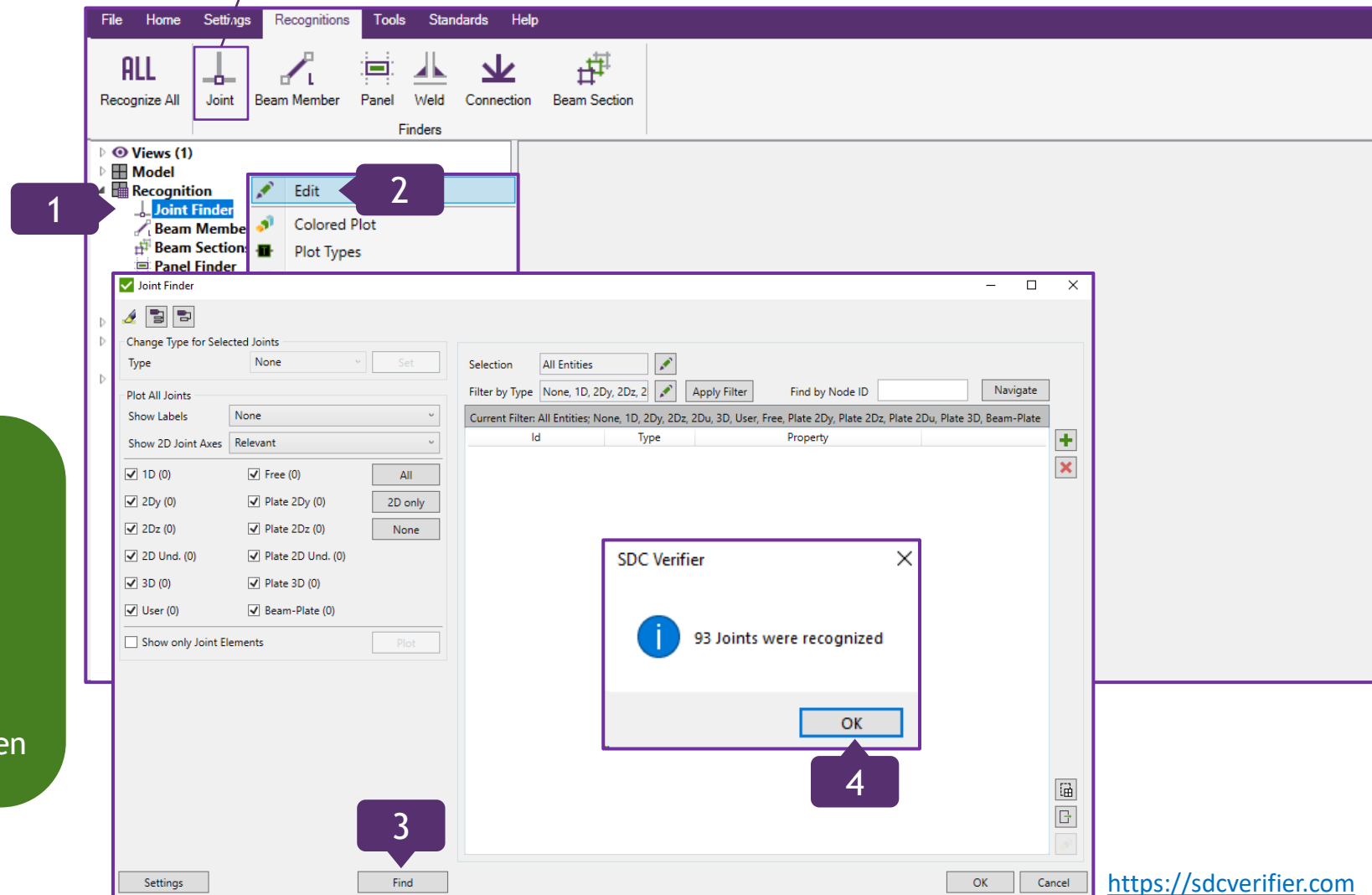
When performing Joint Recognition, there are 3 options for existing joints:

Default option - Keep only modified;

Remove All joints (except for those, edited by a user);


Keep All Existing options - it should be used, when additional elements were added to the model.

An alternative method of using a Joint Finder Tool is to press Joint in the Recognition section of the Toolbar.

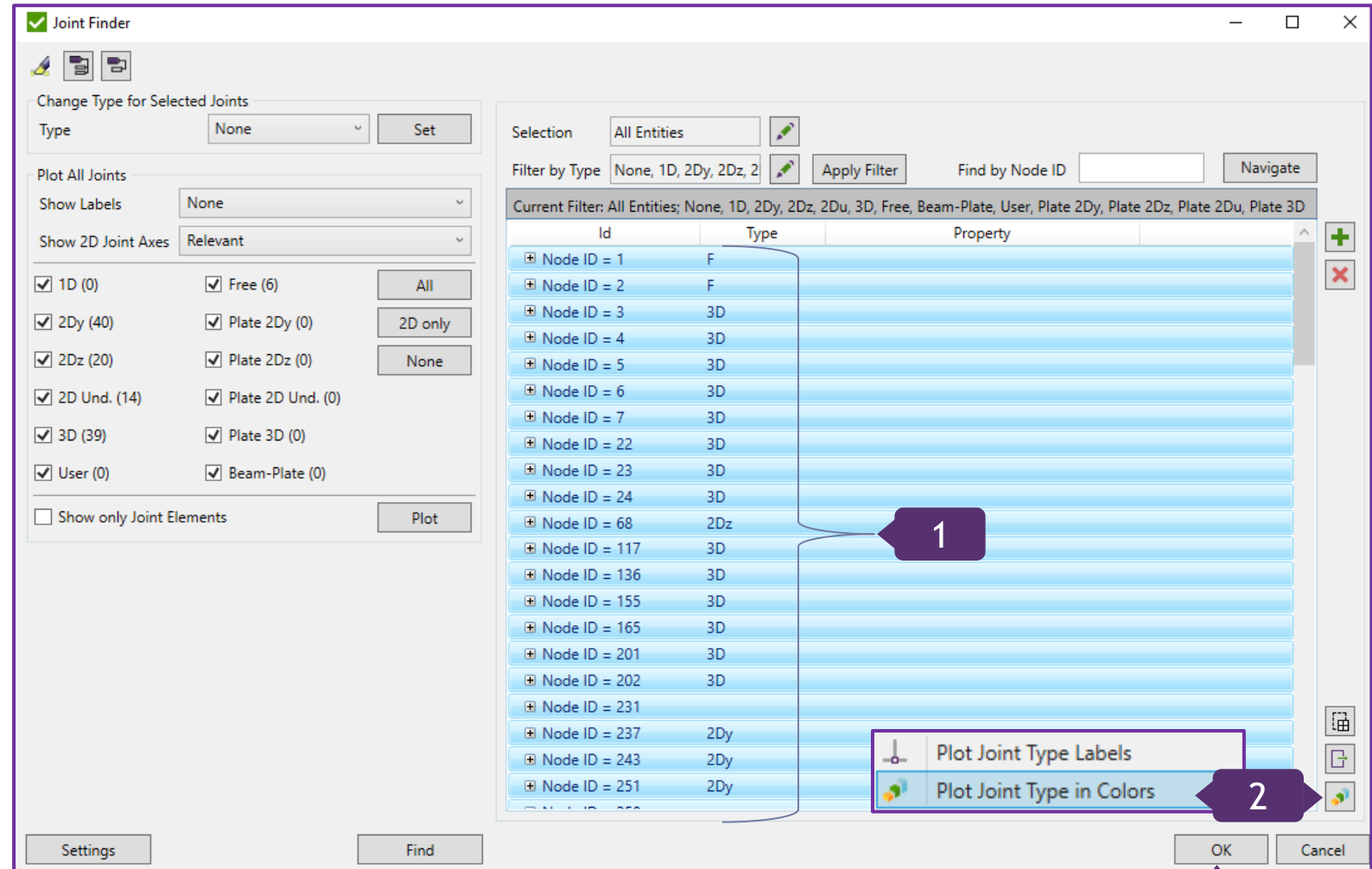


# Plot Joints

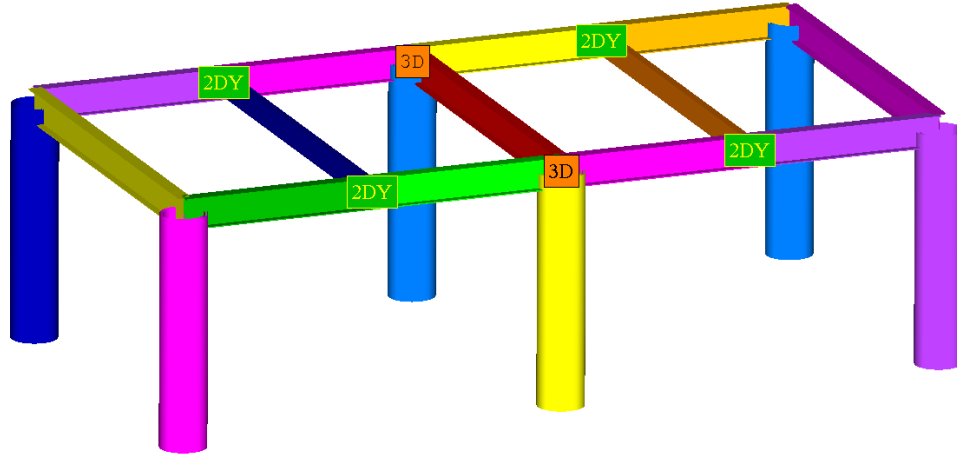
1 Select all Joints (*Ctrl+A*)

2 Press  and select *Plot Joint Type in Colors*

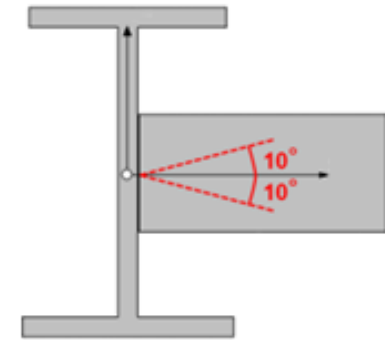
3 Press *OK*



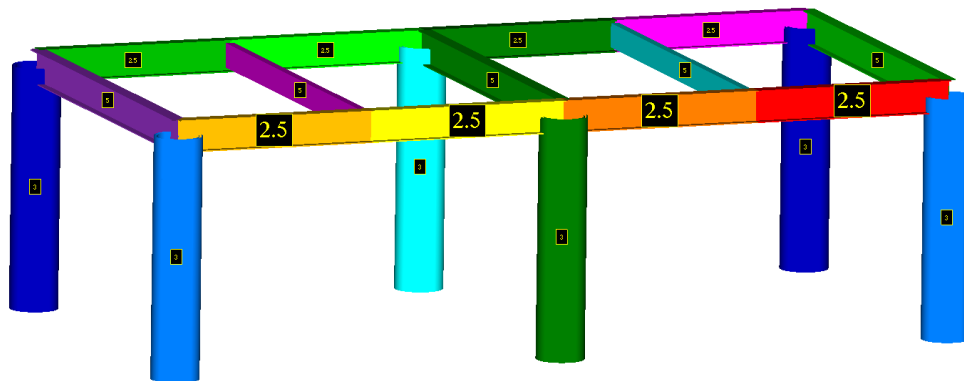
Beam Member Finder recognizes Beam members and (buckling) Lengths for different directions (Y, Z and Torsional).



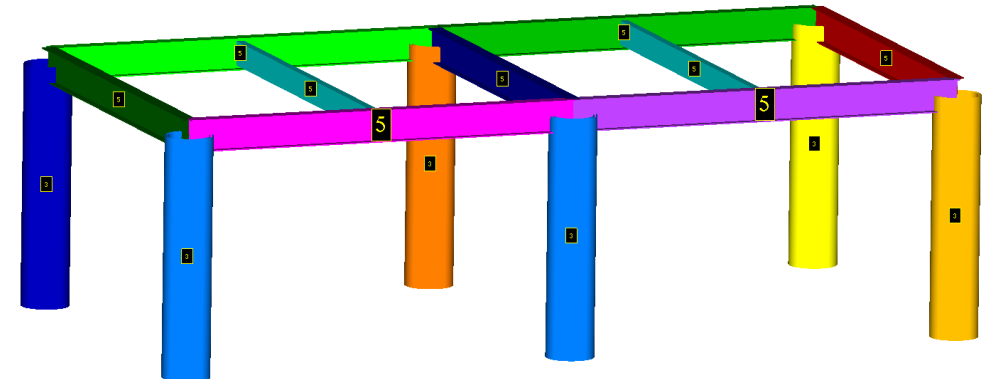
2DY  
Joint



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



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





# Recognize Length Y

1

In *Recognition* section of the *Model Tree*, execute right click on *Beam Member Finder* and press *Edit*

2

*Length Y* - 2Dy, 3D, Plate 2Dy, Plate 3D  
*Length Z* - 2Dz, 3D, Plate 2Dz, Plate 3D  
*Torsion (Lb)* - 2Dy, 2Dz, 2D Und., 3D

3

Press *Find*

4

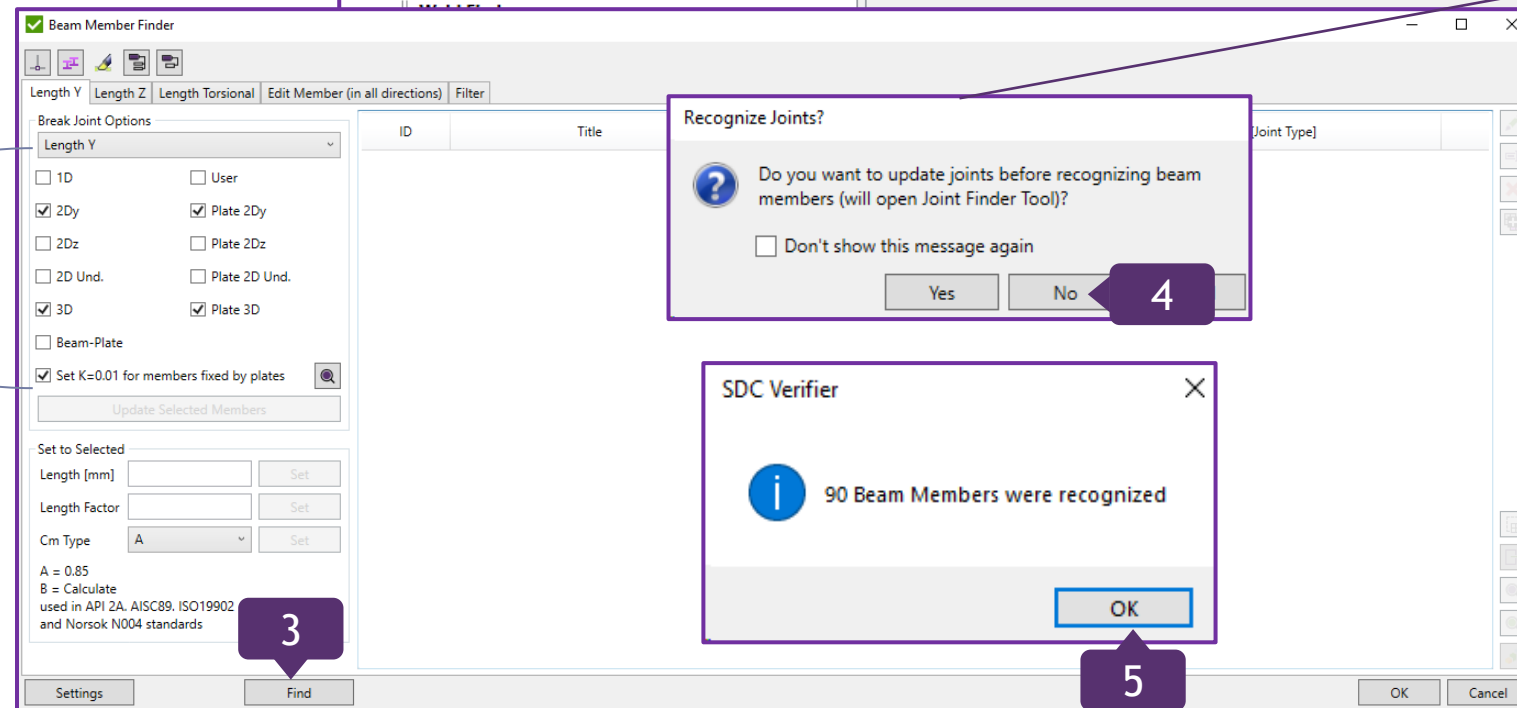
Press *No*

5

Press *OK remove*

An alternative method of using a Beam Member Finder Tool is to press Beam Member in the Recognition section of the Toolbar.

As Beam Member Finder Tool is based on Joint Finder Tool, it is a reminder to check if all Joints have been recognized, especially in case the model has been previously modified.



# Beam Member Finder Interface Explanation

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

Break Joint 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.

Break Joint Options

Length Y

☐ 1D ☐ User

☒ 2Dy ☒ Plate 2Dy

☐ 2Dz ☐ Plate 2Dz

☐ 2D Und. ☐ Plate 2D Und.

☒ 3D ☒ Plate 3D

☐ Beam-Plate

☒ Set K=0.01 for members fixed by plates

Update Selected Members

Set to Selected

Length [mm]

Set

Length Factor

Set

Cm Type

A

Set

A = 0.85

B = Calculate

used in API 2A, AISC89, ISO19902

and Norsok N004 standards

Settings

Find

ID	Title	Elements	Length	Length Factor	Cm Type	Modified	Joint - NodeID [Joint Type]
1	Beam Member 1 (Y)	47	13000				201[3D] 1110[3D] 202[3D] 1111[3D]
2	Beam Member 2 (Y)	47	13000				1107[3D] 155[3D] 1104[3D] 4[3D]
3	Beam Member 3 (Y)	47	13000				1109[3D] 136[3D] 1108[3D] 117[3D]
4	Beam Member 4 (Y)	47	13000				1105[3D] 165[3D] 1106[3D] 22[3D]
5	Beam Member 5 (Y)	47	13000				2225[3D] 1273[3D] 2222[3D] 1122[3D]
6	Beam Member 6 (Y)	47	13000				2226[3D] 1235[3D] 1254[3D] 2227[3D]
7	Beam Member 7 (Y)	16	5000	1	A		
8	Beam Member 8 (Y)	32	10000				2208[2Dy] 22[3D] 1090[2Dy]
9	Beam Member 9 (Y)	16	5000				2211[2Dy]
10	Beam Member 10 (Y)	32	10000				2221[2Dy] 201[3D] 1103[2Dy]
11	Beam Member 11 (Y)	16	5000				1093[2Dy]
12	Beam Member 12 (Y)	40	10000				231[2Dy] 237[2Dy] 243[2Dy] 3[3D] 1361[2Dy] 1355[2Dy] 1349[2Dy]
13	Beam Member 13 (Y)	40	10000				251[2Dy] 258[2Dy] 265[2Dy] 5[3D] 1383[2Dy] 1376[2Dy] 1369[2Dy]
14	Beam Member 14 (Y)	32	10000				1100[2Dy] 1117[3D] 2218[2Dy]
15	Beam Member 15 (Y)	32	10000				1101[2Dy] 1116[3D] 2219[2Dy]
16	Beam Member 16 (Y)	18	5000				6[3D] 24[3D] 7[3D]
17	Beam Member 17 (Y)	18	5000				1124[3D] 1142[3D] 1125[3D]
18	Beam Member 18 (Y)	12	5000	1	A		
19	Beam Member 19 (Y)	12	5000	1	A		
20	Beam Member 20 (Y)	40	10000				23[3D] 271 1389
21	Beam Member 21 (Y)	18	5000				1376[2Dz] 1389 1355[2Dy]
22	Beam Member 22 (Y)	5	1500	1	A		

Select all Beam Members and press Select Plot Members ID Labels.

Plot selected members

Plot Length Criteria

Plot Members ID Labels

Plot Full Members ID Labels

Plot Length Labels

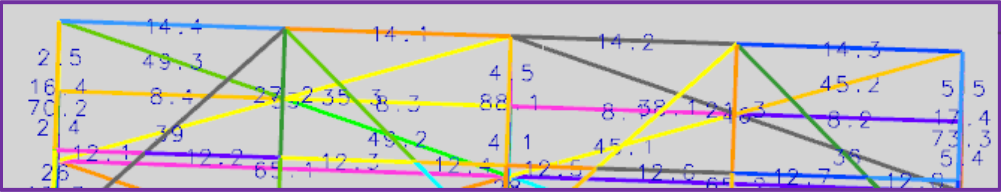
Plot Cm Type Labels

Plot Length Factor Labels

Plot Joints for Selected Members

Plot Members Y and Z axes

Plot Length Labels in Y and Z axes



14	Beam Member 14 (Y)	32	10000				1100[2Dy] 1117[3D] 2218[2Dy]
14.1	Beam Member 14.1 (Y)	8	2500	1	A		
14.2	Beam Member 14.2 (Y)	8	2500	1	A		
14.3	Beam Member 14.3 (Y)	8	2500	1	A		
14.4	Beam Member 14.4 (Y)	8	2500	1	A		

# Beam Member's Length Plot

1

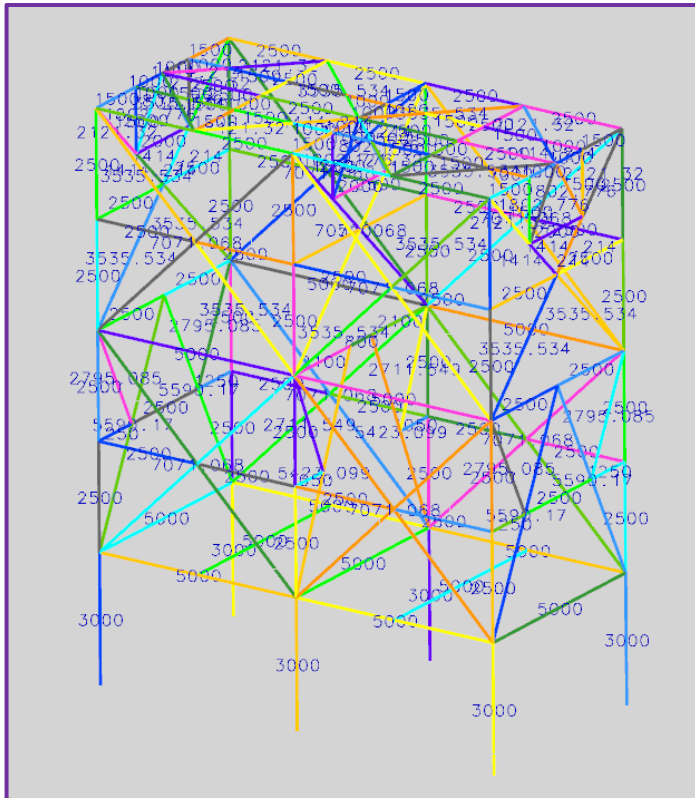
Select all Beam Members (**Ctrl+A**)

2

Press  and select **Plot Length Labels**

3

Press **OK**



Beam Member Finder

Length Y Length Z Length Torsional Edit Member (in all directions) Filter

Break Joint Options

Length Y

☐ 1D ☐ User

☒ 2Dy ☒ Plate 2Dy

☐ 2Dz ☐ Plate 2Dz

☐ 2D Und. ☐ Plate 2D Und.

☒ 3D ☒ Plate 3D

☐ Beam-Plate

☒ Set K=0.01 for members fixed by plates

Update Selected Members

Set to Selected

Length [mm]  Set


Length Factor  Set

Cm Type A Set











A = 0.85  
B = Calculate  
used in API 2A, AISC89, ISO19902  
and Norsok N004 standards

ID	Title	Elements	Length	Length Factor	Cm Type	Modified	Joint - NodeID [Joint Type]
1	Beam Member 1 (Y)	47	13000				201[3D] 1110[3D] 202[3D] 144[3D]
2	Beam Member 2 (Y)	47	13000				1107[3D] 155[3D] 1104[3D] 4[3D]
3	Beam Member 3 (Y)	47	13000				1109[3D] 136[3D] 1108[3D] 117[3D]
4	Beam Member 4 (Y)	47	13000				1105[3D] 165[3D] 1106[3D] 22[3D]
5	Beam Member 5 (Y)	47	13000				2225[3D] 1273[3D] 2222[3D] 1122[3D]
6	Beam Member 6 (Y)	47	13000				2226[3D] 1235[3D] 1254[3D] 2227[3D]
7	Beam Member 7 (Y)	16	5000	1	A		
8	Beam Member 8 (Y)	32	10000				2208[2Dy] 22[3D] 1090[2Dy]
9	Beam Member 9 (Y)	16	5000				2211[2Dy]
10	Beam Member 10 (Y)	32	10000				2221[2Dy] 201[3D] 1103[2Dy]
11	Beam Member 11 (Y)	16	5000				1093[2Dy]
12	Beam Member 12 (Y)	40	10000				231[2Dy] 237[2Dy] 243[2Dy] 3[3D] 1361[2Dy] 1355[2Dy] 1349[2Dy]
13	Beam Member 13 (Y)	40	10000				251[2Dy] 258[2Dy] 265[2Dy] 5[3D] 1383[2Dy] 1376[2Dy] 1369[2Dy]
14	Beam Member 14 (Y)	32	10000				1100[2Dy] 1117[3D] 2218[2Dy]
15	Beam Member 15 (Y)	32	10000				1101[2Dy] 1116[3D] 2219[2Dy]
16	Beam Member 16 (Y)	18	5000				6[3D] 24[3D] 7[3D]
17	Beam Member 17 (Y)	18	5000				1124[3D] 1142[3D] 1125[3D]
18	Beam Member 18 (Y)	12	5000	1	A		
19	Beam Member 19 (Y)	12	5000	1	A		
20	Beam Member 20 (Y)	40	10000				23[3D] 271 1389
21	Beam Member 21 (Y)	18	5000				1376[2Dy] 1389 1355[2Dy]
22	Beam Member 22 (Y)	5	1500	1	A		

Settings Find OK Cancel

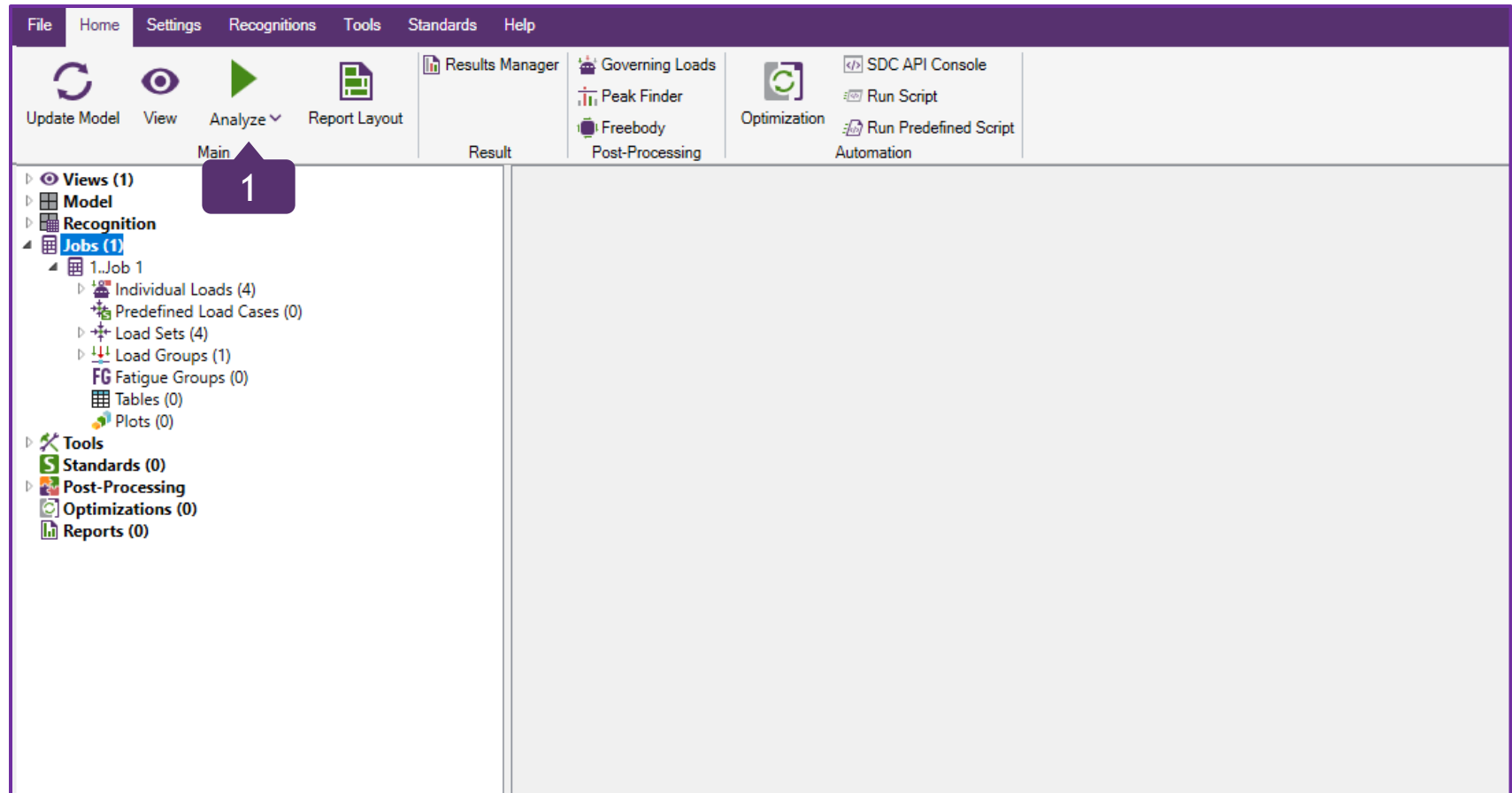
Also, it is possible to display Beam Members IDs by pressing 



-  Plot selected members
-  Plot Length Criteria
-  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
-  Plot Length Labels in Y and Z axes

1

In *Home* section, press *Analyze*



ANSI/AISC 360-10 is 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.

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## Specification for Structural Steel Buildings

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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



AMERICAN INSTITUTE OF STEEL CONSTRUCTION, INC.

One East Wacker Drive, Suite 700  
Chicago, Illinois 60601-1802

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

☒ LRFD ☐ ASD

Tension (F <sub>t</sub> )	0.9
Tensile Rupture (F <sub>tr</sub> )	0.75
Compression (F <sub>c</sub> )	0.9
Shear (F <sub>v</sub> )	0.9
Bending (F <sub>b</sub> )	0.9
Torsion (F <sub>tor</sub> )	0.9

Resistance Factors

☐ LRFD ☒ ASD

Tension (F <sub>t</sub> )	0.6
Tensile Rupture (F <sub>tr</sub> )	0.5
Compression (F <sub>c</sub> )	0.6
Shear (F <sub>v</sub> )	0.6
Bending (F <sub>b</sub> )	0.6
Torsion (F <sub>tor</sub> )	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;

$\phi$  = resistance factor, specified in Chapters B through K;

$\phi R_n$  = 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;

$\Omega$  = safety factor, specified in Chapters B through K;

$R_n / \Omega$  = 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:

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

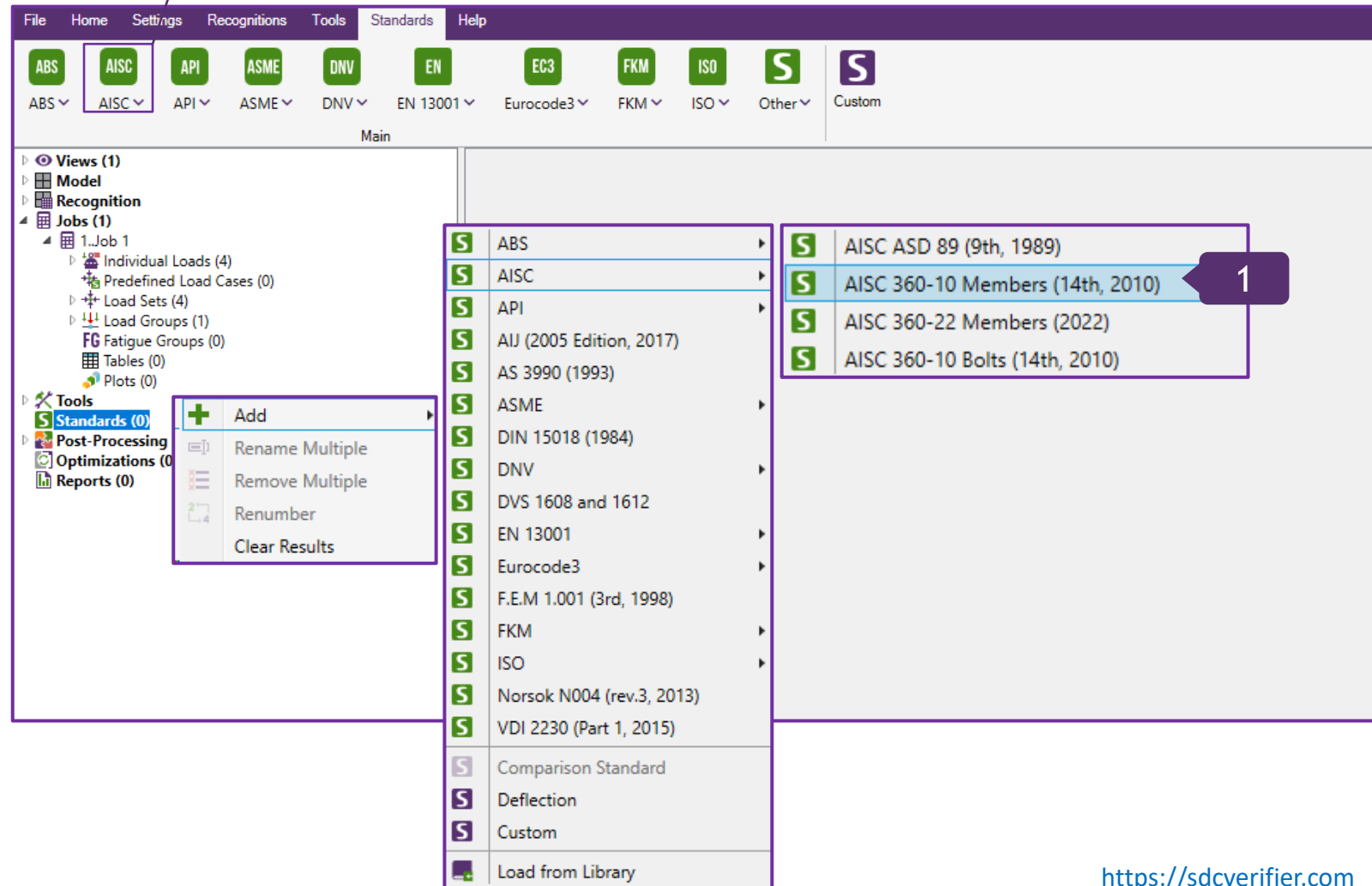
$\phi_t = 0.90 \text{ (LRFD)} \quad \Omega_t = 1.67 \text{ (ASD)}$

In SDC Verifier, multiplication is always used and ASD factor is converted to  $1 / S_f \text{ (ASD)}$ . For example: tensile resistance factor (F<sub>t</sub>) =  $1 / 1.67 = 0.6$

1

Execute right click on *Standards* and select *Add* => *AISC* => *AISC 360-10 Members (14th, 2010)*

An alternative method of adding Standards is to select AISC (in this case) in the Standards section of the Toolbar.





# Define AISC 360-10 LRFD Standard

1

Resistance Factors: *LRFD*

2

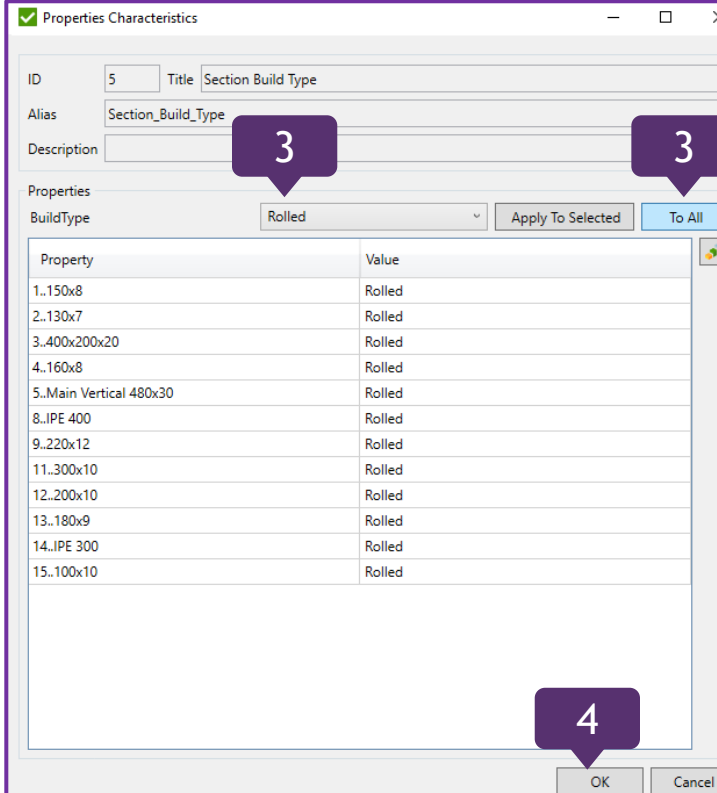
Press  to set *Section Build Type*

3

BuildType: *Rolled*;  
Press *To All*

4

Press *OK*



Properties Characteristics

ID: 5 Title: Section Build Type

Alias: Section\_Build\_Type

Description:

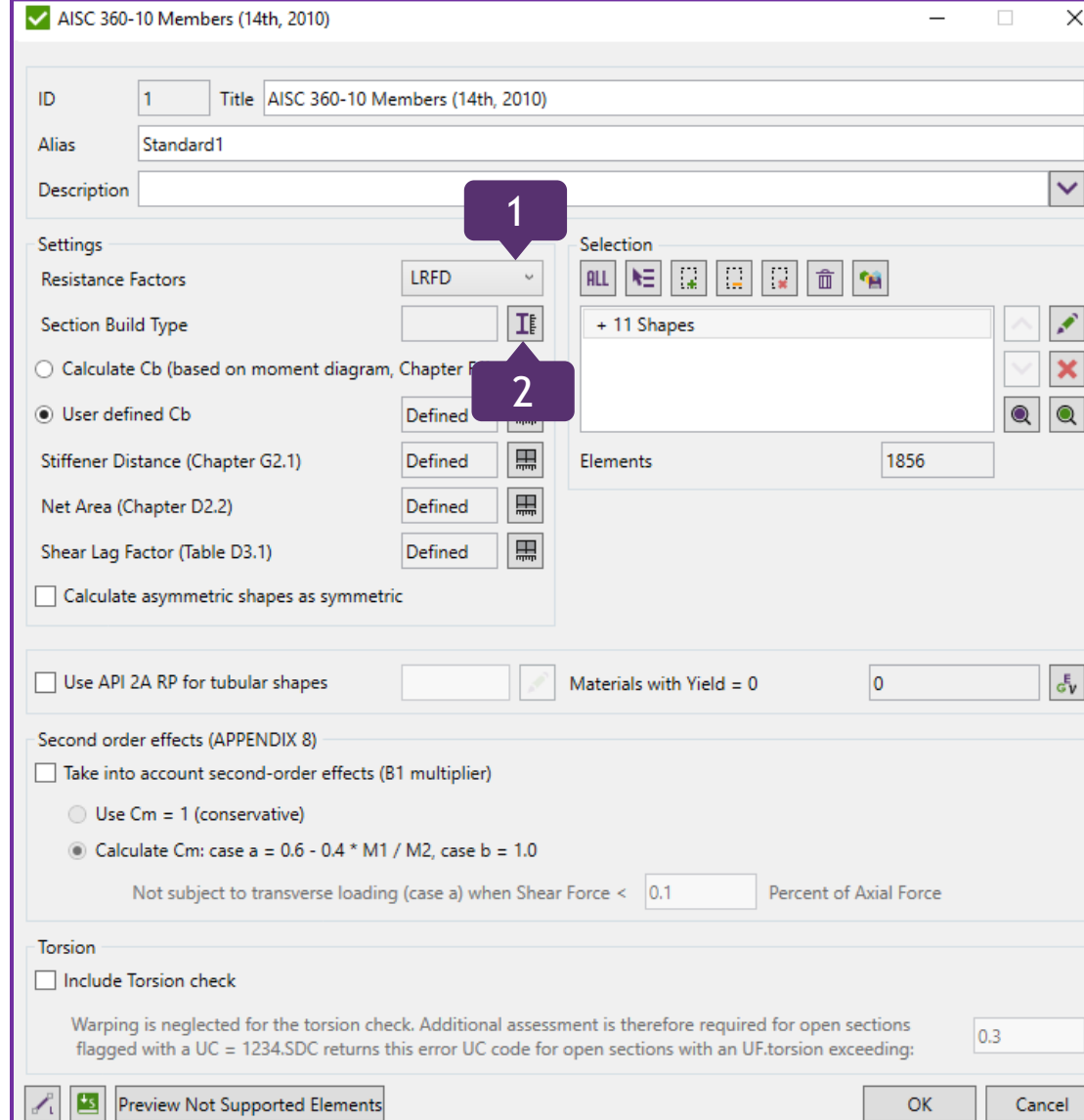
Properties

BuildType: Rolled

Apply To Selected To All

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

OK Cancel



AISC 360-10 Members (14th, 2010)


ID: 1 Title: AISC 360-10 Members (14th, 2010)

Alias: Standard1

Description:

Settings

Resistance Factors: LRFD

Section Build Type: 

☐ Calculate Cb (based on moment diagram, Chapter F)

☒ User defined Cb

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 = 0

Second order effects (APPENDIX 8)

☐ Take into account second-order effects (B1 multiplier)

☐ Use  $C_m = 1$  (conservative)

☒ Calculate  $C_m$ : case a =  $0.6 - 0.4 * M_1 / M_2$ , 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



# Lateral-Torsional Buckling Modification Factor ( $C_b$ )

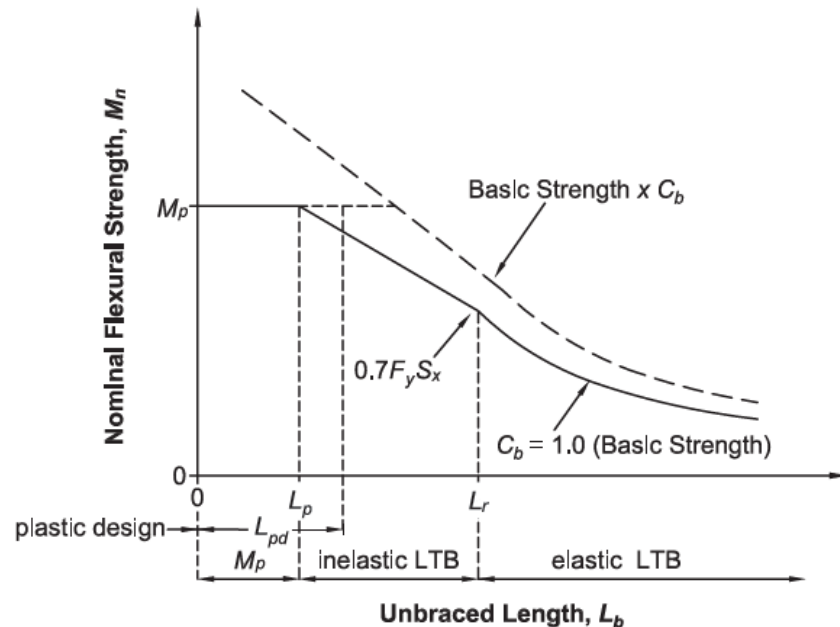
1

Select *Calculate  $C_b$  (based on moment diagram, Chapter F1)*

2

Press OK

SDC Verifier follows a 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:

Settings

Resistance Factors: LRFD

Section Build Type: Defined

☒ Calculate  $C_b$  (based on moment diagram, Chapter F1)

Member defined  $C_b$ : Defined

Member 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 = 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

1

2

# Standard has been created

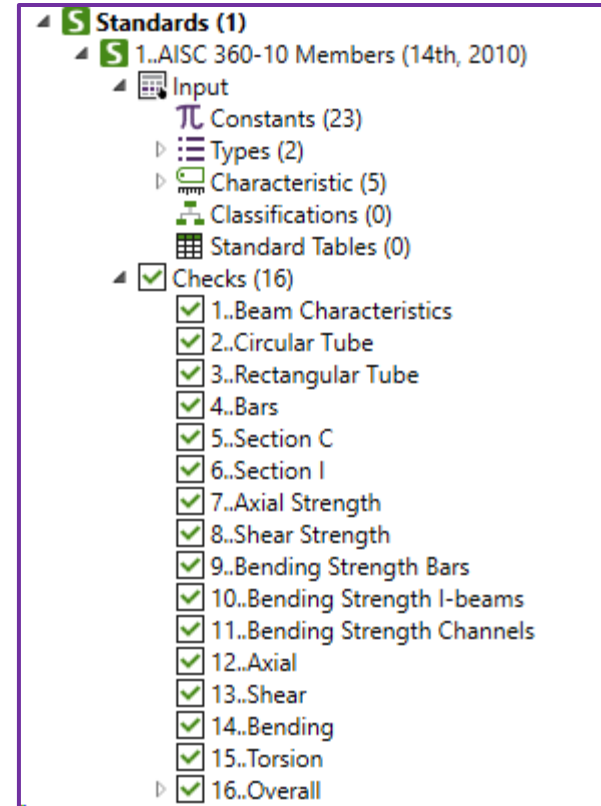
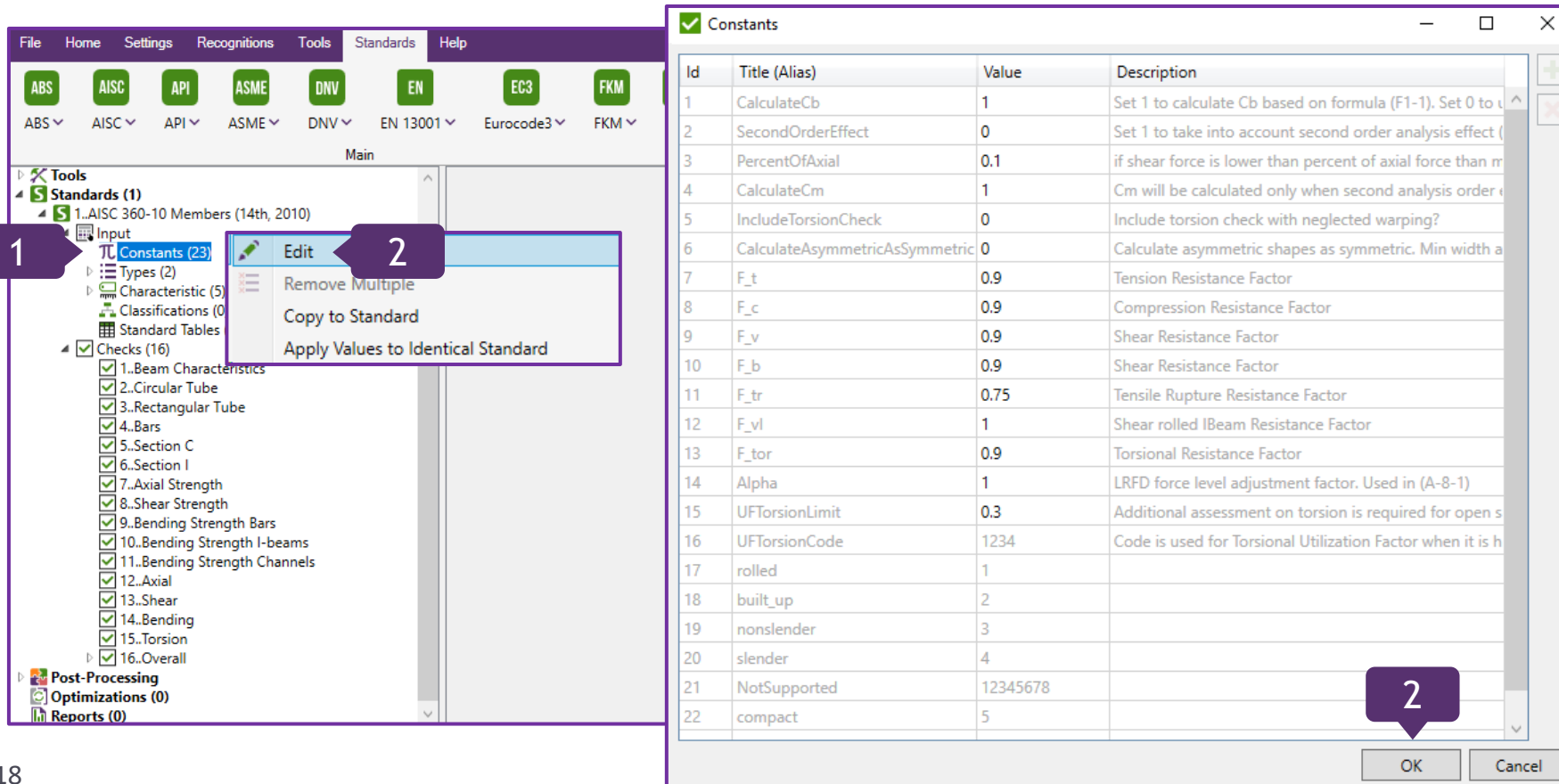
1

To check *Constants*, expand *Standards*  
=> 1.. AISC 360-10 Members (14th,  
2010) => *Input* and select *Constants*

2

Execute right click on *Constants* and select *Edit*;  
Press *OK*

It is possible to modify Safety  
Factors in Constants section.



16 Checks have been created.

# Preview Table Results

1

In *Checks* section, expand *16..Overall* and select *Tables*

2

Execute right click on *Tables* and select *Table (expand/extreme)*

3

In Load Group, press

4

Select *Load Group* => *1..Overall* and press *OK*

5

*Detailed (extreme locations - element and loads (for Loads Groups))* is ON

6

Press *Fill Table*

7

Press *OK*

**Custom Check Table**

ID: 2 Title:   
 Default Title: All (LG1, Component '3..AISC360 selection (s1)')  
 Description:   
 Options:   
 Check: 16..Overall  
 Load Group: 1..Overall  
 Direction/Parameter: All  
 Expand/Extreme Options:   
 Table Type: Extreme (worst result on selection)  
☒ Detailed (extreme locations - element and loads (for Loads Groups))  
☐ Report (only extremes)  
 Parameter: None  
 Value >: 1  
 Sort by:   
 Parameter: None  
 Order: Ascending  
 Selection:   
 + Component '3..AISC360 selection (s1)'  
 Elements: 1856  
 Fill Table

**Table Info: Component '3..AISC360 selection (s1)', LG1..Overall, Direction: All, Detailed, Extreme.**

Extreme	Uf Axial	Uf Bending Major	Uf Bending Minor	Uf Shear	Uf Axial and Bending	Uf Overall
<b>Minimum</b>						
Value	0.00	0.00	0.00	0.00	0.00	0.00
Element ID	59	1528	1134	1877	1180	201
Load	LS3	LS2	LS2	LS4	LS2	LS2
<b>Maximum</b>						
Value	0.32	0.65	1.82	0.22	1.82	1.82
Element ID	955	171	1854	1125	1854	1854
Load	LS3	LS3	LS3	LS3	LS4	LS4
<b>Absolute</b>						
Value	0.32	0.65	1.82	0.22	1.82	1.82
Element ID	955	171	1854	1125	1854	1854
Load	LS3	LS3	LS3	LS3	LS4	LS4

**Select Load**

Load Type:   
☐ Individual Load  
☐ Load Set  
☒ Load Group  
 Fatigue Group:   
 Load Group: 1..Overall  
 OK Cancel

**Table (expand/extreme)**

- Table (expand/extreme)
- Components Extreme Table (over selections)
- Flow Table (over loads)
- Rename Multiple
- Remove Multiple
- Renumber

Utilization Factor on element ID=1854 does not pass the check:  $1.82 > 1$

# Utilization Factor Plot

1

In Checks section, expand 16..Overall and select *Plots*

2

Execute right click on *Plots* and select *Criteria Plot*

3

In Load Group, press 

4

Select *Load Group* => *1..Overall* and press *OK*

5

Parameter: *Uf Overall*

6

LG Parameter: *Absolute*

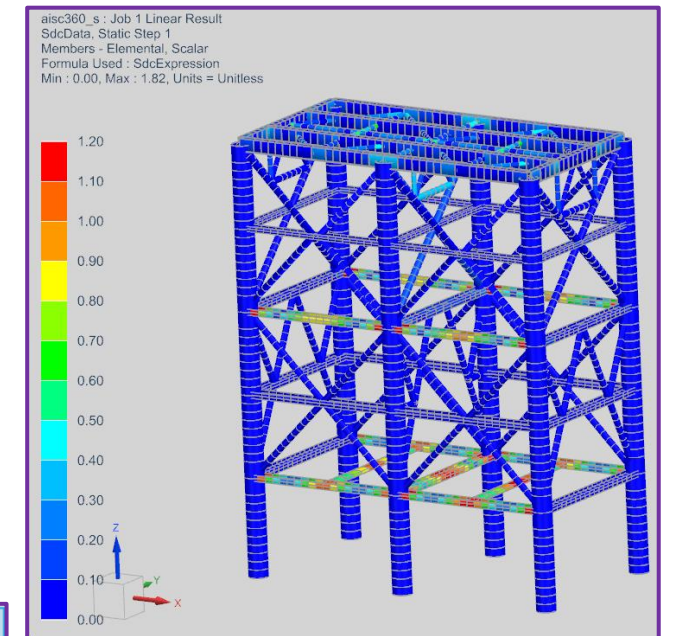
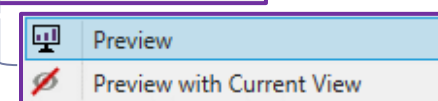
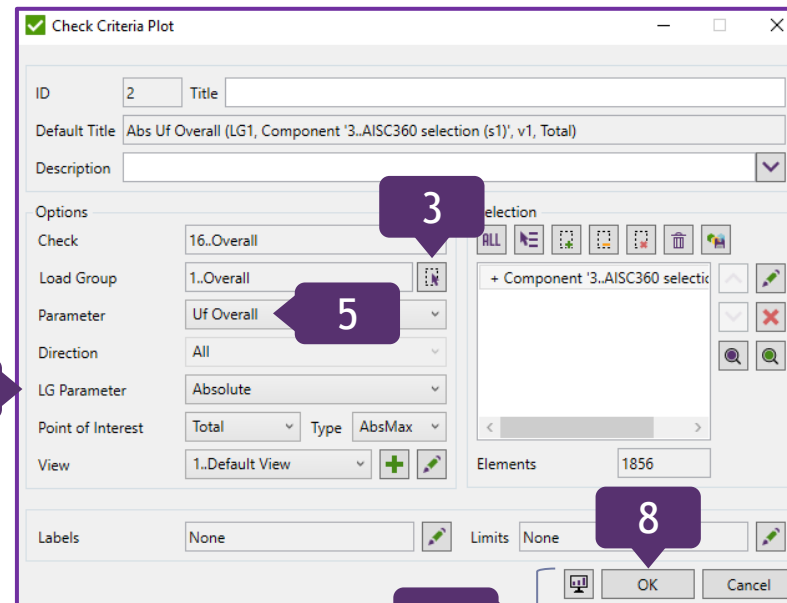
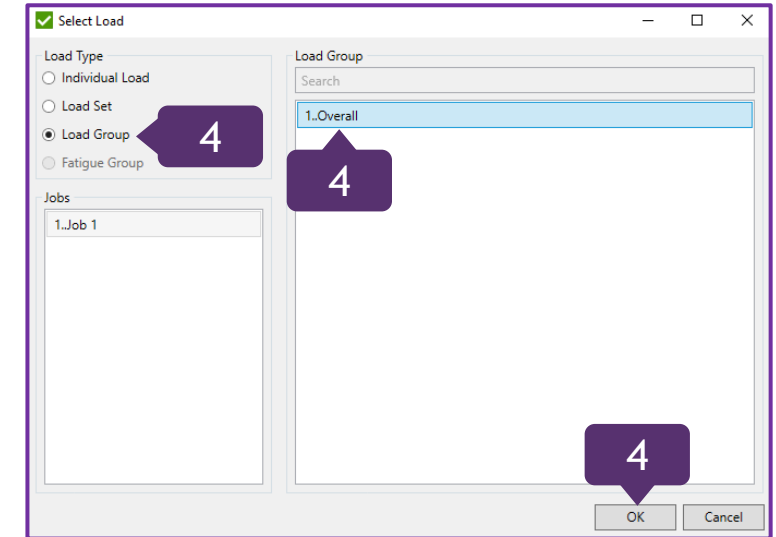
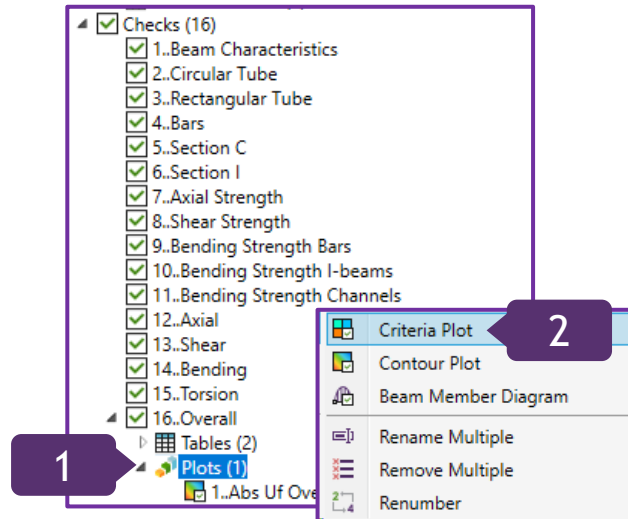
7

Press , and then *Preview*

8

Press *OK*

SDC Verifier uses Legend from 0.00 to 1.20 for Utilization Factor. Elements in orange and red do not pass the check.

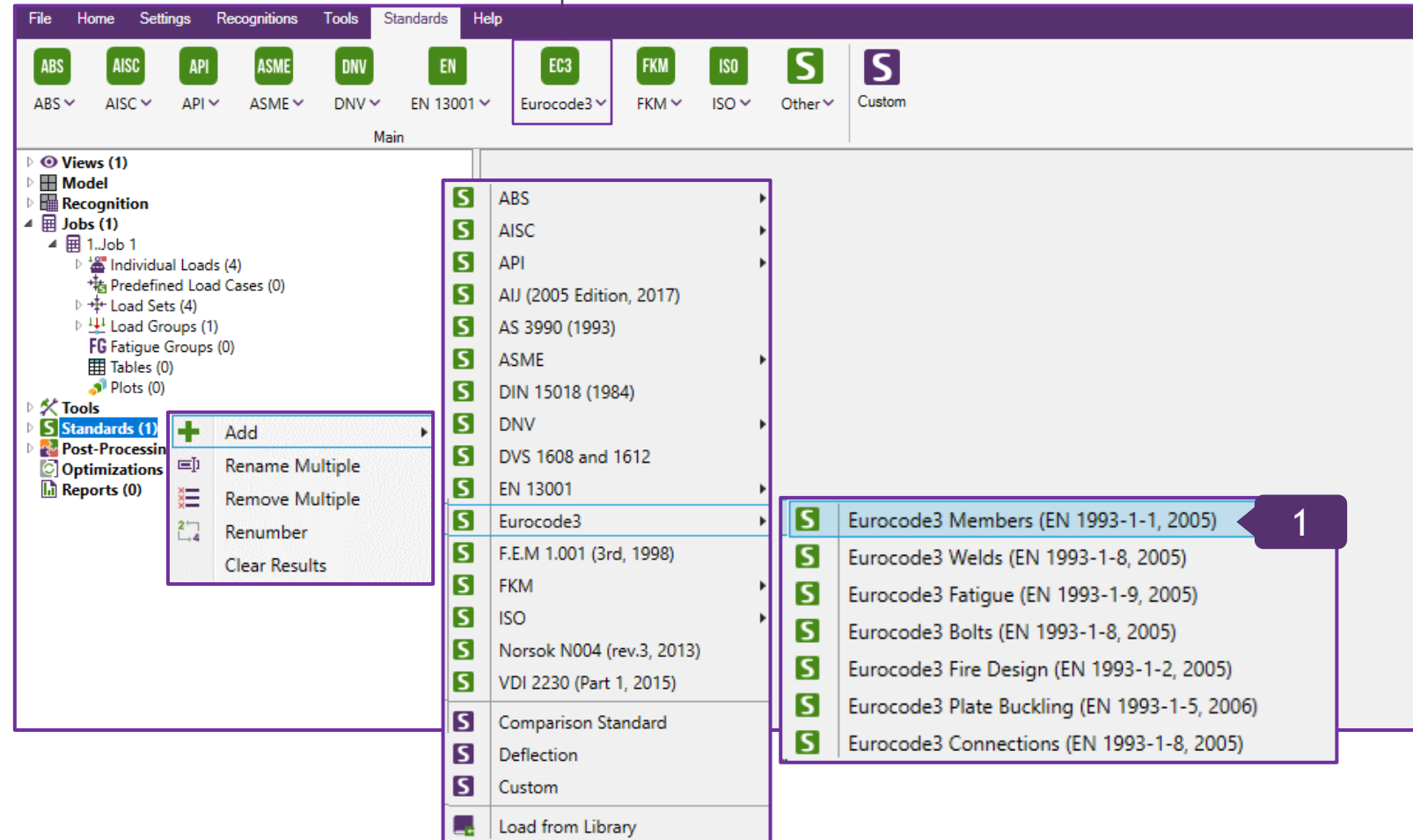


# Add Eurocode3 Members (EN1993-1-1, 2005) Standard

1

Execute right click on *Standards* and select *Add* => *Eurocode3* => *Eurocode3 Members (EN 1993-1-1, 2005)*

An alternative method of adding Standards is to select Eurocode3 (in this case) in the Standards section of the Toolbar.



**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;  
**B** - correction factor for the lateral torsional buckling curves for rolled sections;  
 $\eta$  - is used in the shear area calculations.

**Note:** All parameters may be taken from the National Annex.

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).

**Fabrication Type:** Rolled/Welded;  
**Manufacture Type:** Hot Finished/Cold Formed;  
**Fillet** 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.

☒ 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
Partial Factor Gm1	1
Partial Factor Gm2	1.25
Lambda LT,0	0.4
Beta	0.75
Eta	1.2

**Correction Factor Kc**

☒ Calculate According to Table 6.6

☐ Set Kc = 1 for All Members

**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)

**Fabrication Type**

Fabrication Type: Defined

Manufacture Method: Defined

Fillet: Defined

Section Net Area: Defined

Material Type: Defined

**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

☐ Calculate Asymmetric Shapes as Symmetric

☐ Calculate Class 4 of Cross Section as Class 3

Materials with Yield and Tensile = 0: 0

Selection: 12 Properties

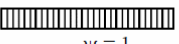




Preview Not Supported Elements

OK Cancel






A correction Factor  $K_c$  can be calculated, using the  $C_m$  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

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

ID: 2 Title: Eurocode3 Members (EN1993-1-1, 2005)

Alias: Standard2

Description:

Factors

Partial Factor  $G_{m0}$ : 1

Partial Factor  $G_{m1}$ : 1

Partial Factor  $G_{m2}$ : 1.25

Lambda  $LT,0$ : 0.4

Beta: 0.75

Eta: 1.2

Fabrication Type: Defined

Manufacture Method: Defined

Fillet: Defined

Section Net Area: Defined

Material Type: Defined

Correction Factor  $K_c$

☒ Calculate According to Table 6.6

☐ Set  $K_c = 1$  for All Members

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)

Lengths for Torsional-Flexural and Lateral Torsional Buckling

☒  $LT = \text{Max}(L_y, L_z)$

☐  $L_{LT} = \text{Length in Strong Axis (} L_y \text{ or } L_z \text{)}$

☐ Use Torsional Length from Beam Member Finder

☐ Calculate Asymmetric Shapes as Symmetric

☐ Calculate Class 4 of Cross Section as Class 3

Materials with Yield and Tensile = 0: 0

Selection: 12 Properties

Preview Not Supported Elements

OK Cancel

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 a user.

**Beam Member Finder**

Length Y Length Z Length Torsional Edit Member (in all directions) Filter

Break Joint Options

Torsion (Lb)

☐ 1D ☐ User

☒ 2Dy ☐ Plate 2Dy

☒ 2Dz ☐ Plate 2Dz

ID	Title	Elements	Length	Length Factor	Cm Type	Modified	Joint - NodeID [Joint Type]
1	Beam Member 1 (T)	47	13000				201[3D] 1110[3D] 202[3D] 1111[3D]
1.1	Beam Member 1.1 (T)	9	2500	1	A		
1.2	Beam Member 1.2 (T)	9	2500	1	A		
1.3	Beam Member 1.3 (T)	9	2500	1	A		

# Define Fabrication Type

1

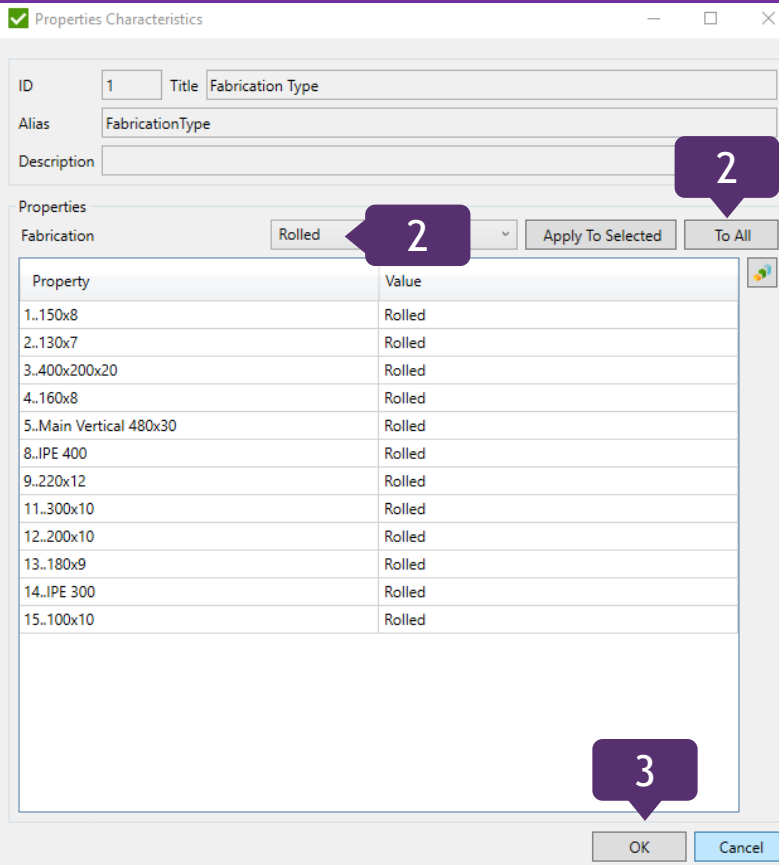
Press  in *Fabrication Type*

2

Fabrication: *Rolled* and press *To All*

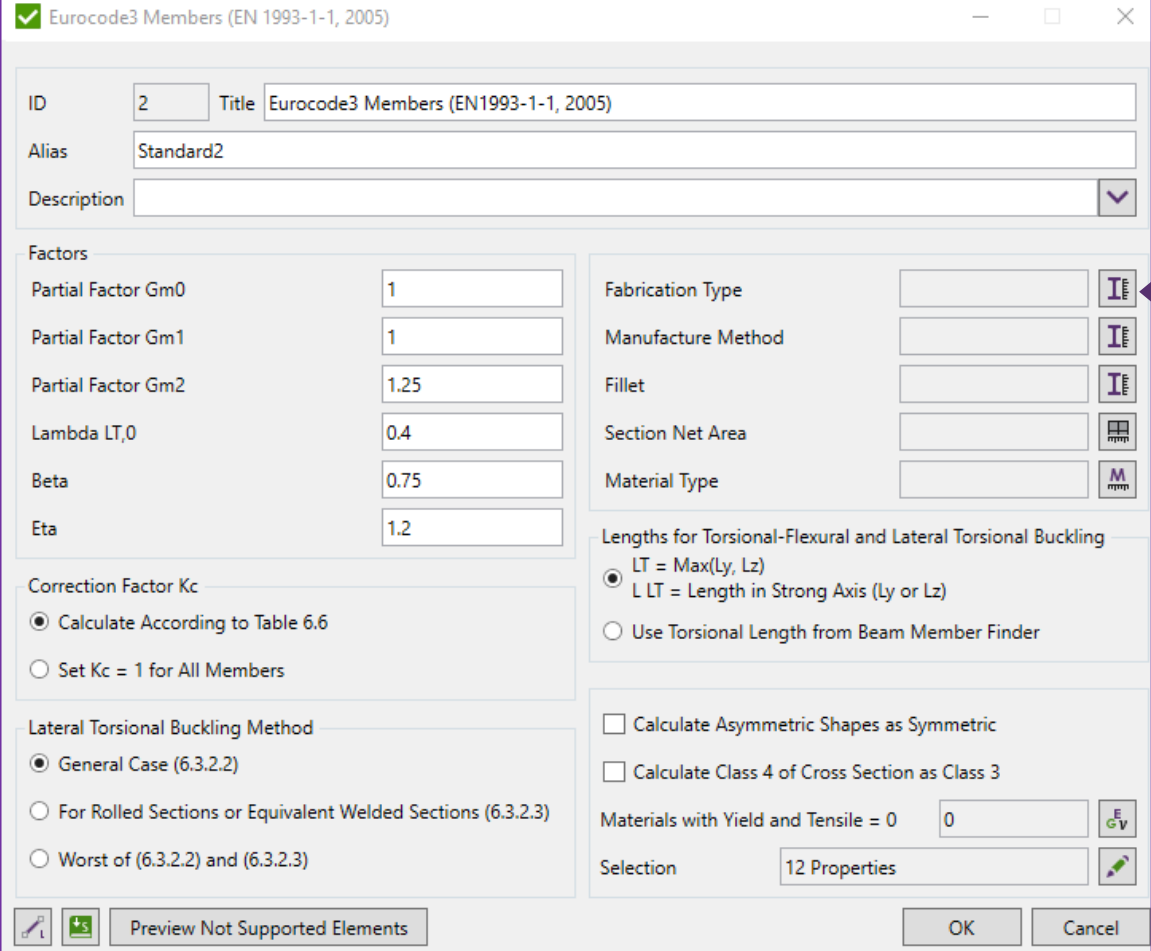
3

Press *OK*



The 'Properties Characteristics' dialog box is shown. The 'ID' is 1 and the 'Title' is 'Fabrication Type'. The 'Alias' is 'FabricationType'. The 'Description' field is empty. Under the 'Properties' section, the 'Fabrication' dropdown is set to 'Rolled' (indicated by callout 2). The 'Apply To Selected' and 'To All' buttons are visible. A table lists 15 properties, all with a value of 'Rolled'. At the bottom, there are 'OK' and 'Cancel' buttons (indicated by callout 3).

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



The 'Eurocode3 Members (EN 1993-1-1, 2005)' dialog box is shown. The 'ID' is 2 and the 'Title' is 'Eurocode3 Members (EN1993-1-1, 2005)'. The 'Alias' is 'Standard2'. The 'Description' field is empty. The 'Factors' section contains input fields for Partial Factor Gm0 (1), Partial Factor Gm1 (1), Partial Factor Gm2 (1.25), Lambda LT,0 (0.4), Beta (0.75), and Eta (1.2). The 'Correction Factor Kc' section has radio buttons for 'Calculate According to Table 6.6' (selected), 'Set Kc = 1 for All Members', and 'General Case (6.3.2.2)'. The 'Lateral Torsional Buckling Method' section has radio buttons for 'General Case (6.3.2.2)' (selected), 'For Rolled Sections or Equivalent Welded Sections (6.3.2.3)', and 'Worst of (6.3.2.2) and (6.3.2.3)'. The 'Fabrication Type' dropdown is set to 'Rolled' (indicated by callout 1). The 'Manufacture Method' dropdown is set to 'Standard'. The 'Fillet' dropdown is set to 'Standard'. The 'Section Net Area' dropdown is set to 'Standard'. The 'Material Type' dropdown is set to 'Standard'. The 'Lengths for Torsional-Flexural and Lateral Torsional Buckling' section has radio buttons for 'LT = Max(Ly, Lz)' (selected) and 'L LT = Length in Strong Axis (Ly or Lz)'. The 'Use Torsional Length from Beam Member Finder' checkbox is unchecked. The 'Calculate Asymmetric Shapes as Symmetric' checkbox is unchecked. The 'Calculate Class 4 of Cross Section as Class 3' checkbox is unchecked. The 'Materials with Yield and Tensile = 0' input field is set to 0. The 'Selection' dropdown is set to '12 Properties'. At the bottom, there are 'Preview Not Supported Elements', 'OK', and 'Cancel' buttons.



# Define Manufacture Method

1

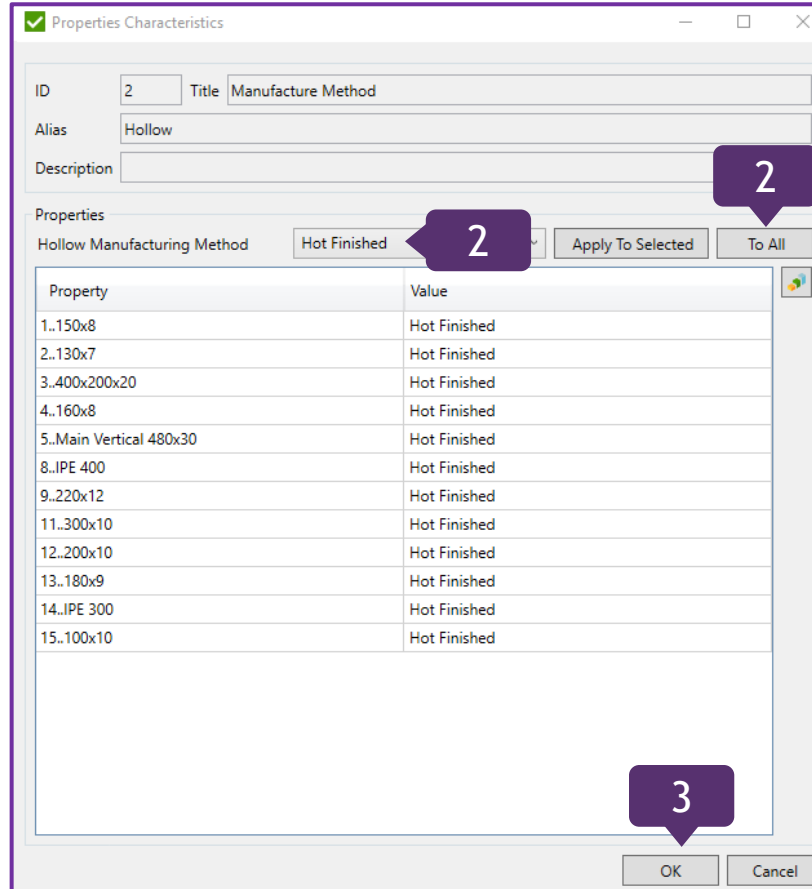
Press  in *Manufacture Method*

2

Hollow Manufacturing Method: *Hot Finished* and press *To All*

3

Press *OK*



Properties Characteristics

ID: 2 Title: Manufacture Method

Alias: Hollow

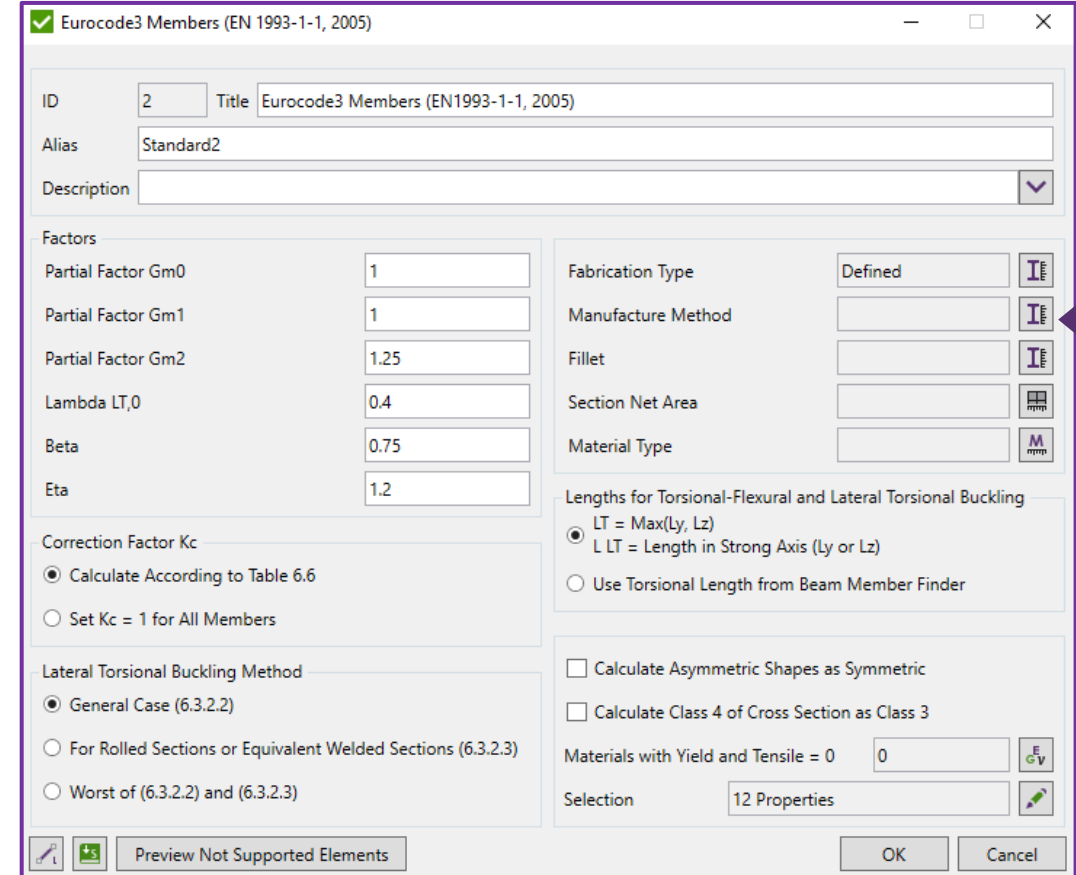
Description:

Properties

Hollow Manufacturing Method: **Hot Finished** (2) [Apply To Selected] [To All] (2)

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

(3) [OK] [Cancel]



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

ID: 2 Title: Eurocode3 Members (EN1993-1-1, 2005)

Alias: Standard2

Description:

Factors

Partial Factor Gm0: 1

Partial Factor Gm1: 1


Partial Factor Gm2: 1.25


Lambda LT,0: 0.4


Beta: 0.75


Eta: 1.2

Fabrication Type: Defined (1)

Manufacture Method:  (1)

Fillet: 

Section Net Area: 

Material Type: 

Lengths for Torsional-Flexural and Lateral Torsional Buckling

☒ LT = Max(Ly, Lz)

☐ LT = Length in Strong Axis (Ly or Lz)

☐ Use Torsional Length from Beam Member Finder

Correction Factor Kc

☒ Calculate According to Table 6.6

☐ Set Kc = 1 for All Members

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)

☐ Calculate Asymmetric Shapes as Symmetric

☐ Calculate Class 4 of Cross Section as Class 3

Materials with Yield and Tensile = 0

Selection: 12 Properties

[Preview Not Supported Elements] [OK] [Cancel]

# Define Fillet

1

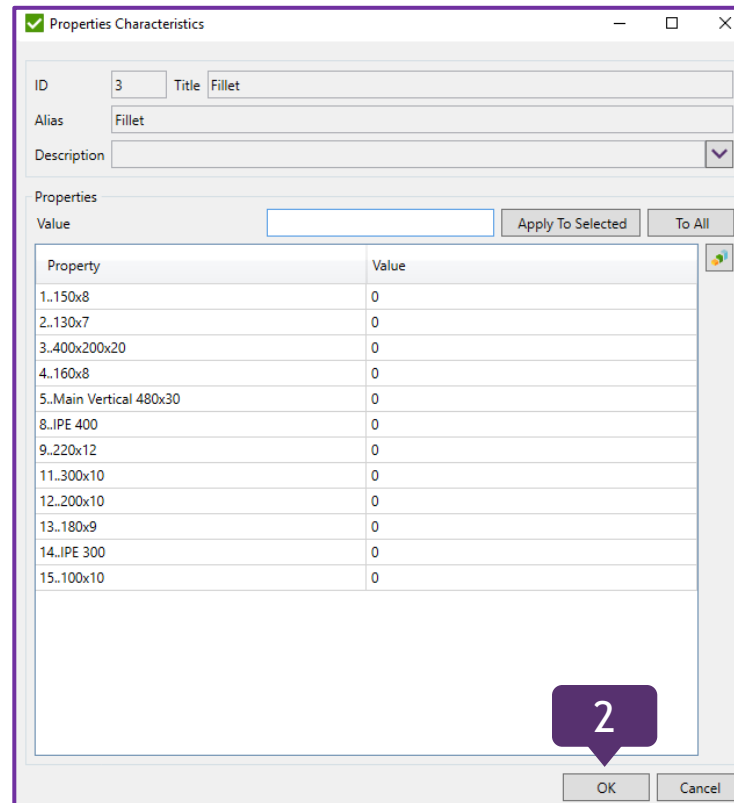
Press  in *Fillet*

2

Press *OK*

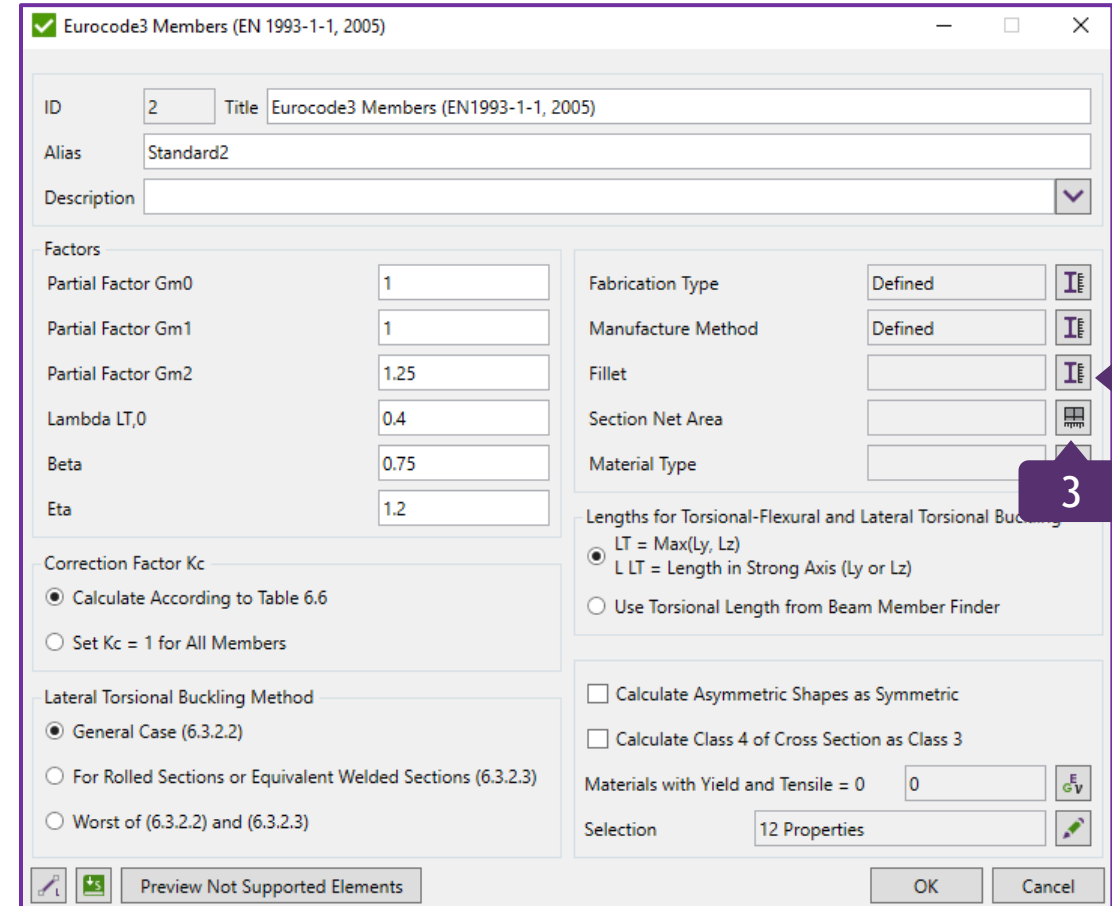
3

Repeat steps 1-2 for *Section Net Area*



Properties Characteristics dialog box. ID: 3, Title: Fillet, Alias: Fillet. A table lists 15 properties with values of 0. Callout 2 points to the OK button.




Property	Value
1..150x8	0
2..130x7	0
3..400x200x20	0
4..160x8	0
5..Main Vertical 480x30	0
8..IPE 400	0
9..220x12	0
11..300x10	0
12..200x10	0
13..180x9	0
14..IPE 300	0
15..100x10	0



Eurocode3 Members (EN 1993-1-1, 2005) dialog box. ID: 2, Title: Eurocode3 Members (EN1993-1-1, 2005), Alias: Standard2. Callout 1 points to the Fillet icon, and callout 3 points to the Section Net Area icon.

Factors

Partial Factor Gm0	1
Partial Factor Gm1	1
Partial Factor Gm2	1.25
Lambda LT,0	0.4
Beta	0.75
Eta	1.2

Fabrication Type: Defined  
Manufacture Method: Defined  
Fillet:  (Callout 1)  
Section Net Area:  (Callout 3)  
Material Type: 

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

Correction Factor Kc

- ☒ Calculate According to Table 6.6
- ☐ Set Kc = 1 for All Members

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)

Materials with Yield and Tensile = 0

Selection: 12 Properties

Preview Not Supported Elements

OK Cancel

# Define Material Type

1

Press  **Material Type**

2

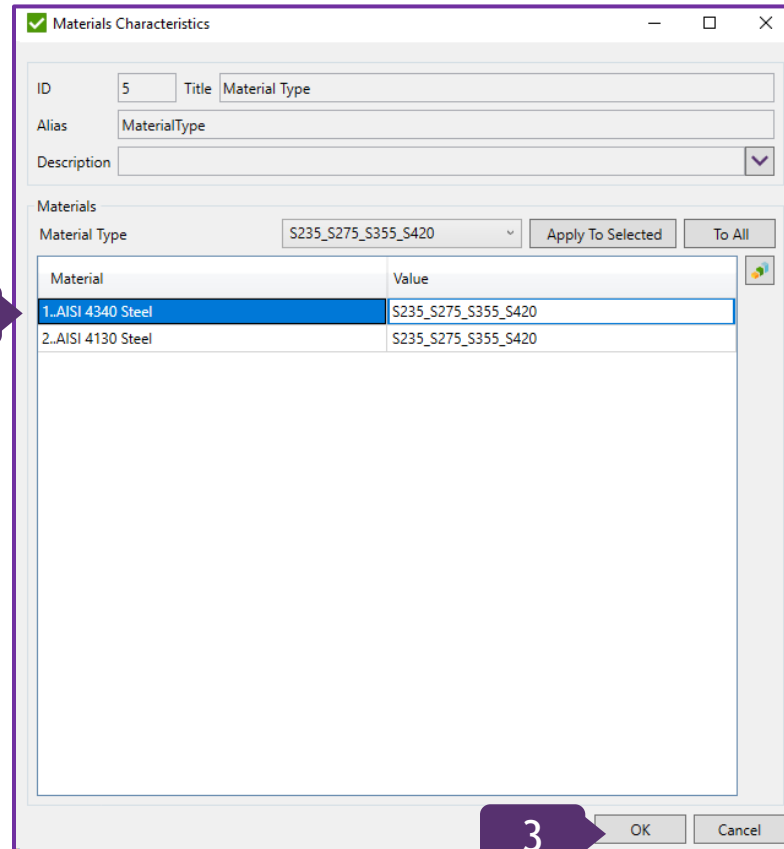
Select **1..AISI 4340 Steel** with **Value:**  
**S235\_S275\_S355\_S420**

3

Press **OK**

4

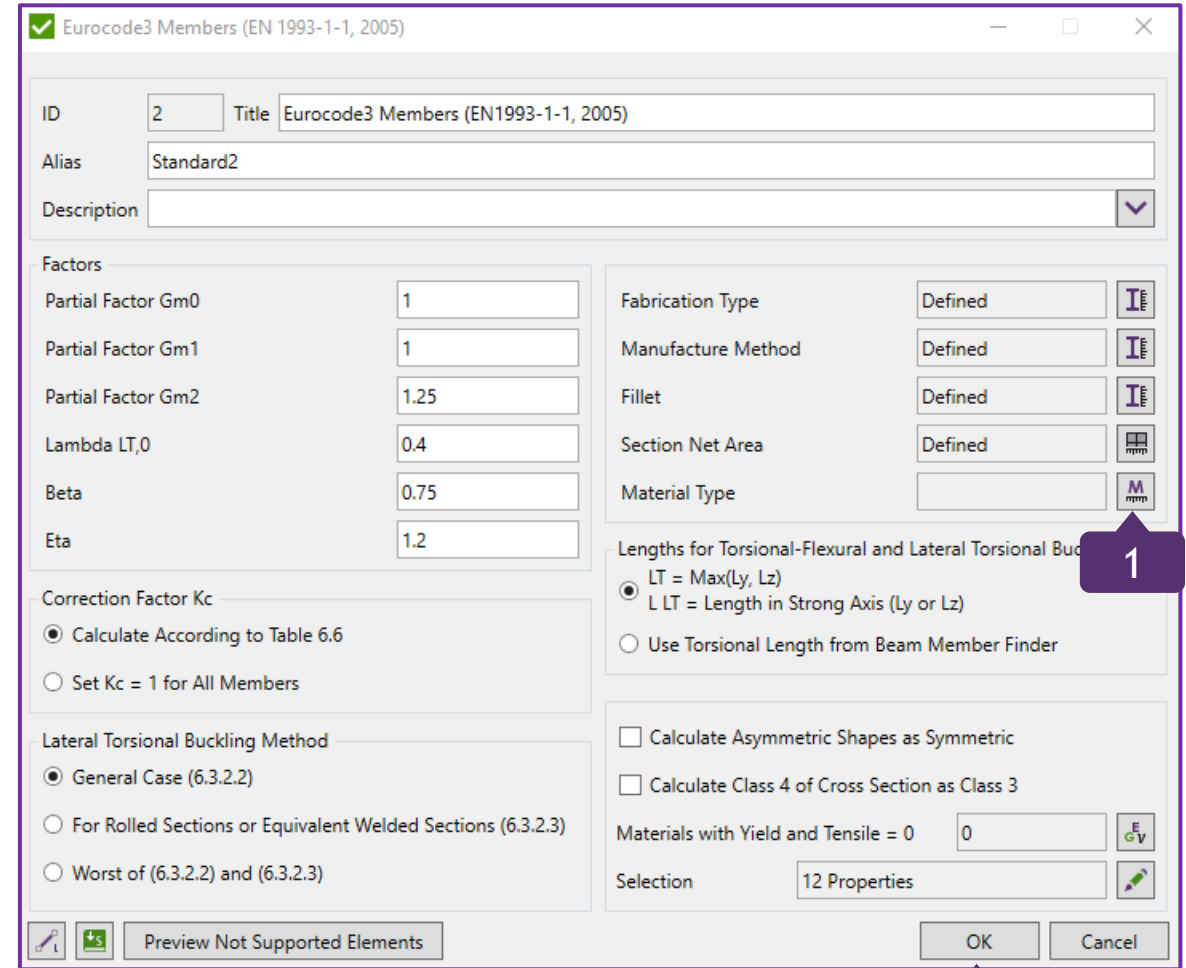
Press **OK**



The **Materials Characteristics** dialog box is shown. The **ID** is 5 and the **Title** is **Material Type**. The **Alias** is **MaterialType**. The **Description** is empty. The **Materials** section shows **Material Type** set to **S235\_S275\_S355\_S420**. Below this is a table with two columns: **Material** and **Value**.

Material	Value
1..AISI 4340 Steel	S235_S275_S355_S420
2..AISI 4130 Steel	S235_S275_S355_S420

The **OK** button is highlighted with a blue arrow labeled '3'.



The **Eurocode3 Members (EN 1993-1-1, 2005)** dialog box is shown. The **ID** is 2 and the **Title** is **Eurocode3 Members (EN1993-1-1, 2005)**. The **Alias** is **Standard2**. The **Description** is empty. The **Factors** section has the following values: **Partial Factor Gm0** (1), **Partial Factor Gm1** (1), **Partial Factor Gm2** (1.25), **Lambda LT,0** (0.4), **Beta** (0.75), and **Eta** (1.2). The **Fabrication Type** is **Defined**, **Manufacture Method** is **Defined**, **Fillet** is **Defined**, **Section Net Area** is **Defined**, and **Material Type** is empty. The **Lengths for Torsional-Flexural and Lateral Torsional Buckling** section has **LT = Max(Ly, Lz)** selected. The **Correction Factor Kc** section has **Calculate According to Table 6.6** selected. The **Lateral Torsional Buckling Method** section has **General Case (6.3.2.2)** selected. The **Materials with Yield and Tensile** is 0. The **Selection** is **12 Properties**. The **OK** button is highlighted with a blue arrow labeled '4'.

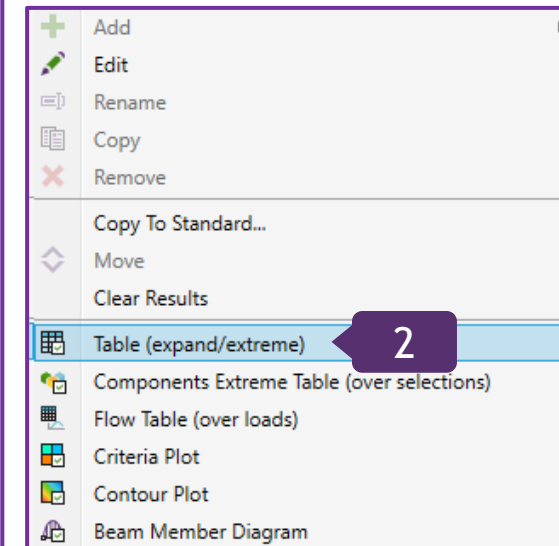
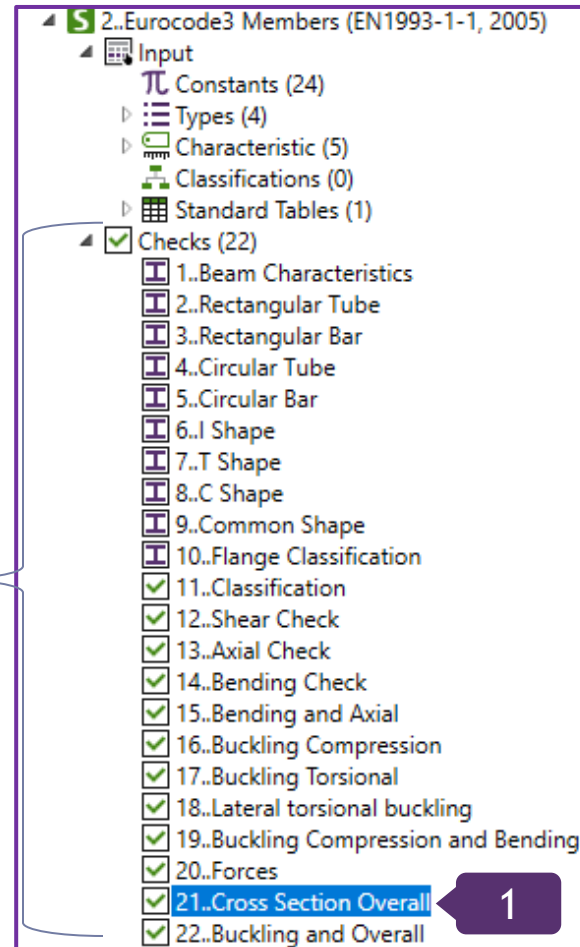
1

In *Checks* section of 2..Eurocode3 Members, execute right click on 21..*Cross Section Overall*

2

Select *Table (expand/extreme)*

22 Checks have been created.



# Preview Table Results (Continuation)

3

Press  to select *Load*

4

Select *Load Group* => *1..Overall*;  
Press *OK*

5

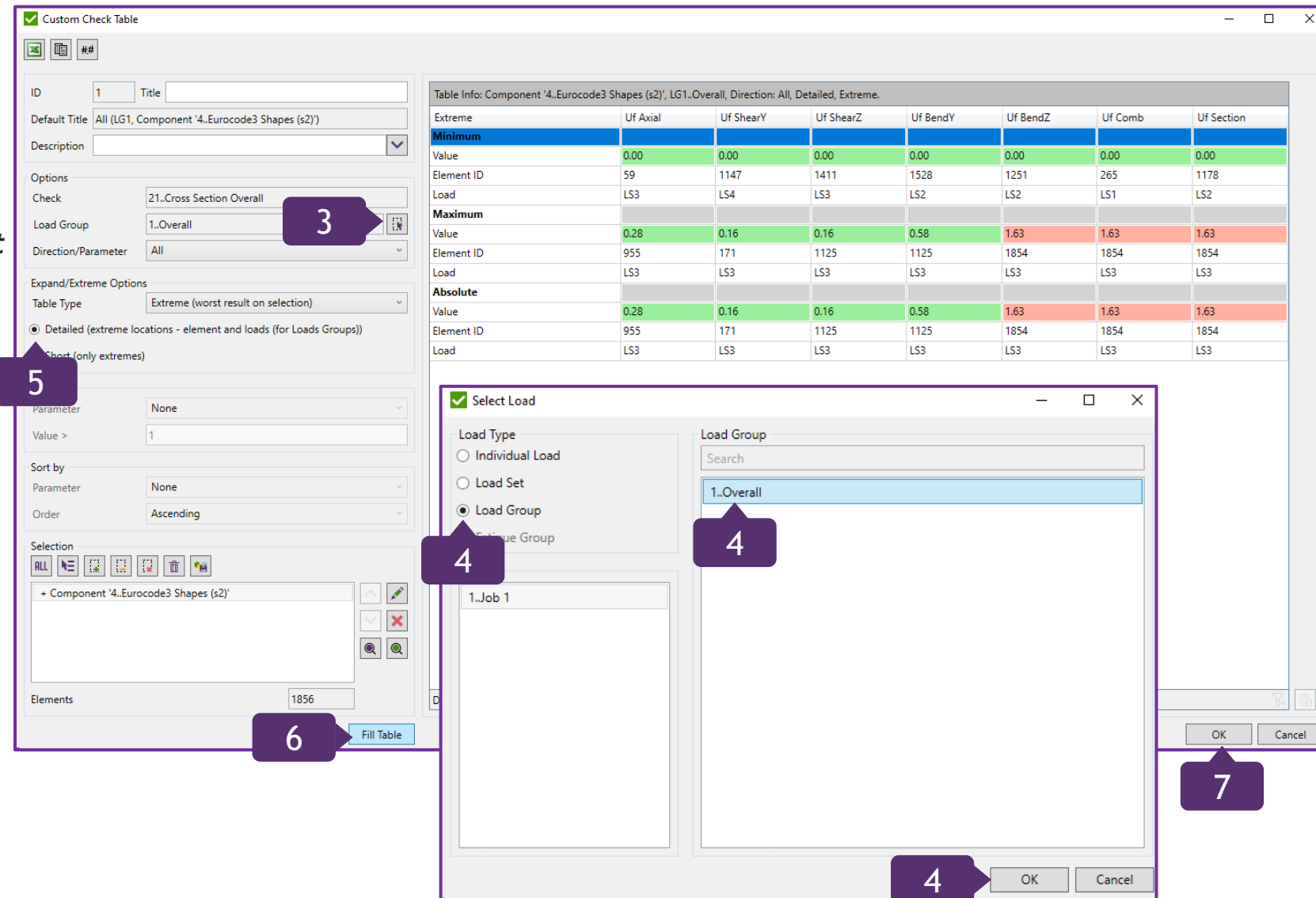
*Detailed (extreme locations - element  
and loads (for Loads Groups))* is *ON*

6

Press *Fill Table*

7

Press *OK*



**Custom Check Table**

ID: 1 Title:   
Default Title: All (LG1, Component '4.Eurocode3 Shapes (s2)')  
Description:   
Options:  
Check: 21..Cross Section Overall  
Load Group: 1..Overall  
Direction/Parameter: All  
Expand/Extreme Options:  
Table Type: Extreme (worst result on selection)  
☒ Detailed (extreme locations - element and loads (for Loads Groups))  
☐ Short (only extremes)  
Parameter: None  
Value >: 1  
Sort by:  
Parameter: None  
Order: Ascending  
Selection:  
+ Component '4.Eurocode3 Shapes (s2)'  
Elements: 1856  
Fill Table

**Table Info:** Component '4.Eurocode3 Shapes (s2)', LG1..Overall, Direction: All, Detailed, Extreme.

Extreme	Uf Axial	Uf ShearY	Uf ShearZ	Uf BendY	Uf BendZ	Uf Comb	Uf Section
<b>Minimum</b>							
Value	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Element ID	59	1147	1411	1528	1251	265	1178
Load	LS3	LS4	LS3	LS2	LS2	LS1	LS2
<b>Maximum</b>							
Value	0.28	0.16	0.16	0.58	1.63	1.63	1.63
Element ID	955	171	1125	1125	1854	1854	1854
Load	LS3	LS3	LS3	LS3	LS3	LS3	LS3
<b>Absolute</b>							
Value	0.28	0.16	0.16	0.58	1.63	1.63	1.63
Element ID	955	171	1125	1125	1854	1854	1854
Load	LS3	LS3	LS3	LS3	LS3	LS3	LS3

**Select Load**

Load Type:  
☐ Individual Load  
☐ Load Set  
☒ Load Group  
Load Group:  
Search:  
1..Overall  
1..Job 1  
OK Cancel

# Utilization Factor Plot

1

In *Checks* section of 2..Eurocode3 Members, execute right click on 21..Cross Section Overall

2

Select *Criteria Plot*

3

Press  to select *Load*

4

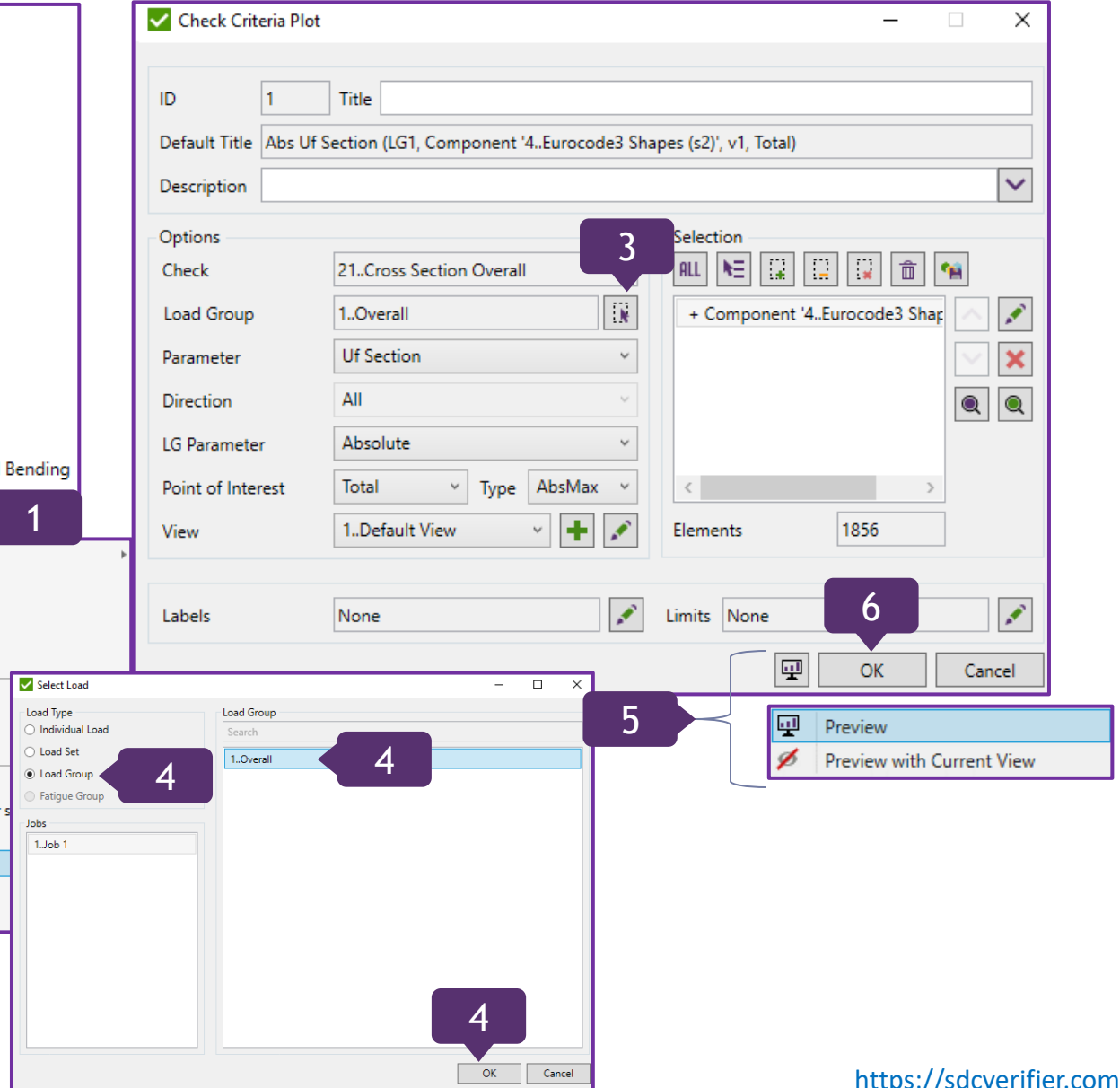
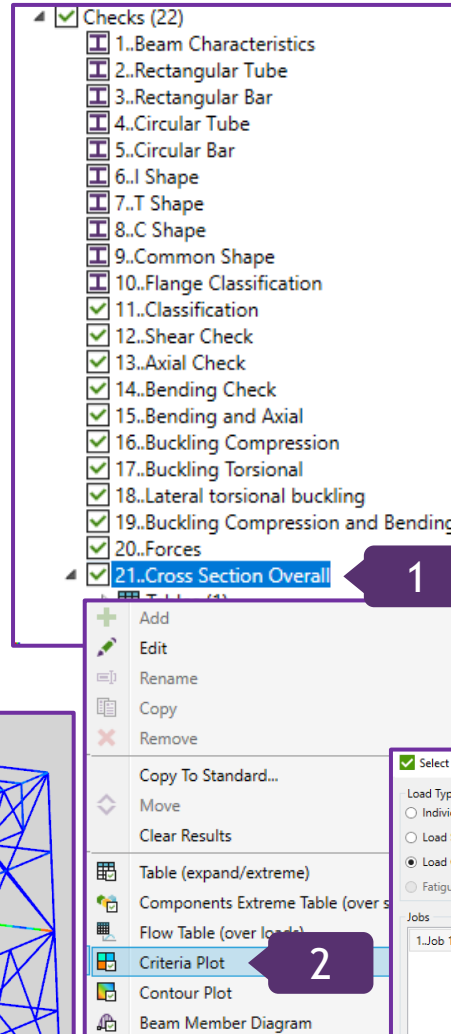
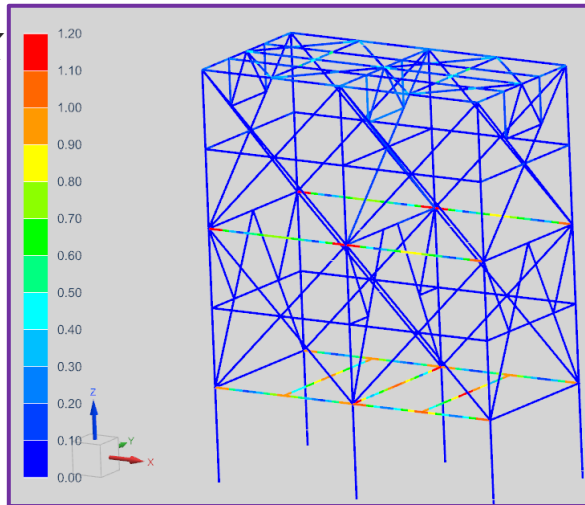
Select *Load Group* => 1..Overall; Press *OK*

5

Press , and then *Preview*

6

Press *OK*



To learn how to obtain reports, please check a separate Tutorial that depicts the functionality of SDC Verifier Report Designer. It may be downloaded via this link:

<https://sdcverifier.com/tutorials/report-designer/>