



Tutorial

# AISC 360-10 & Eurocode3

Updated on: 18 Apr 2023

Tested with: SDC Verifier 2023 R1

Ansys version 2022

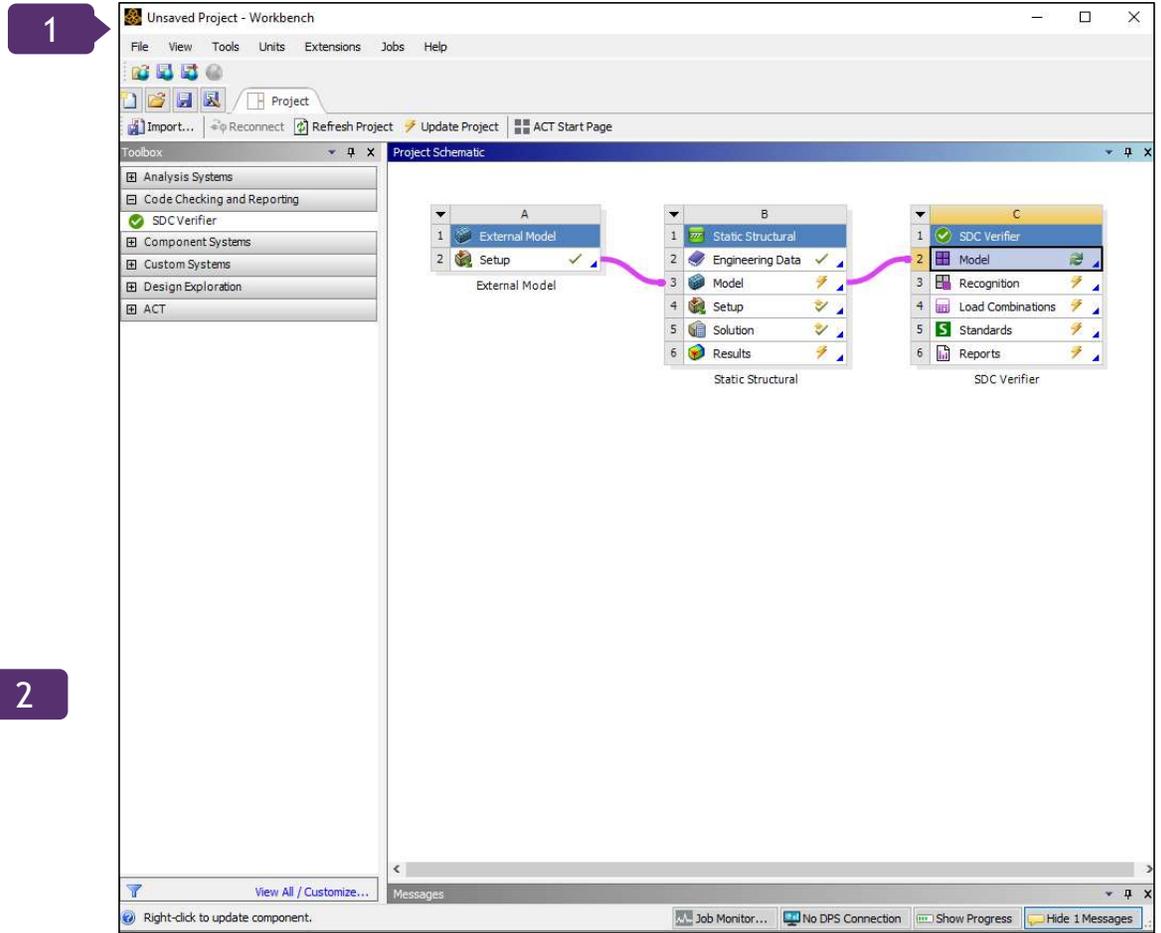
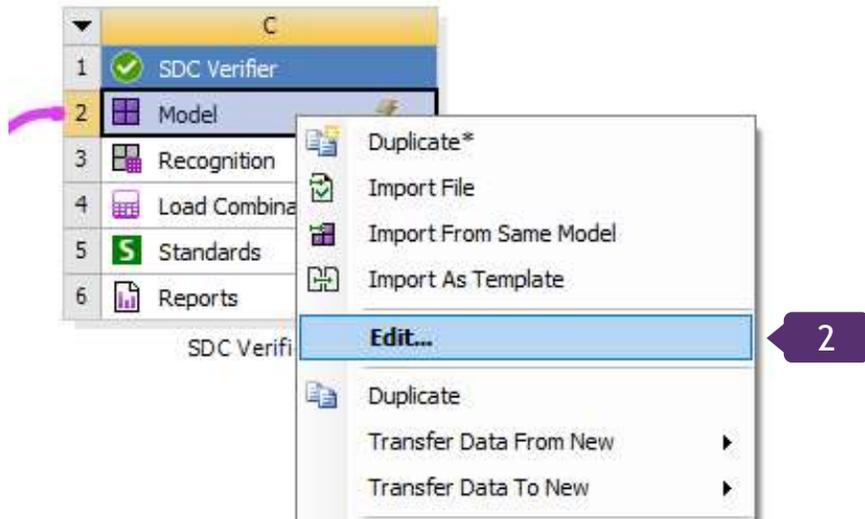
## Preface

- In this tutorial, AISC 360-10 & Eurocode3 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 & Eurocode3 standards.

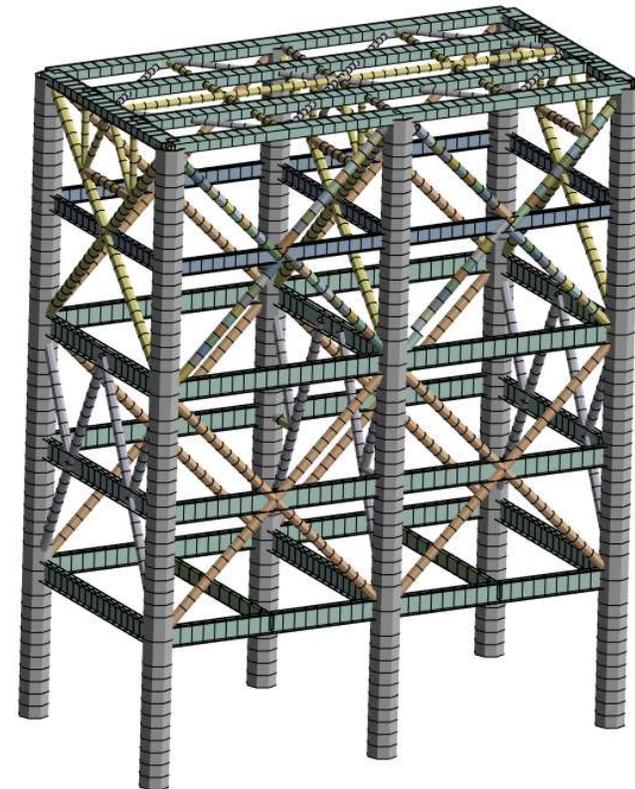
# Launch SDC Verifier

1 Open in Ansys *Workbench* *AISC360 and Eurocode3.wbpj*

2 Double Click on Model or in context menu click *Edit*



- ▶ Views (1)
- ▶ Model
- ▶ Recognition
- ▶ Jobs (1)
  - ▶ 1..Static Structural
    - ▶ Individual Loads (4)
      - ▶ 1..Gravity (S1)
      - ▶ 2..Force Down (S2)
      - ▶ 3..Force Top (S3)
      - ▶ 4..Force Middle (S4)
    - ▶ Load Sets (4)
      - ▶ 1..The worst case
      - ▶ 2..1 and 2 loads
      - ▶ 3..3 and 4 loads
      - ▶ 4..2-4 loads
    - ▶ Load Groups (1)
    - ▶ FG Fatigue Groups (0)
    - ▶ Tables (0)
    - ▶ Plots (1)
- ▶ Tools
- ▶ Standards (2)
- ▶ Post-Processing
- ▶ Optimizations (0)
- ▶ Reports (0)

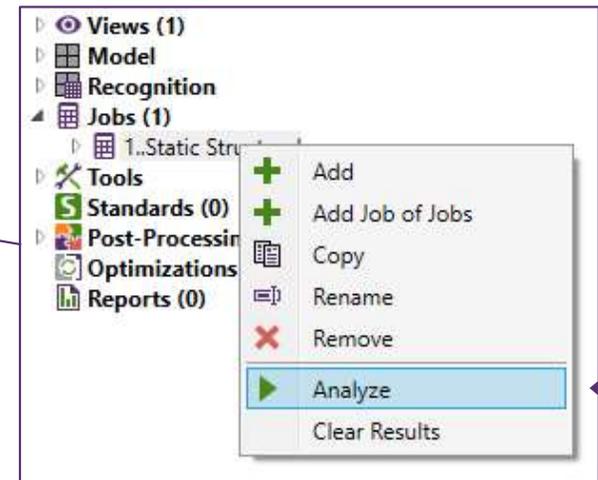
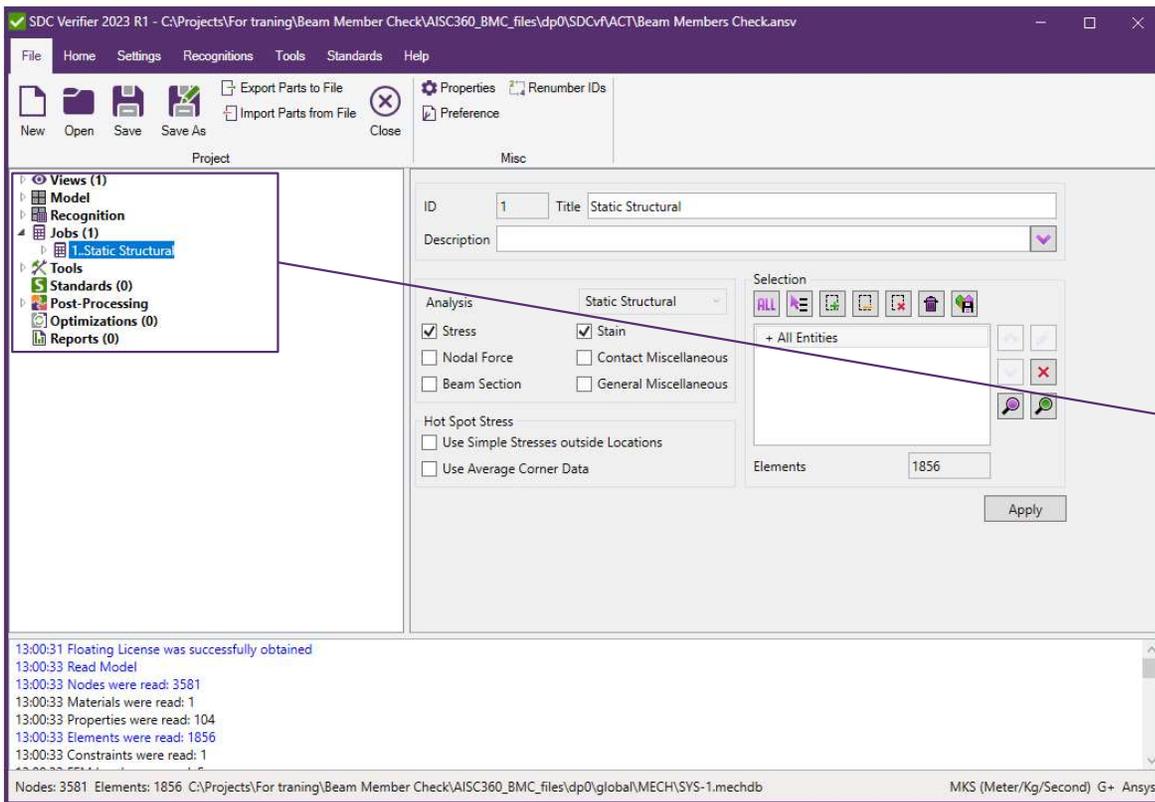


This tutorial uses project with predefined boundary condition, load combinations and load group.  
The model contains only beam elements of the following types: I-Beam, Circular and Rectangular Tubes

# Analyze Job

1

Execute  Analyze from *Static Structural* context menu



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:

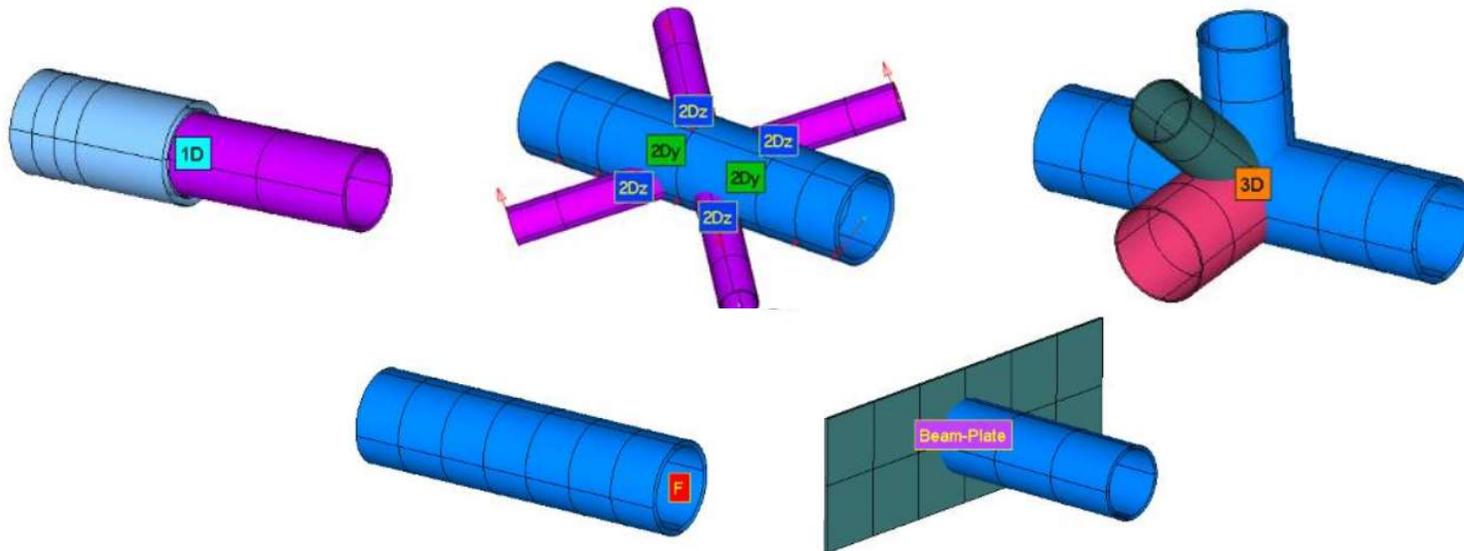
1D Joint - 2 beam members that lie on the curve but with different properties;

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);

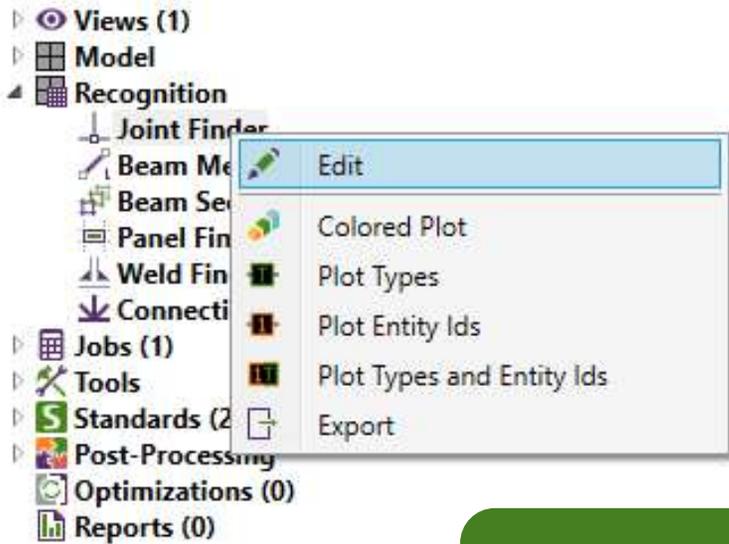
Beam-Plate Joint - beam member connected to plates (perpendicularly); User Defined;



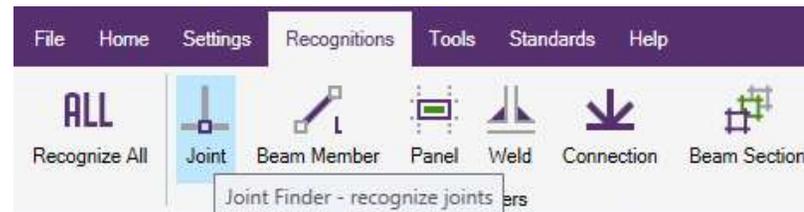
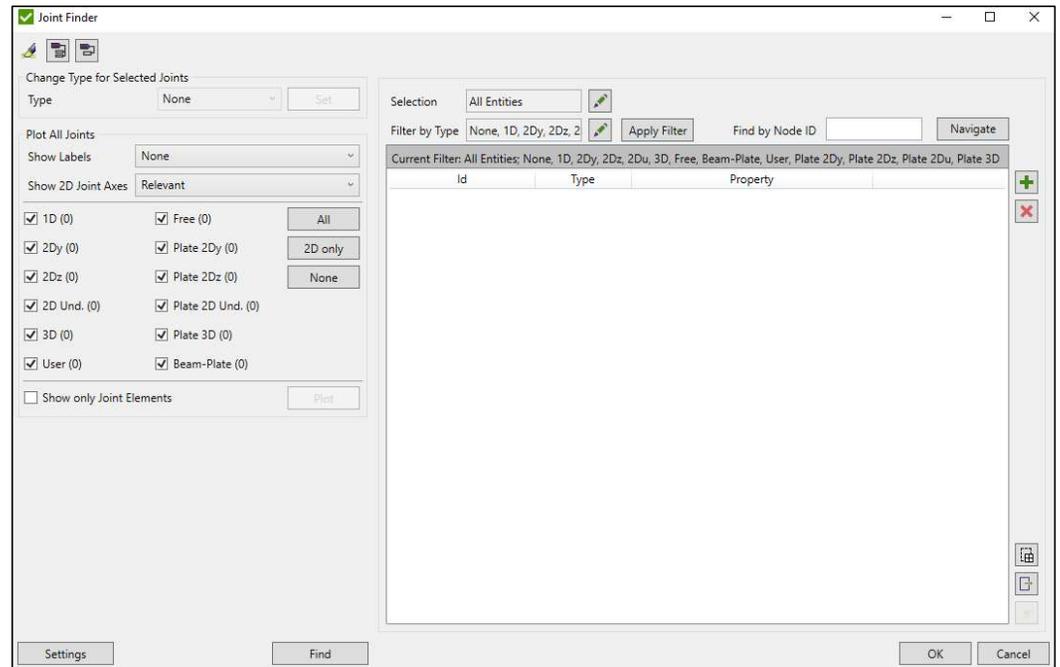
# Joint Recognition

1 Execute **Edit** from **Joint Finder** context menu

2 Press **Find**.



It is possible go to **Recognitions** on Ribbon tab and press **Joint**:

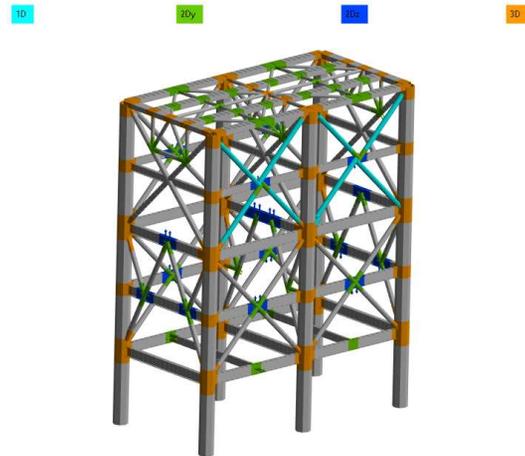


# Joints Plot

1 Select All Joints (Ctrl+A).

2 Press and execute Plot Joint Type in Colors

3 Press **OK**.



Modify Joint Type

Plot Joints of specific type

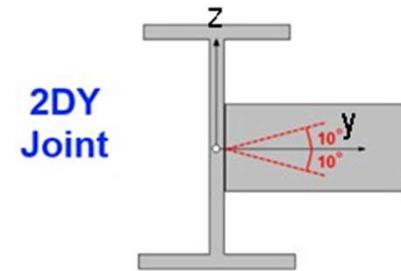
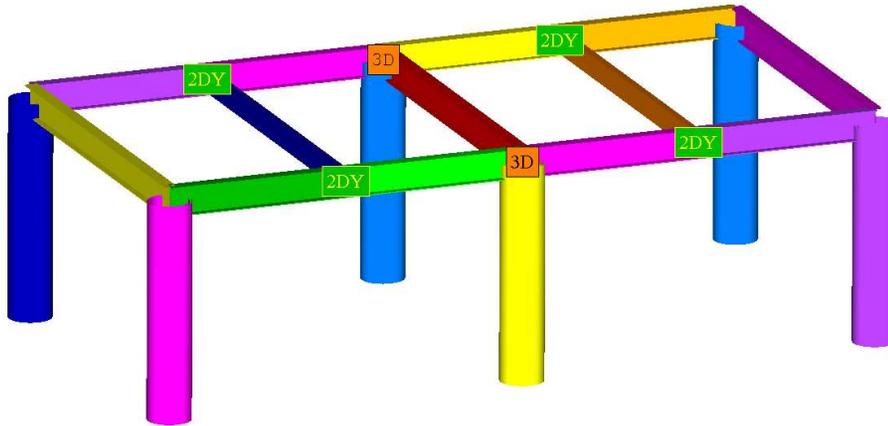
Id	Type	Property
Node ID = 1		
Node ID = 2	3D	
Node ID = 27	3D	
Node ID = 52		
Node ID = 53	3D	
Node ID = 78	3D	
Node ID = 103	3D	
Node ID = 104	2Dz	
Node ID = 129	3D	
Node ID = 154		
Node ID = 167		
Node ID = 192	3D	
Node ID = 205	2Dz	
Node ID = 230	3D	
Node ID = 255	2Dz	
Node ID = 280	3D	
Node ID = 305		
Node ID = 318		
Node ID = 343	3D	
Node ID = 356	2Dz	
Node ID = 405	3D	
Node ID = 419		
Node ID = 445	3D	

3

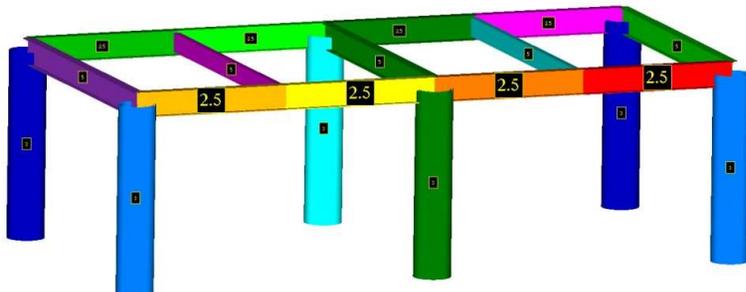
2

# Beam Member Lengths in 2 directions

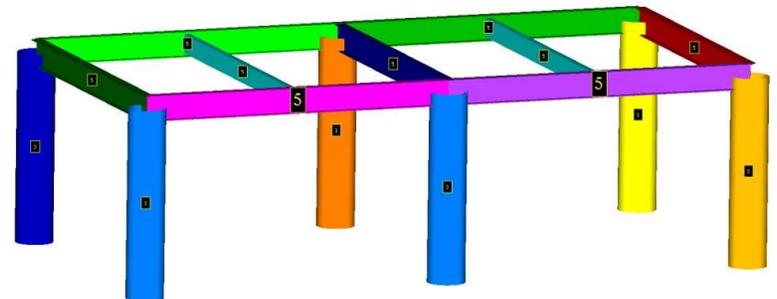
Beam Member Finder recognizes beam members and (buckling) lengths for different directions (Y, Z and Torsional).



Length Y - 4 Beam Members with L = 2.5



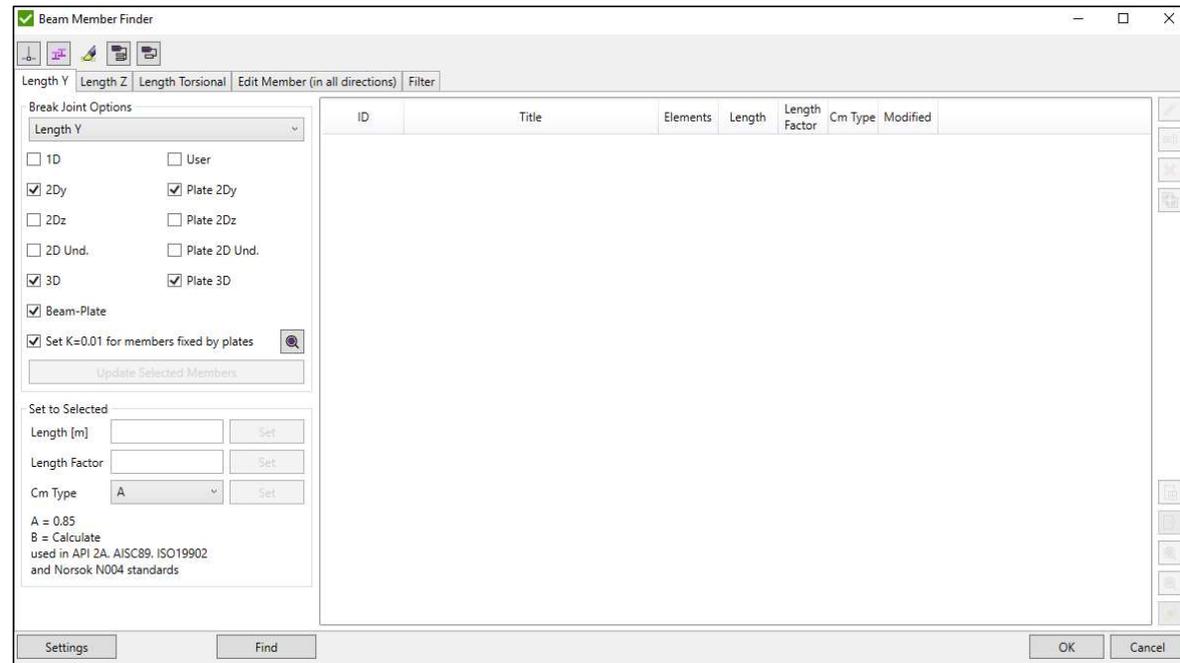
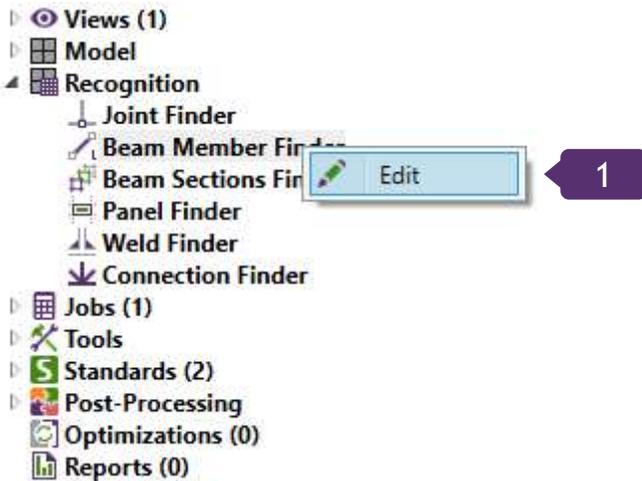
Length Z - 2 Beam Members with L = 5



# Recognize Length

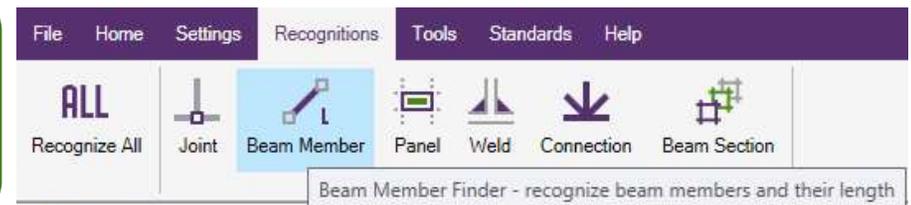
1 Execute **Edit** from **Beam Member Finder** context menu

2 Press **Find**.



Default *Break Joint Options* for Tabs:  
Length Y: 2DY, 3D, Plate 2DY, Plate 3D  
Length Z: 2DZ, 3D, Plate 2DZ, Plate 3D  
Length Torsional: 2DY, 2DZ, 2D Und, 3D

It is possible to open it another way - go to **Recognitions** tab in Ribbon and press **Beam Member**:



# Beam Member's Length Plot

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

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

Press Settings to define recognition options: selection, default title

Press Find to automatically recognize Beam Members and Sub Members for all 3 directions (Y, Z and torsional)

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

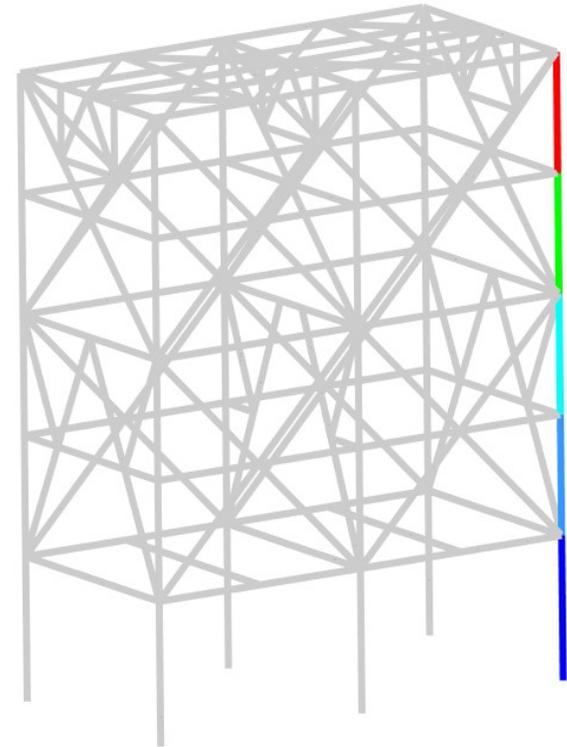
ID	Title	Elements	Length	Length Factor	Cm Type	Modified
1	bm1 (Y, [-2.50; 7.50; -6.50] - 1..CrossSection:5)	47	13			1107[3D] 155[3D] 1104[3D] 4[3D]
2	bm2 (Y, [-2.50; 2.50; -6.50] - 1..CrossSection:5)	47	13			1109[3D] 136[3D] 1108[3D] 117[3D]
3	bm3 (Y, [7.50; 7.50; -6.50] - 1..CrossSection:5)	47	13			2225[3D] 1273[3D] 2222[3D] 1122[3D]
4	bm4 (Y, [7.50; 2.50; -6.50] - 1..CrossSection:5)	47	13			2227[3D] 1254[3D] 2226[3D] 1235[3D]
5	bm5 (Y, [2.50; 7.50; -6.50] - 1..CrossSection:5)	47	13			22[3D] 1105[3D] 165[3D] 1106[3D]
6	bm6 (Y, [2.50; 2.50; -6.50] - 1..CrossSection:5)	47	13			1110[3D] 202[3D] 1111[3D] 201[3D]
7	bm7 (Y, [2.50; 7.50; -2.50] - 2..CrossSection:11)	32	10			1090[2Dz] 22[3D] 2208[2Dz]
8	bm8 (Y, [-2.50; 5.00; -2.50] - 2..CrossSection:11)	16	5	1	A	
9	bm9 (Y, [2.50; 2.50; -2.50] - 2..CrossSection:11)	32	10			1103[2Dz] 201[3D] 2221[2Dz]
10	bm10 (Y, [7.50; 5.00; -2.50] - 2..CrossSection:11)	16	5	1	A	
11	bm11 (Y, [2.50; 5.00; -2.50] - 2..CrossSection:11)	16	5	1	A	
12	bm12 (Y, [5.00; 5.00; -10.00] - 3..CrossSection:8)	12	5	1	A	
13	bm13 (Y, [0.00; 5.00; -10.00] - 3..CrossSection:8)	12	5	1	A	
14	bm14 (Y, [2.50; 7.50; -5.00] - 4..CrossSection:9)	45	14.144			1090[2Dy] 1105[3D] 2232[2Dy]
15	bm15 (Y, [0.00; 7.50; -2.50] - 4..CrossSection:9)	23	7.072			1090
16	bm16 (Y, [0.00; 7.50; -7.50] - 4..CrossSection:9)	22	7.072			1114 Plot selected members
17	bm17 (Y, [2.50; 7.50; -5.00] - 4..CrossSection:9)	45	14.144			1114 Plot Length Criteria
18	bm18 (Y, [-2.50; 5.00; -1.50] - 4..CrossSection:9)	6	2	1	A	1114 Plot Members ID Labels
19	bm19 (Y, [2.50; 2.50; -5.00] - p4, p16, p17, p19)	45	14.144			1114 Plot Full Members ID Labels
20	bm20 (Y, [0.00; 2.50; -7.50] - 4..CrossSection:9)	22	7.072			1115 Plot Length Labels
21	bm21 (Y, [5.00; 7.50; -2.50] - 4..CrossSection:9)	23	7.072			1115 Plot Cm Type Labels

# Sub beam members

Break Joint Options define which types of joints will be used to split Beam Member on sub members. There are 3 predefined Break Joint Options (Length Y, Length Z, and Torsional) and custom.

Sub members from table on a plot:

ID	Title	Elements	Length	Length Factor	Cm Type	Modified
1	Beam Member 1 (Y)	47	13			Modified 1107[3D] 155[3D] 1104[3D] 4[3D]
1.1	Beam Member 1.1 (Y)	11	3	1	A	Modified
1.2	Beam Member 1.2 (Y)	9	2.5	1	A	Modified
1.3	Beam Member 1.3 (Y)	9	2.5	1	A	Modified
1.4	Beam Member 1.4 (Y)	9	2.5	1	A	Modified
1.5	Beam Member 1.5 (Y)	9	2.5	1	A	Modified
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]

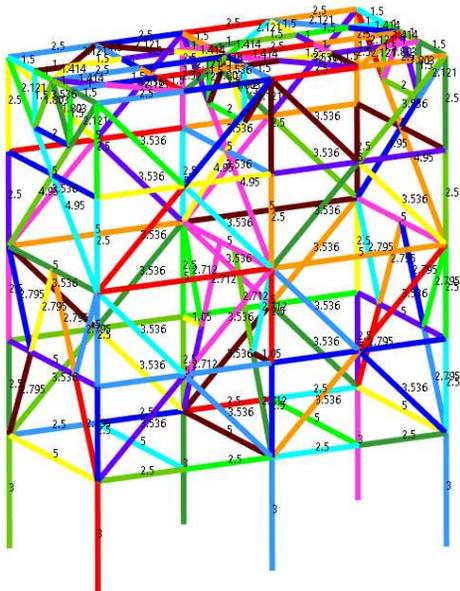


# Beam Member Finder interface

1 Select all Beam Members (Ctrl+A)

2 Press and execute to display **Length Plot**

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 [m]  Set

Length Factor  Set

Cm Type A  Set

A = 0.85  
B = Calculate  
used in API 2A, AISI C89, ISO19902 and Norsok N004 standards

ID	Title	Elements	Length	Length Factor	Cm Type	Modified
17	bm17 (Y, [2.50; 7.50; -5.00] - 4.CrossSection:9)	45	14.144			1114[2Dy] 1105[3D] 2208[2Dy]
18	bm18 (Y, [-2.50; 5.00; -1.50] - 4.CrossSection:9)	6	2	1	A	
19	bm19 (Y, [2.50; 2.50; -5.00] - p4, p16, p17, p19)	45	14.144			1115[2Dy] 1110[3D] 1538[1D] 1539[1D] 1540[1D] 1541[1D] 1542[1D] 1543
20	bm20 (Y, [0.00; 2.50; -7.50] - 4.CrossSection:9)	22	7.072			1115[2Dy]
21	bm21 (Y, [5.00; 7.50; -2.50] - 4.CrossSection:9)	23	7.072			2208[2Dy]
22	bm22 (Y, [5.00; 7.50; -7.50] - 4.CrossSection:9)	22	7.072			2232[2Dy]
23	bm23 (Y, [2.50; 5.00; -1.50] - 4.CrossSection:9)	6	2	1	A	
24	bm24 (Y, [7.50; 5.00; -1.50] - 4.CrossSection:9)	6	2	1	A	
25	bm25 (Y, [2.50; 2.50; -5.00] - p4, p8, p9, p11, p	45	14.144			2233[2Dy] 1110[3D] 420[1D] 421[1D] 422[1D] 423[1D] 424[1D] 425[1D] 42
26	bm26 (Y, [5.00; 2.50; -7.50] - 4.CrossSection:9)	22	7.072			2233[2Dy]
27	bm27 (Y, [2.50; 7.50; -5.00] - 5.CrossSection:6)	36	10			1105[3D]
28	bm28 (Y, [2.50; 7.50; -7.50] - 5.CrossSection:6)	32	10			1114[2Dz] 165[3D] 2232[2Dz]
29	bm29 (Y, [2.50; 7.50; -10.00] - 5.CrossSection:6)	36	10			1106[3D] 932[2Dy] 381[2Dy]
30	bm30 (Y, [-2.50; 5.00; -5.00] - 5.CrossSection:6)	15	5	1	A	1097[2Dz]
31	bm31 (Y, [-2.50; 5.00; -7.50] - 5.CrossSection:6)	14	5	1	A	1099[2Dz] 1098[2Dz]
32	bm32 (Y, [-2.50; 5.00; -10.00] - 5.CrossSection:6)	18	5	1	A	
33	bm33 (Y, [2.50; 2.50; -5.00] - 5.CrossSection:6)	36	10			1110[3D]
34	bm34 (Y, [2.50; 2.50; -10.00] - 5.CrossSection:6)	36	10			1111[3D] 68[2Dy] 520[2Dy]
35	bm35 (Y, [2.50; 2.50; -7.50] - 5.CrossSection:6)	32	10			1115[2Dz] 202[3D] 2233[2Dz]
36	bm36 (Y, [7.50; 5.00; -5.00] - 5.CrossSection:6)	15	5	1	A	2215[2Dz]
37	bm37 (Y, [2.50; 5.00; -5.00] - 5.CrossSection:6)	12	5	1	A	1112[2Dz] 1113[2Dz]

Settings Find OK Cancel

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

2

3

2

# STEEL CONSTRUCTION



## MANUAL

AMERICAN INSTITUTE  
OF  
STEEL CONSTRUCTION  
INC.

THIRTEENTH EDITION

### About AISC 360-10:

- 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



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		Resistance Factors	
	<input checked="" type="radio"/> LRFD	<input type="radio"/> LRFD	<input checked="" type="radio"/> ASD
Tension (F <sub>t</sub> )	<input type="text" value="0.9"/>	<input type="text" value="0.6"/>	
Tensile Rupture (F <sub>tr</sub> )	<input type="text" value="0.75"/>	<input type="text" value="0.5"/>	
Compression (F <sub>c</sub> )	<input type="text" value="0.9"/>	<input type="text" value="0.6"/>	
Shear (F <sub>v</sub> )	<input type="text" value="0.9"/>	<input type="text" value="0.6"/>	
Bending (F <sub>b</sub> )	<input type="text" value="0.9"/>	<input type="text" value="0.6"/>	
Torsion (F <sub>tor</sub> )	<input type="text" value="0.9"/>	<input type="text" value="0.6"/>	

Design for Strength Using Load and Resistance Factor Design (LRFD)  
Design will be performed in accordance with Equation B3-1:

$R_u \leq \phi R_n$  (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:

$R_a \leq R_n / \Omega$  (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:

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

$\phi_t = 0.90$  (LRFD)     $\Omega_t = 1.67$  (ASD)

In SDC Verifier multiplication is always used ASD factor is converted to  $1 / \phi$  (ASD).

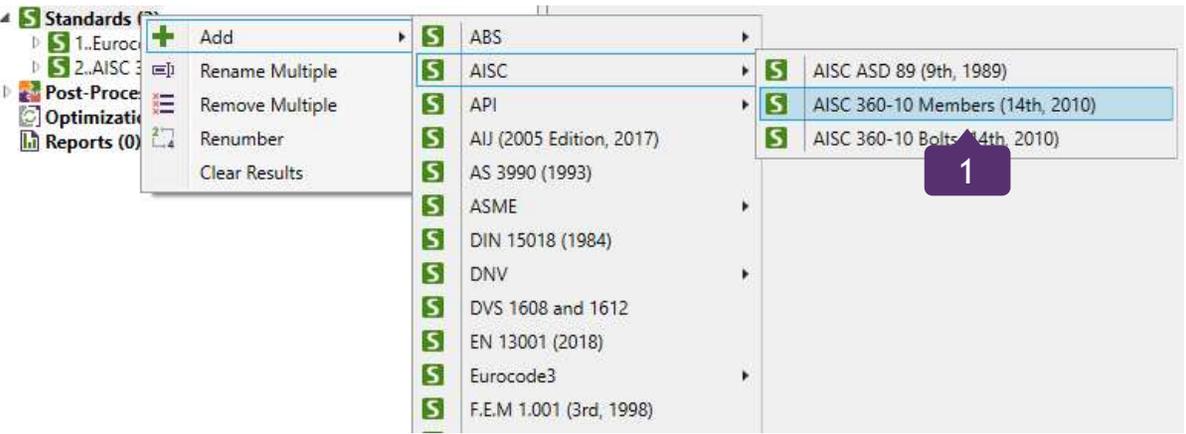
For example:

tensile resistance factor (F<sub>t</sub>) =  $1 / 1.67 = 0.6$ .

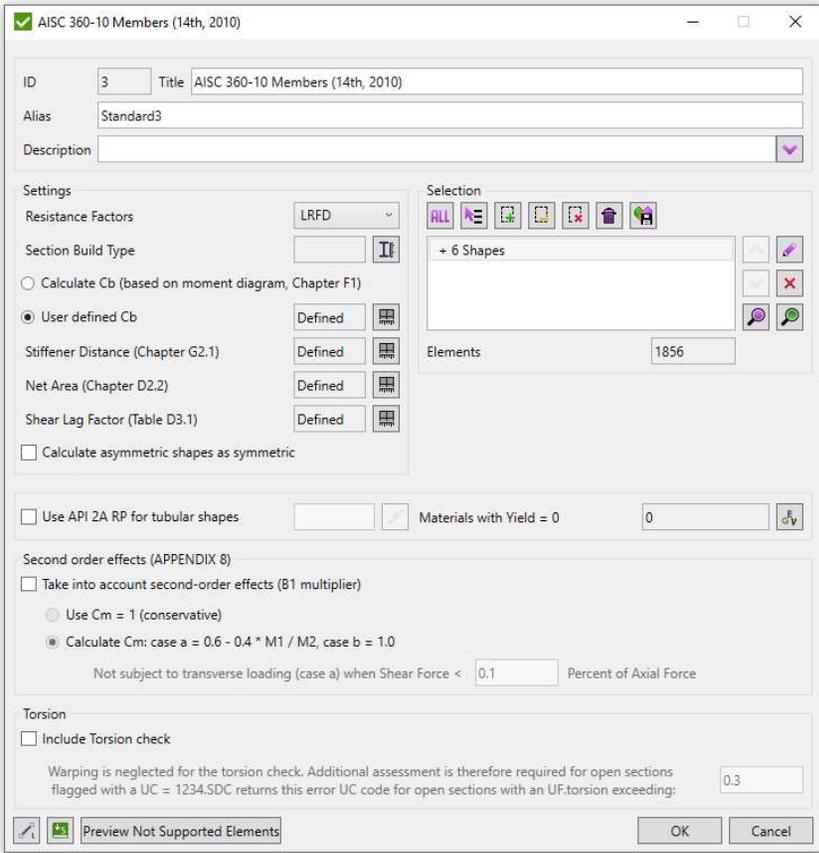
# Add AISC360-10 standard

1 Execute **Standards** => **Add** => **AISC** => **AISC 360-10 Members** from context menu

2 Resistance Factors: **LRFD**



2



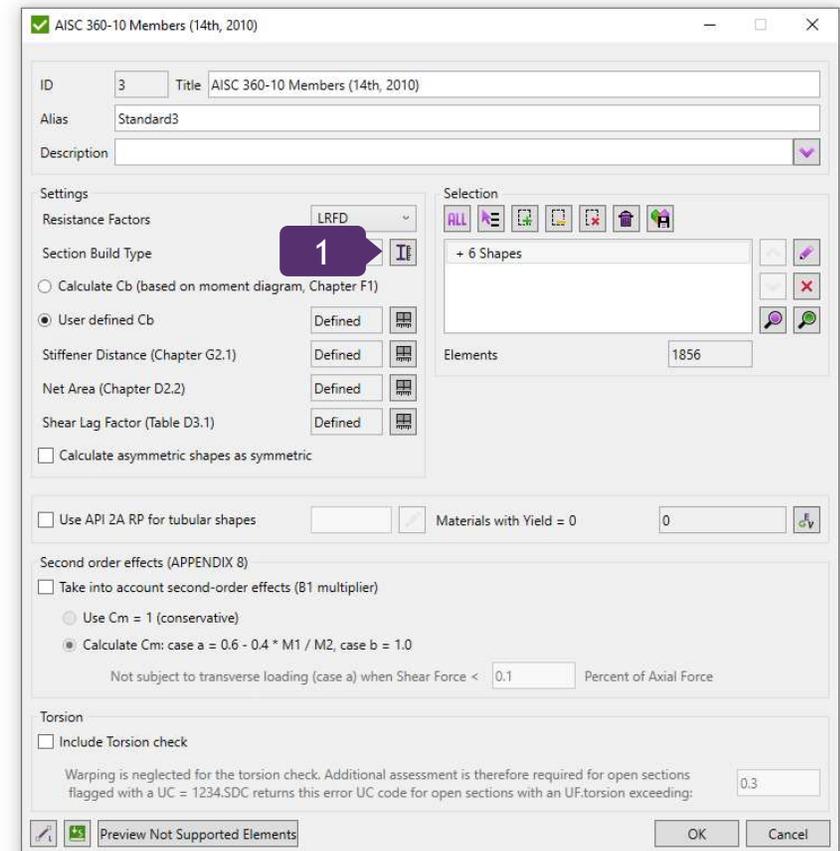
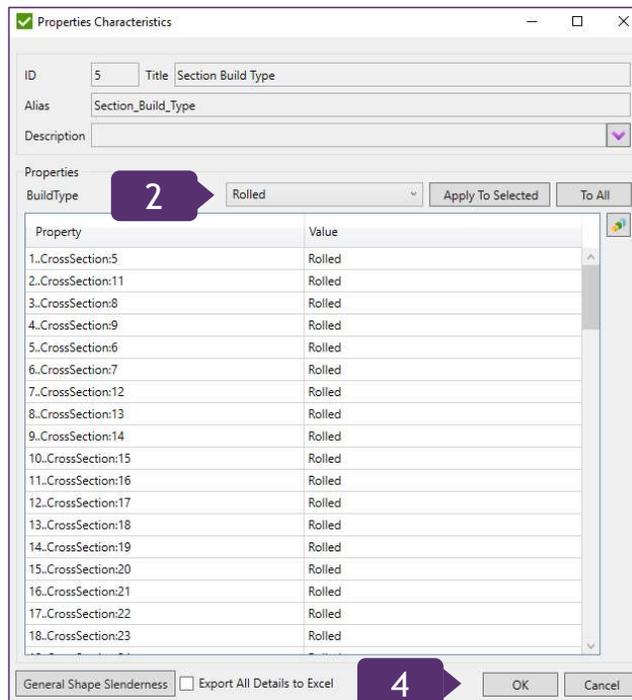
# Section Build Type

1 Press for **Section Build Type**

2 Build Type: **Rolled**

3 Select **To All**

4 Press **OK**.

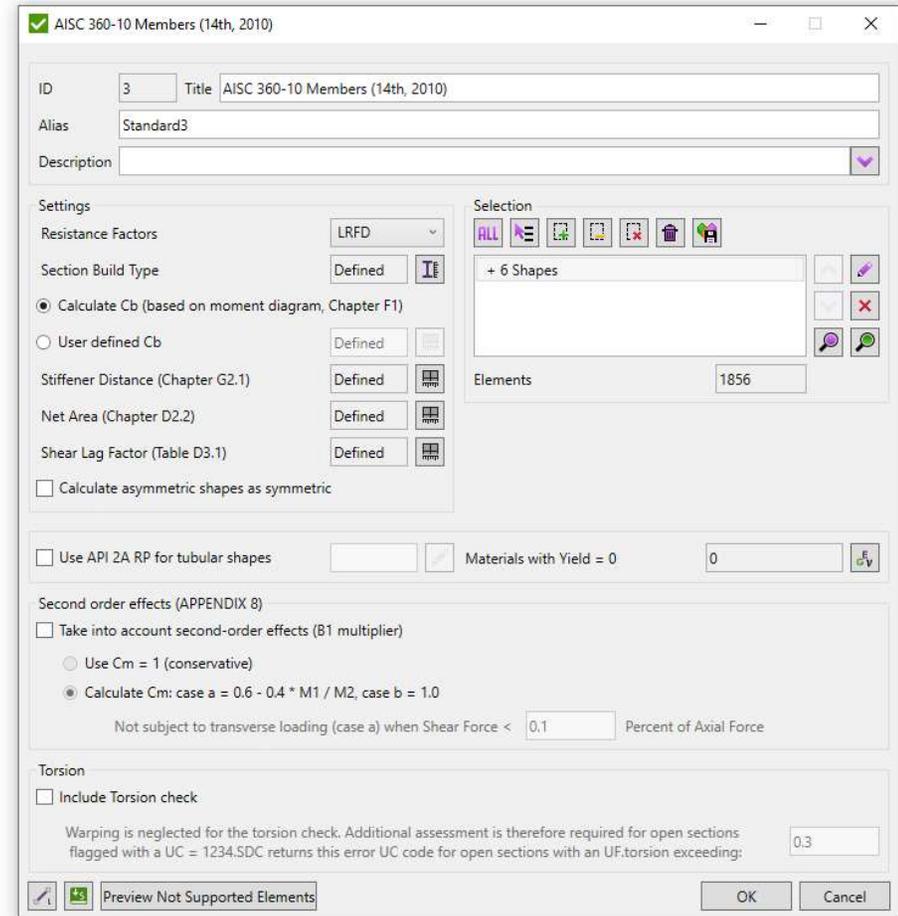
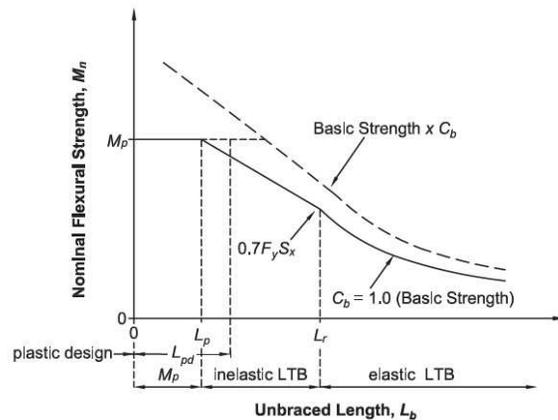


# Lateral-torsional buckling factor ( $C_b$ )

## 1 Select - Calculate $C_b$

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



# 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 dialog box showing a table with columns: Materials, Tensile Strength [Pa], and Yield Stress [Pa]. The row for '1..Structural Steel' has values 360000000 and 240000000. A 'Set' button is visible below the table.

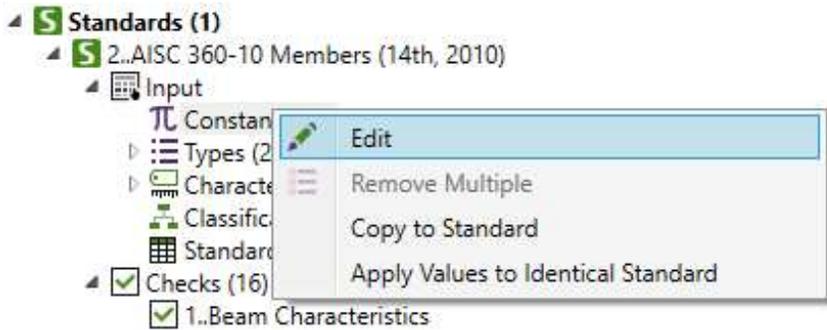
Materials	Tensile Strength [Pa]	Yield Stress [Pa]
1..Structural Steel	360000000	240000000

AISC 360-10 Members (14th, 2010) dialog box showing settings for LRFD, Section Build Type (Defined), and various material properties. A 'Set' button is visible in the Properties section.

Properties  
Tensile Strength [Pa] 360000000  
Yield Stress [Pa] 240000000  
Set

# Standard is created

It is possible to modify Safety Factors in Constants section.



A screenshot of the 'Constants' dialog box. The dialog has a title bar with a checkmark and the text 'Constants'. It contains a table with the following data:

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

The dialog also has 'OK' and 'Cancel' buttons at the bottom right.



# Preview Table Results

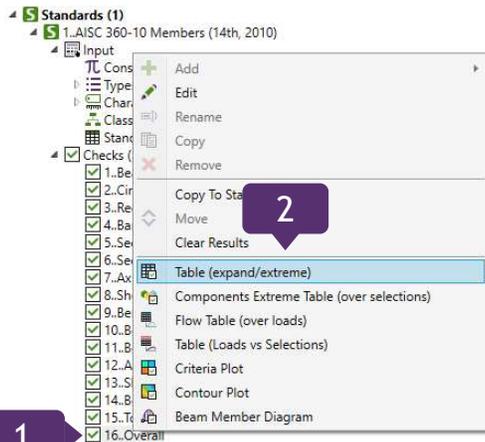
1 Execute *Overall*

2 Execute *Table (expand/extreme)* in context menu

3 Select Extreme Options - *Detailed*

4 Press *Fill Table*

5 Press *OK*



3

Extreme	UF Axial	UF Bending Major	UF Bending Minor	UF Shear	UF torsion	UF Axial and Bending	UF combined torsion	UF Overall
<b>Minimum</b>								
Value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Element ID	2399	1040	1171	801	1210	1102	1	1921
Load	LS3	LS1	LS1	LS1	LS3	LS1	LS4	LS1
<b>Maximum</b>								
Value	0.03	1.14	0.03	0.20	0.05	1.14	0.00	1.14
Element ID	1501	64	1121	1854	1861	64	1	64
Load	LS2	LS1	LS2	LS1	LS1	LS1	LS4	LS1
<b>Absolute</b>								
Value	0.03	1.14	0.03	0.20	0.05	1.14	0.00	1.14
Element ID	1501	64	1121	1854	1861	64	1	64
Load	LS2	LS1	LS2	LS1	LS1	LS1	LS4	LS1

4

5

# View for plots

1 Select **Overall**

2 Execute **Criteria Plot** in context menu

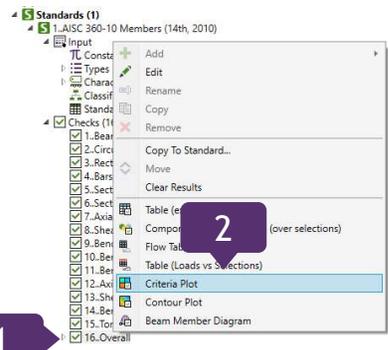
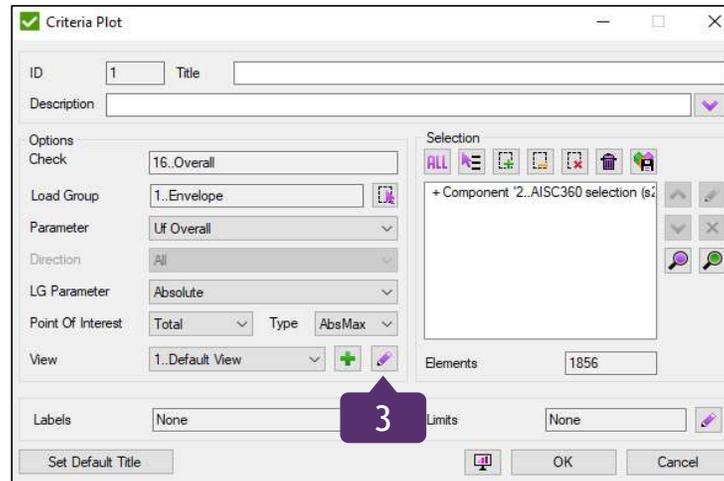
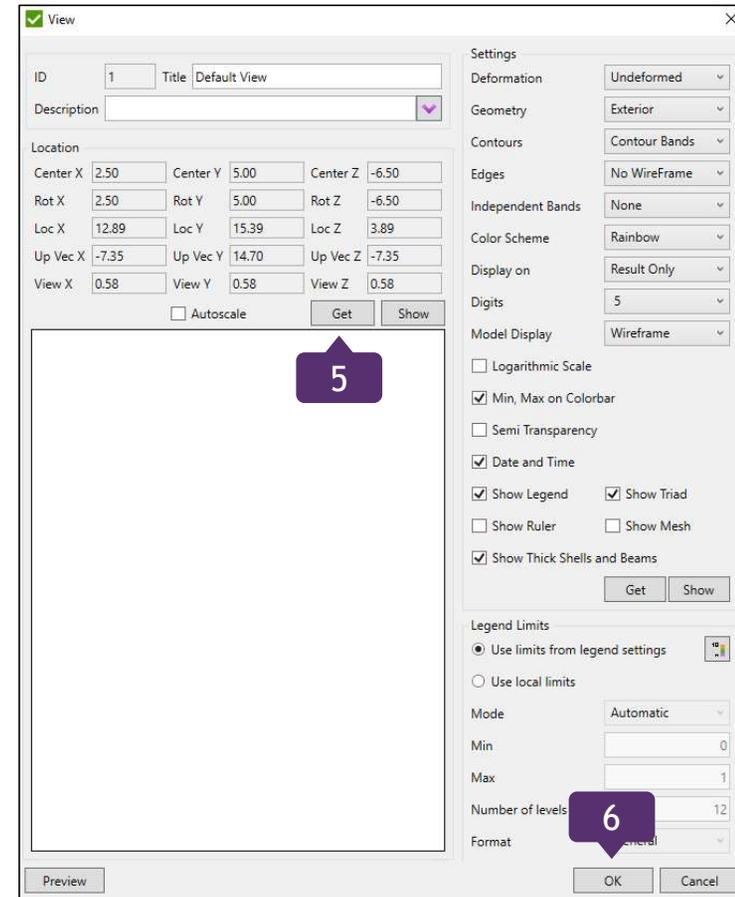
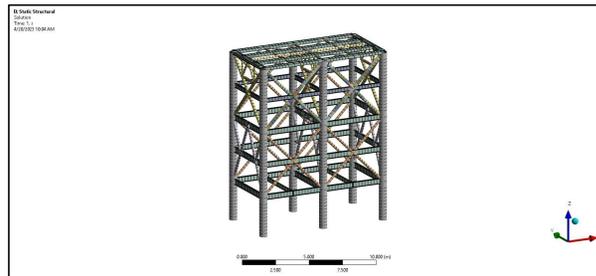
3 Press to edit view

4 Replace your model in Ansys

5 Press **Get**

6 Press **Ok**

4 Example of view in Ansys



1

6

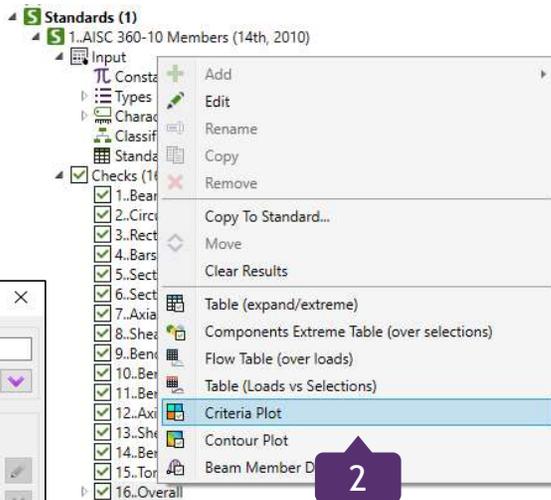
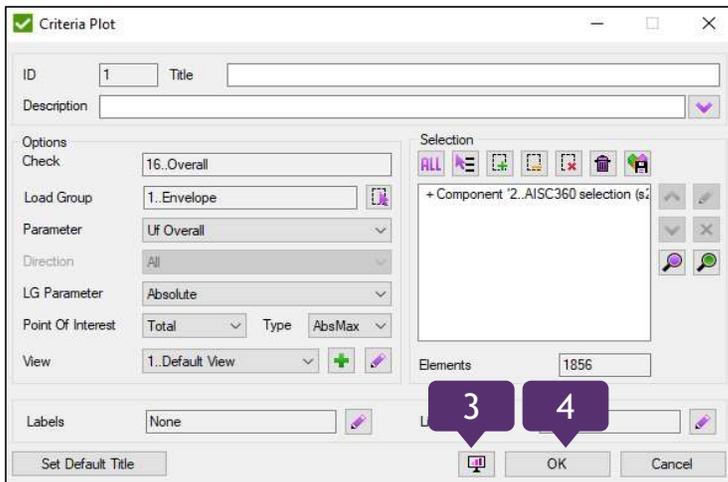
# Utilization Factor Plot

1 Select *Overall*

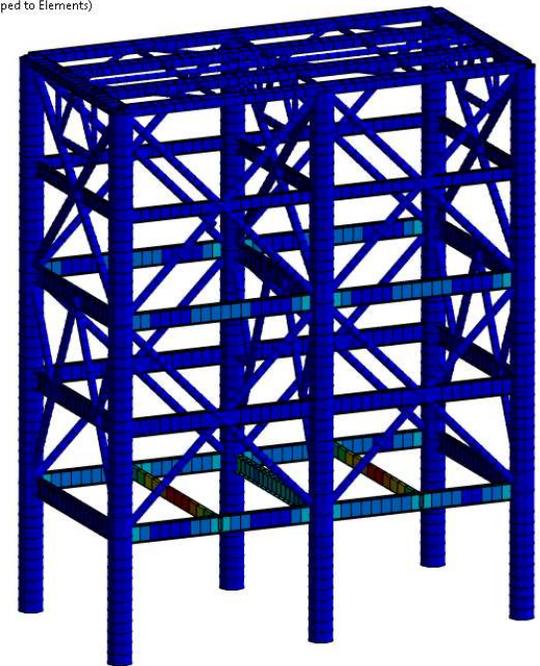
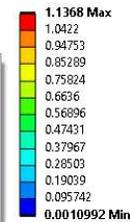
2 Execute *Criteria Plot* in context menu

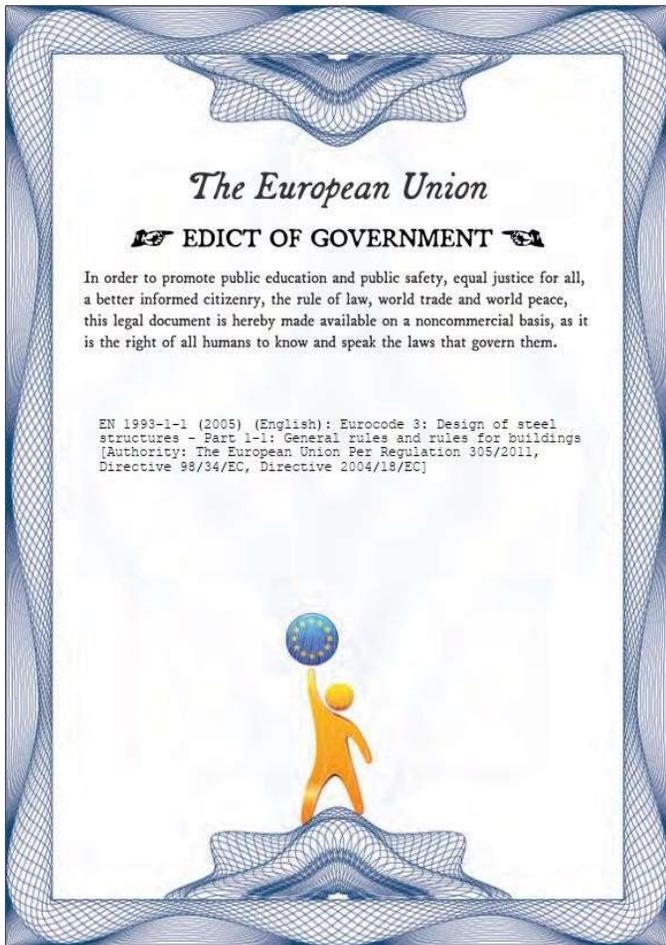
3 Press to preview *Plot*

4 Press *Ok* to save plot



**B: Static Structural**  
Abs Uf Overall (LG1, Component '2..AISC360 selection (s1)', v1, Total)  
Expression: RES74 (Unaveraged) (Scoped to Elements)  
Time: 4 :  
4/19/2023 3:36 PM





**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;  
 **$\beta$**  - 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: 3 Title: Eurocode3 Members (EN1993-1-1, 2005)  
Alias: Standard1  
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: [Field] [Icon]  
Manufacture Method: [Field] [Icon]  
Fillet: [Field] [Icon]  
Section Net Area: [Field] [Icon]  
Material Type: [Field] [Icon]

**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 [Icon]

Selection: 104 Properties [Icon]

Preview Not Supported Elements [OK] [Cancel]

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

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	$k_c$
	1.0
	$\frac{1}{1,33 - 0,33\psi}$
	0,94
	0,90
	0,91

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.

# 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**

The dialog box 'Eurocode3 Members (EN 1993-1-1, 2005)' contains the following fields and options:

- ID: 2, Title: Eurocode3 Members (EN1993-1-1, 2005)
- Alias: Standard2
- Description: (empty)
- 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: (dropdown menu with icon)
- Manufacture Method: (dropdown menu with icon)
- Fillet: (dropdown menu with icon)
- Section Net Area: (dropdown menu with icon)
- Material Type: (dropdown menu with icon)
- 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: 0
- Selection: 104 Properties
- Buttons: Preview Not Supported Elements, OK, Cancel

The dialog box 'Properties Characteristics' contains the following fields and options:

- ID: 1, Title: Fabrication Type
- Alias: FabricationType
- Description: (empty)
- Properties:
  - Fabrication: Rolled (dropdown menu)
  - Buttons: Apply To Selected, To All
- Table:

Property	Value
1..CrossSection:5	Rolled
2..CrossSection:11	Rolled
3..CrossSection:8	Rolled
4..CrossSection:9	Rolled
5..CrossSection:6	Rolled
6..CrossSection:7	Rolled
7..CrossSection:12	Rolled
8..CrossSection:13	Rolled
9..CrossSection:14	Rolled
10..CrossSection:15	Rolled
11..CrossSection:16	Rolled
12..CrossSection:17	Rolled
13..CrossSection:18	Rolled
14..CrossSection:19	Rolled
15..CrossSection:20	Rolled
16..CrossSection:21	Rolled
17..CrossSection:22	Rolled
18..CrossSection:23	Rolled
- Buttons: OK, Cancel

The 'Add' menu is open, showing a list of standards. The 'Eurocode3' folder is expanded, and 'Eurocode3 Members (EN 1993-1-1, 2005)' is selected. A callout box with the number '1' points to this selection.

# Eurocode3. Manufacture Method

1

Press  to set **Manufacture Method**

2

Execute - **Hot Finished**

3

Press **To All**

4

Press **Ok**

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

ID: 2 Title: Eurocode3 Members (EN1993-1-1, 2005)  
Alias: Standard2  
Description:

Factors

Partial Factor Gm0	1	Fabrication Type	Defined
Partial Factor Gm1	1	Manufacture Method	<b>1</b>
Partial Factor Gm2	1.25	Fillet	
Lambda LT,0	0.4	Section Net Area	
Beta	0.75	Material Type	
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)

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

Selection: 104 Properties

Preview Not Supported Elements

OK Cancel

**Properties Characteristics**

ID: 2 Title: Manufacture Method  
Alias: Hollow  
Description:

Properties

Hollow Manufacturing Method: Hot Finished

Apply To Selected To All

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

General Shape Slenderness  Export All Details to Excel

OK Cancel

# Eurocode3. Fillet

1 Press to set **Fillet**

2 Properties Value - **0**

3 Press **To All**

4 Press **Ok**

5 Repeat Steps 1-4 for **Section NetArea**

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

ID: 2 Title: Eurocode3 Members (EN 1993-1-1, 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  
Manufacture Method: Defined  
Fillet: (1)  
Section Net Area: (1)  
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: 0

Selection: 104 Properties

Preview Not Supported Elements

OK Cancel

Properties Characteristics

ID: 3 Title: Fillet  
Alias: Fillet  
Description:

Properties Value: 0 (2)

Apply To Selected: To All (3)

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

General Shape Slenderness  Export All Details to Excel

OK (4) Cancel

# Eurocode3. Material Type

1

Press  to set **Material Type**

2

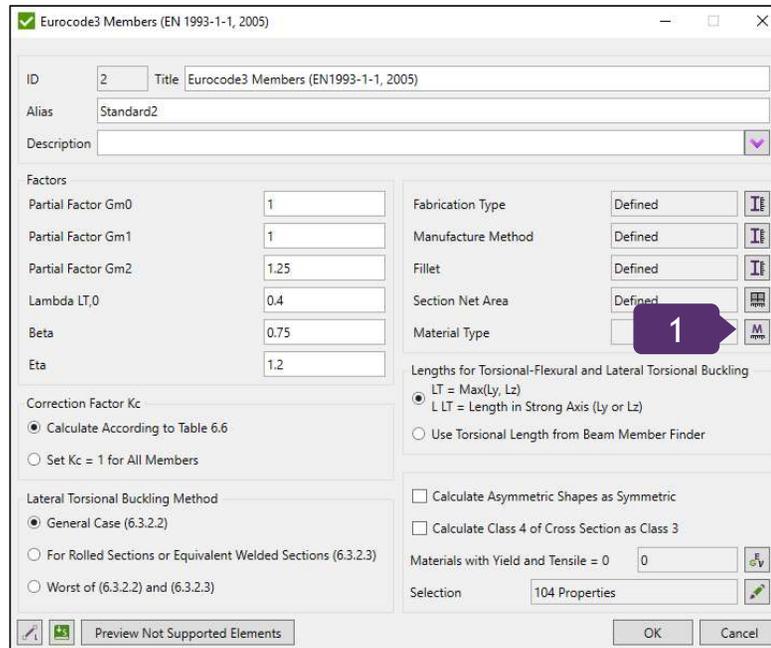
Execute - **S235\_S275\_S355\_S420**

3

Press **To All**

4

Press **Ok**



**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

Fabrication Type: Defined  
Manufacture Method: Defined  
Fillet: Defined  
Section Net Area: Defined  
Material Type: [dropdown] **1**

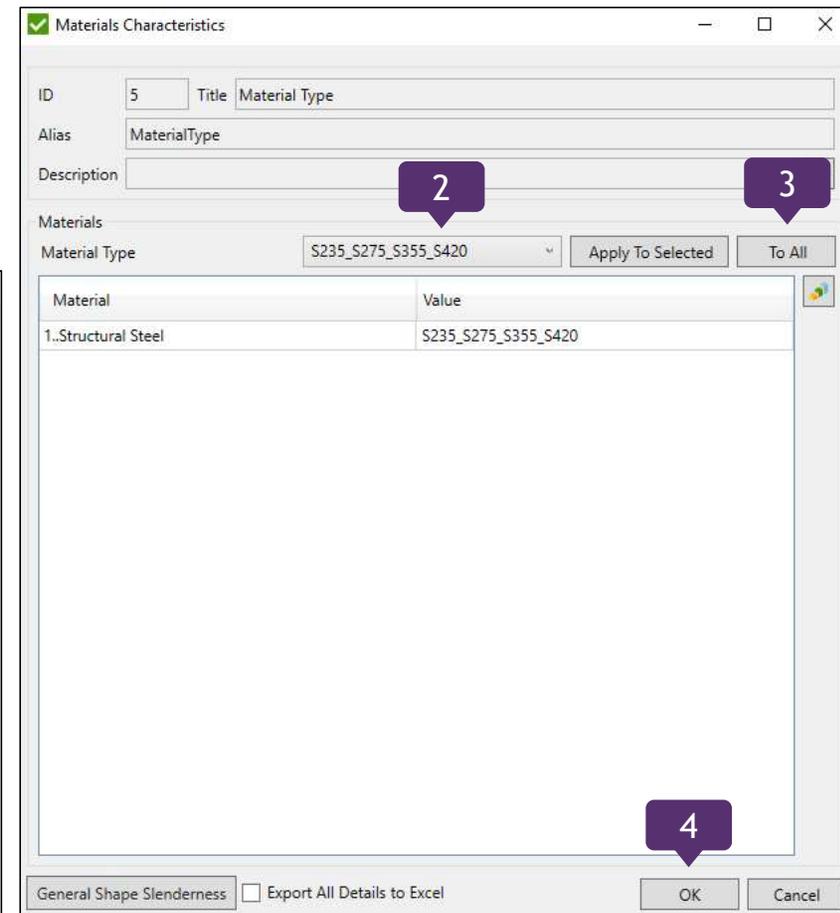
Lengths for Torsional-Flexural and Lateral Torsional Buckling

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: 104 Properties

Preview Not Supported Elements [OK] [Cancel]



**Materials Characteristics**

ID: 5 Title: Material Type  
Alias: MaterialType  
Description: [dropdown] **2**

Materials

Material Type: S235\_S275\_S355\_S420 [Apply To Selected] [To All] **3**

Material	Value
1..Structural Steel	S235_S275_S355_S420

General Shape Slenderness  Export All Details to Excel [OK] [Cancel] **4**

## Standard is created

- 3..Eurocode3 Members (EN1993-1-1, 2005)
  - Input
    - Constants (24)
    - Types (4)
    - Characteristic (5)
    - Classifications (0)
    - Standard Tables (1)
  - Checks (22)
    - 1..Beam Characteristics
    - 2..Rectangular Tube
    - 3..Rectangular Bar
    - 4..Circular Tube
    - 5..Circular Bar
    - 6..I Shape
    - 7..T Shape
    - 8..C Shape
    - 9..Common Shape
    - 10..Flange Classification
    - 11..Classification
    - 12..Shear Check
    - 13..Axial Check
    - 14..Bending Check
    - 15..Bending and Axial
    - 16..Buckling Compression
    - 17..Buckling Torsional
    - 18..Lateral torsional buckling
    - 19..Buckling Compression and Bending
    - 20..Forces
    - 21..Cross Section Overall
    - 22..Buckling and Overall

Standard contains 22 checks:

- 1 - Beam Member Characteristics;
- 2-10 - Calculation Dimensions and factors for 5 different shapes;
- 11 - Classification;
- 12 - Additional Shear Check;
- 13 - Axial Check;
- 14-15 - Bending, Tension And Compression Strength Check;
- 16-17 - Buckling Strength Checks ;
- 18 - Lateral Torsional Check;
- 19 - Buckling Compression And Bending;
- 20 - Forces;
- 21 - Cross Section Overall Strength Check;
- 22 - Buckling And Overall Strength Check.

# Preview Table Results

1 Select **Buckling and Overall**

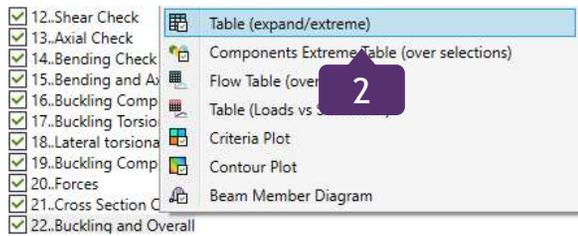
2 Execute **Table (expand/extreme)** in context menu

3 Select Extreme Options - **Detailed**

4 Select **Overall** Load Group

5 Press **Fill Table**

6 Press **OK**



1

Extreme	UF Axial	UF Bending	UF Combined G1	UF Combined G2	UF Buckling	UF Section	UF Overall
<b>Minimum</b>							
Value	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Element ID	1	1	1	1	1	1921	1921
Load	LS4	LS4	LS4	LS4	LS4	LS1	LS1
<b>Maximum</b>							
Value	0.03	1.09	1.08	1.09	1.09	1.04	1.09
Element ID	1501	64	64	64	64	64	64
Load	LS2	LS4	LS2	LS2	LS2	LS1	LS2
<b>Absolute</b>							
Value	0.03	1.09	1.08	1.09	1.09	1.04	1.09
Element ID	1501	64	64	64	64	64	64
Load	LS2	LS4	LS2	LS2	LS2	LS1	LS2

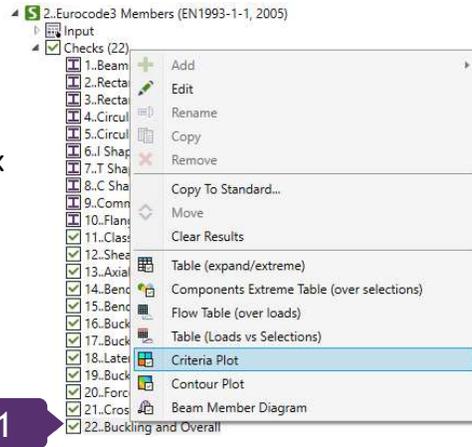
# Utilization Factor Plot

1 Select **Overall and Buckling**

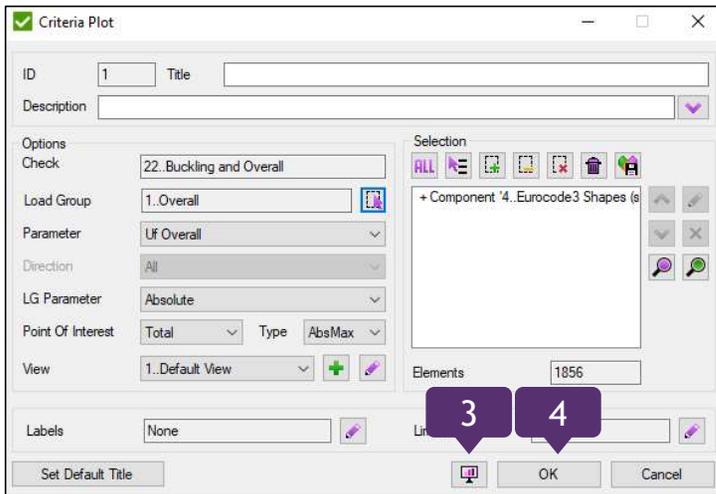
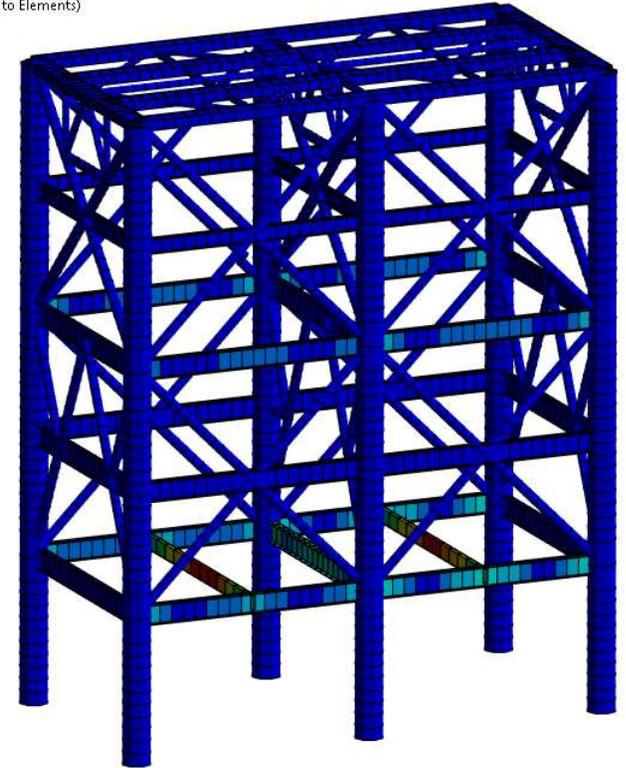
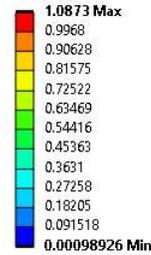
2 Execute **Criteria Plot** in context menu

3 Press to preview Plot

4 Press **Ok**



**B: Static Structural**  
Abs Uf Overall (LG1, Component '4..Eurocode3 Shapes (s2)', v1, Total)  
Expression: RES83 (Unaveraged) (Scoped to Elements)  
Time: 4 s  
4/19/2023 4:06 PM

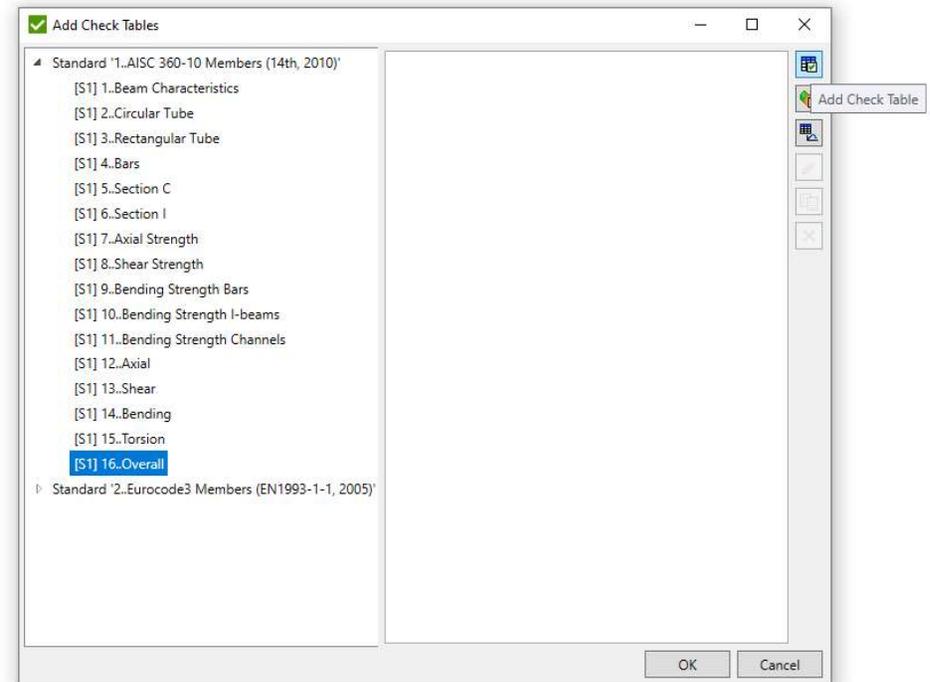
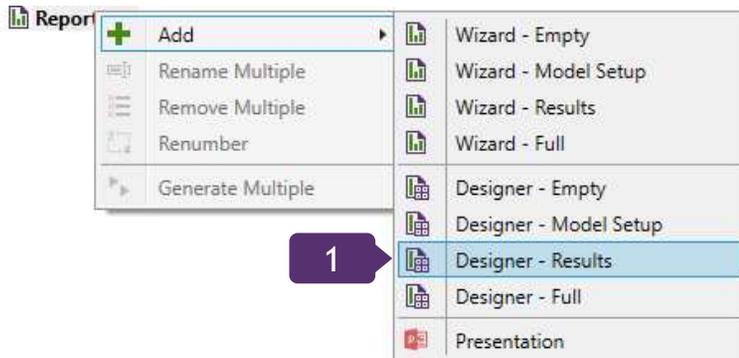


# Report - Tables

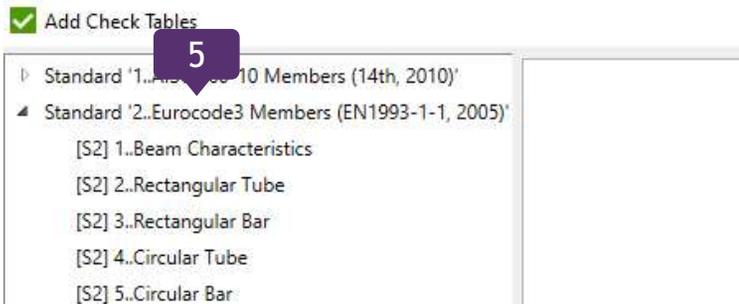
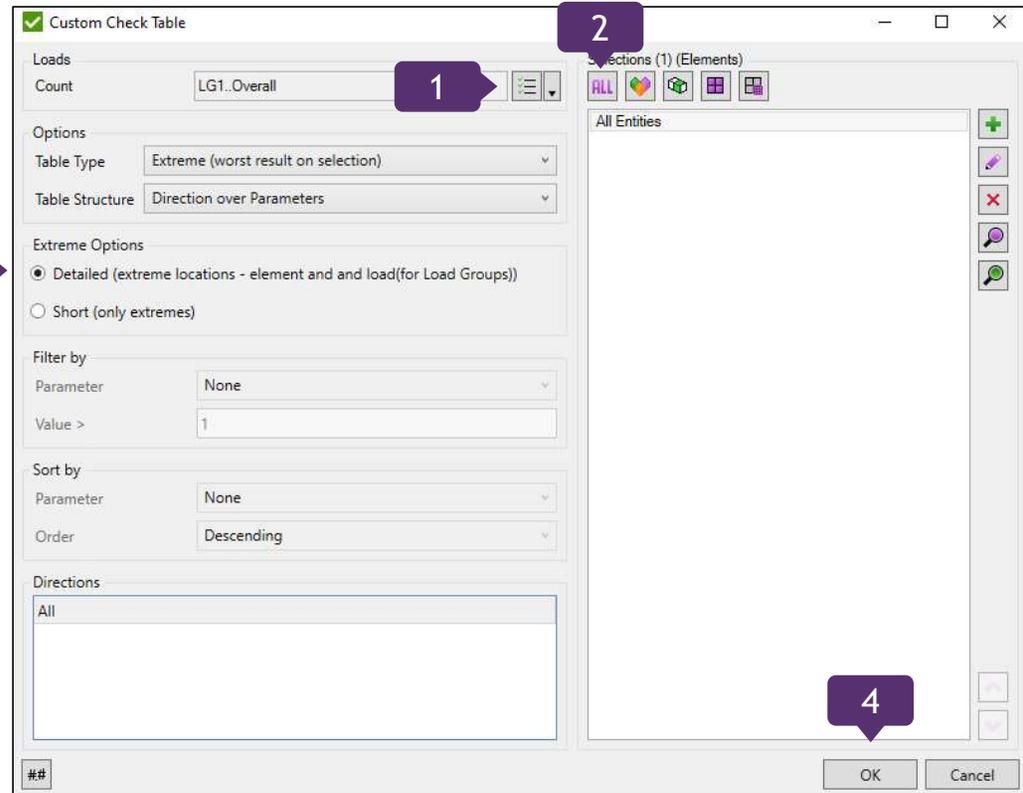
1 Execute *Reports* => *Add* => *Designer Results*

2 Execute *Results* => *Check Tables*

3 Select Standard *AISC 360-10 Members* and press *Add Check Table*



- 1 Select **Overall** Load Group
- 2 Apply **All Entities**
- 3 Select **Detailed**
- 4 Press **Ok**
- 5 Repeat 1-4 step for Standard **Eurocode3 Members**



# Report - Plots

1

Execute **Results** => **Check Plots**

2

Select Standard **AISC 360-10 Members** and press **Add Criteria Plot**

3

Select **Overall** Load Group

4

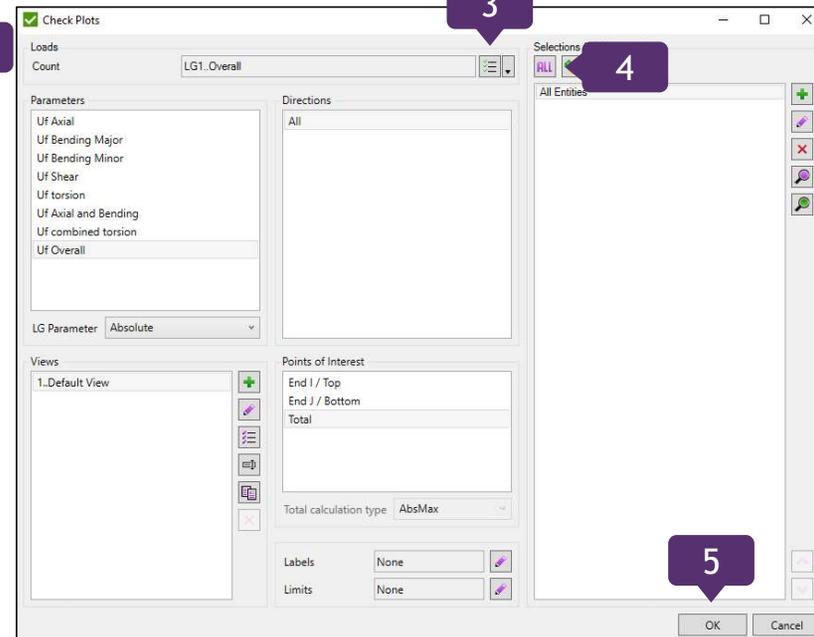
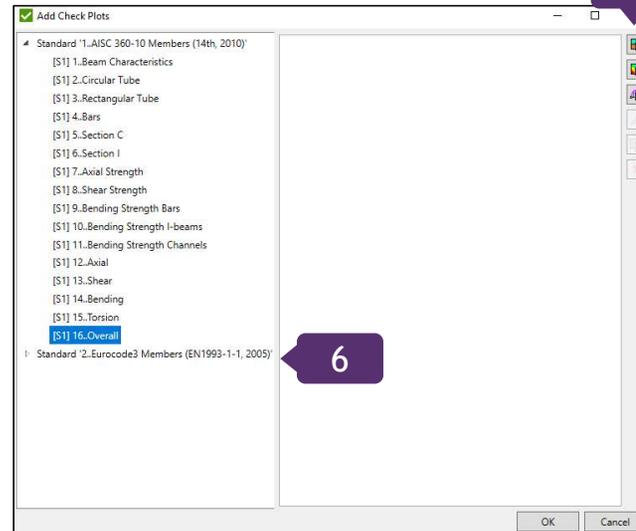
Select **All Entities**

5

Press **OK**

6

Repeat 1-5 step for Standard **Eurocode3 Members**



# Report - Tables

1

Select plot in **AISC 360-10 Members**  
=> **Abs UF Overall**

2

Select **Break Page Before** and press **No**

3

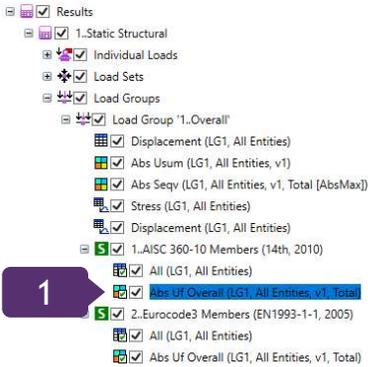
Select plot in **AISC 360-10 Members**  
=> **Abs UF Overall**

4

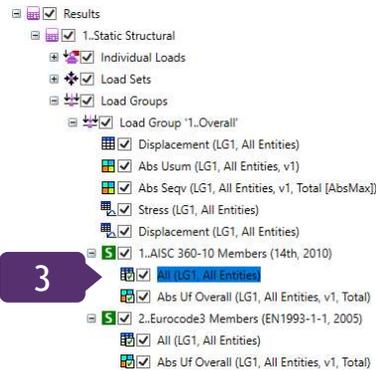
Select **Break Page Before** and press **No**

5

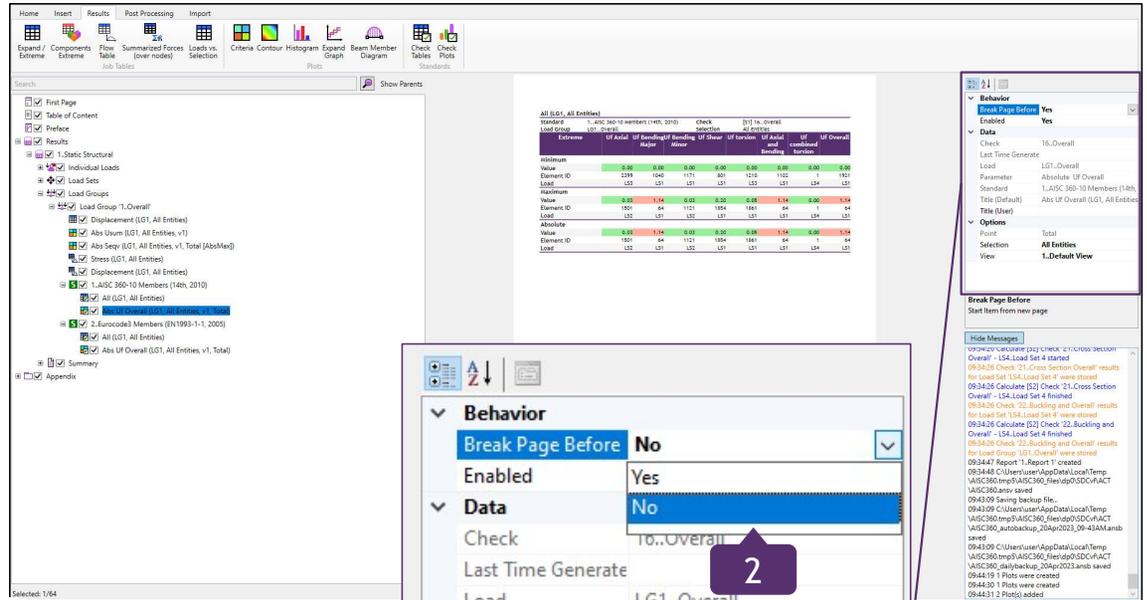
Repeat 1-4 step for **Eurocode3 Members**



1



3



2

# Generated Report

1

Select both Standards and press **Generate**

2

After generation is finished press to export generated report to Word

- AISC 360-10 Members (14th, 2010)**
- All (LG1, All Entities)
- Abs Uf Overall (LG1, All Entities, v1, Total)
- Eurocode3 Members (EN1993-1-1, 2005)**
- All (LG1, All Entities)
- Abs Uf Overall (LG1, All Entities, v1, Total)
- Summary
- Appendix

1

- Generate
- Move Up
- Move Down
- Copy Ctrl + C
- Cut Ctrl + X
- Remove Del
- Select Items ▶
- Apply to Selected ▶

2

Generate

Export to Word

Export to PDF

Generate

Page 2 of 3

### 1..AISC 360-10 Members (14th, 2010)

All (LG1, All Entities)

Standard	1..AISC 360-10 Members (14th, 2010)							Check Selection	[51] 16..Overall All Entities
Load Group	Extreme	Uf Axial	Uf Bending Major	Uf Bending Minor	Uf Shear	Uf torsion	Uf Axial and Bending	Uf combined torsion	Uf Overall
Minimum Value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Element ID	2399	1040	1171	801	1210	1102	1	1921	
Load	L53	L51	L51	L51	L53	L51	L54	L51	
Maximum Value	0.03	1.14	0.03	0.20	0.05	1.14	0.00	1.14	
Element ID	1501	64	1121	1854	1861	64	1	64	
Load	L52	L51	L52	L51	L51	L51	L54	L51	
Absolute Value	0.03	1.14	0.03	0.20	0.05	1.14	0.00	1.14	
Element ID	1501	64	1121	1854	1861	64	1	64	
Load	L52	L51	L52	L51	L51	L51	L54	L51	

Abs Uf Overall (LG1, All Entities, v1, Total)

Check Load Group	[51] 16..Overall LG1, Overall	Point Parameter View	Total Absolute Uf Overall
Selection	All Entities		1..Default View

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Page 3 of 3

### 2..Eurocode3 Members (EN1993-1-1, 2005)

All (LG1, All Entities)

Standard	2..Eurocode3 Members (EN1993-1-1, 2005)				Check Selection	[52] 22..Buckling and Overall All Entities		
Load Group	Extreme	Uf Axial	Uf Bending	Uf Combined 61	Uf Combined 62	Uf Buckling	Uf Section	Uf Overall
Minimum Value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Element ID	1	1	1	1	1	1	1921	1921
Load	L54	L54	L54	L54	L54	L54	L51	L51
Maximum Value	0.03	1.09	1.08	1.09	1.09	1.09	1.04	1.09
Element ID	1501	64	64	64	64	64	64	64
Load	L52	L54	L52	L52	L52	L52	L51	L52
Absolute Value	0.03	1.09	1.08	1.09	1.09	1.09	1.04	1.09
Element ID	1501	64	64	64	64	64	64	64
Load	L52	L54	L52	L52	L52	L52	L51	L52

Abs Uf Overall (LG1, All Entities, v1, Total)

Check Load Group	[52] 22..Buckling and Overall LG1, Overall	Point Parameter View	Total Absolute Uf Overall
Selection	All Entities		1..Default View

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