



# Tutorial

## **AISC 360-10 & Eurocode3**

**ANSYS<sup>®</sup>**

24 Jan 2020  
version 5.3

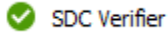

- ▶ In this tutorial, AISC 360-10 & Eurocode3 Beam Design Checks are reviewed in details.
- ▶ A beam model structure has been used as a start FEM model.
- ▶ Beam member finder was used to recognize beam member dimensions.
- ▶ Report was automatically generated in SDC Verifier Report to represent beam checks results according AISC 360-10 & Eurocode3 standards.

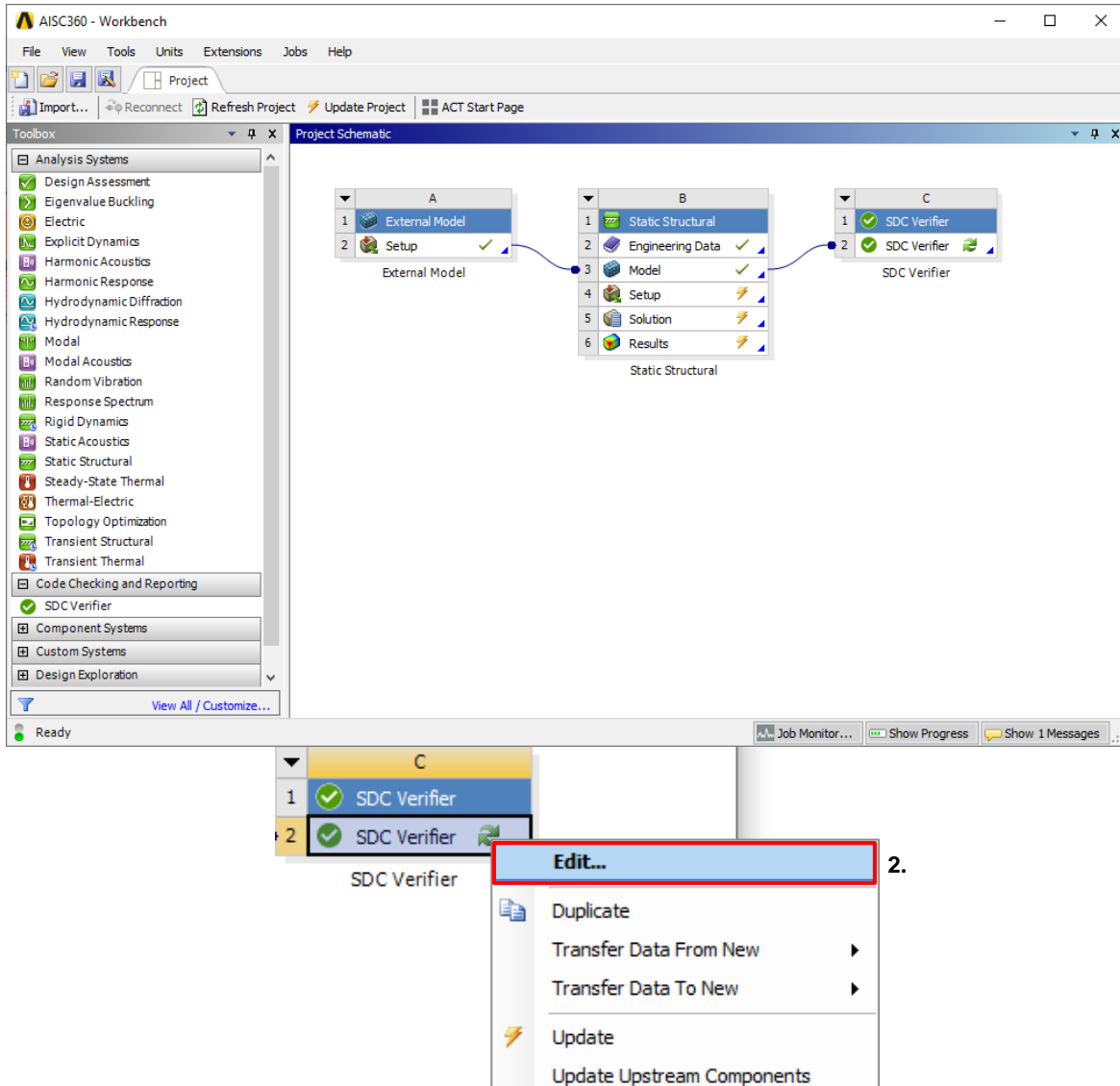
# Launch SDC Verifier

1

Open in Ansys Workbench  
AISC360 and Eurocode3.wbpj

2

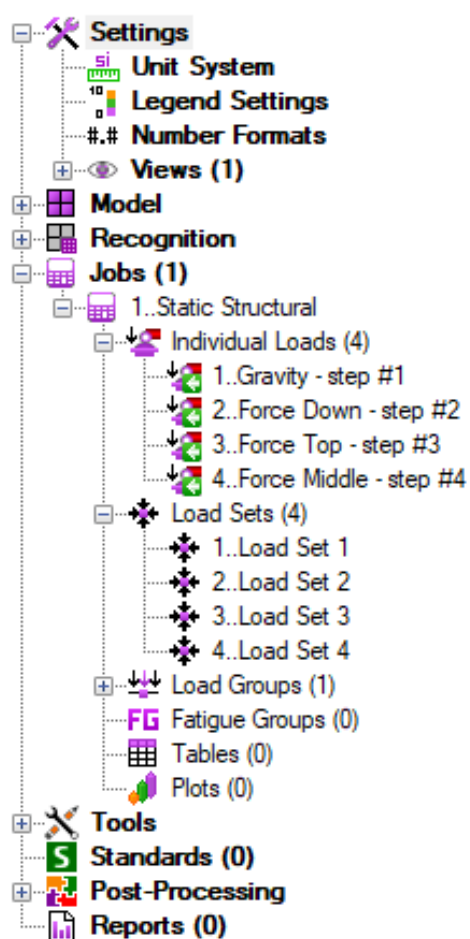
Double Click on  SDC Verifier   
or in context menu click **Edit**



The screenshot displays the Ansys Workbench interface for a project named 'AISC360 - Workbench'. The 'Toolbox' on the left lists various analysis systems, including 'SDC Verifier'. The 'Project Schematic' on the right shows a flow diagram with three main components: 'A' (External Model), 'B' (Static Structural), and 'C' (SDC Verifier). Component 'C' is highlighted, and a context menu is open over it, showing options like 'Duplicate', 'Transfer Data From New', 'Transfer Data To New', 'Update', and 'Update Upstream Components'. The 'Edit...' option is highlighted in the menu.

2.

# Predefined project

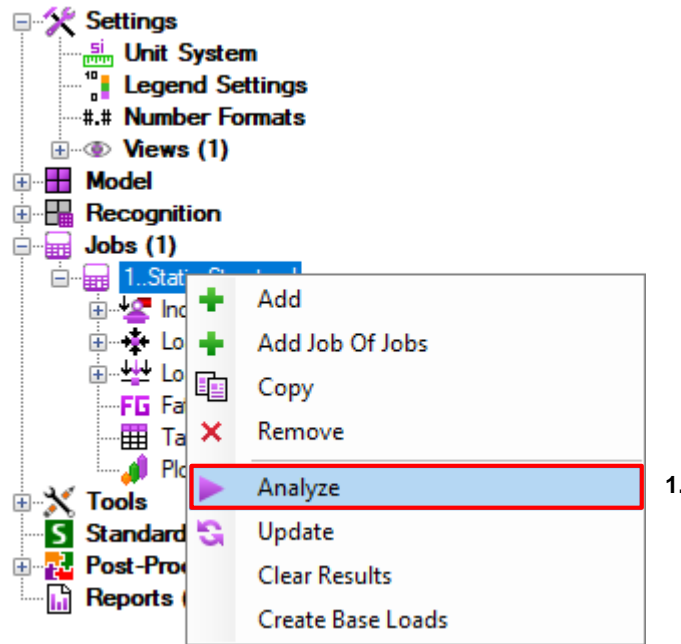


This tutorial uses project with predefined boundary condition, load combinations and load group.  
The model contains only beam elements of the following types: I-Beam, Circular and Rectangular Tubes

# Analyze Job

1

Execute ► **Analyze** from *Static Structural* context menu



# 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;

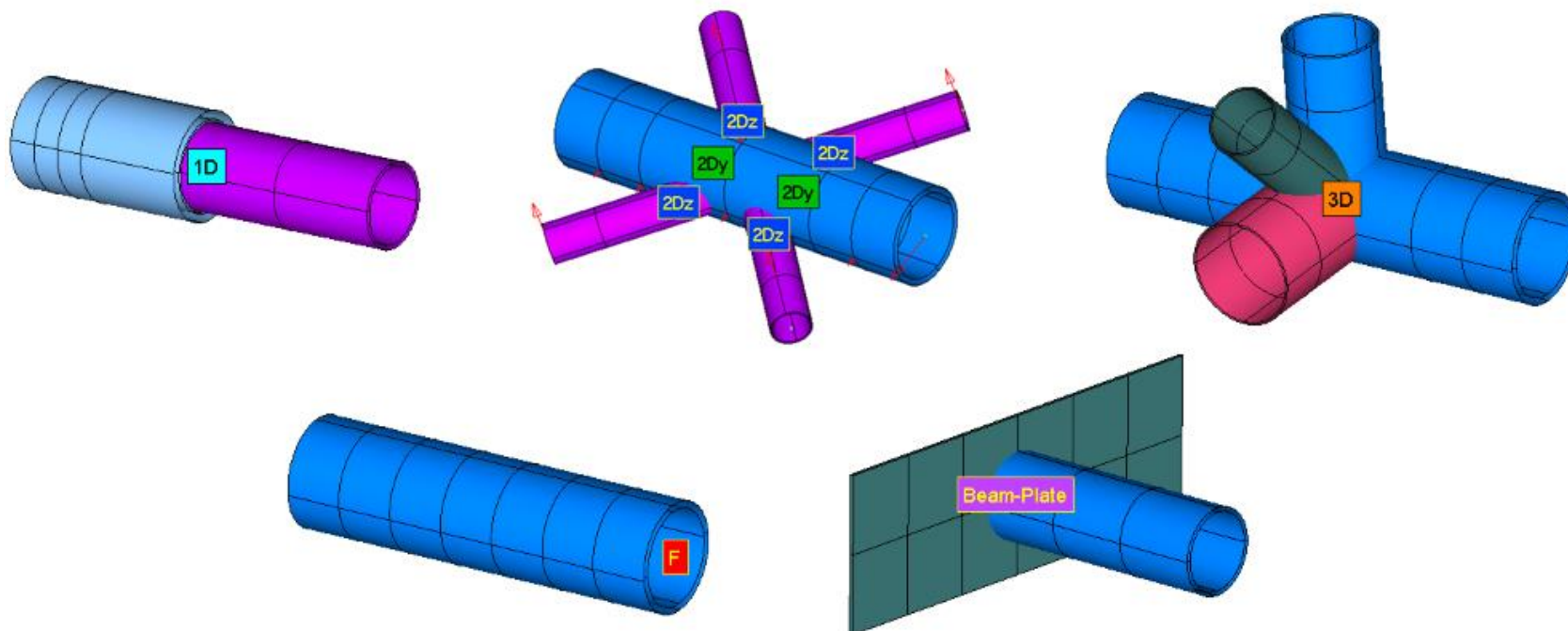
2D Joint – beam members connected in one plane;

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);

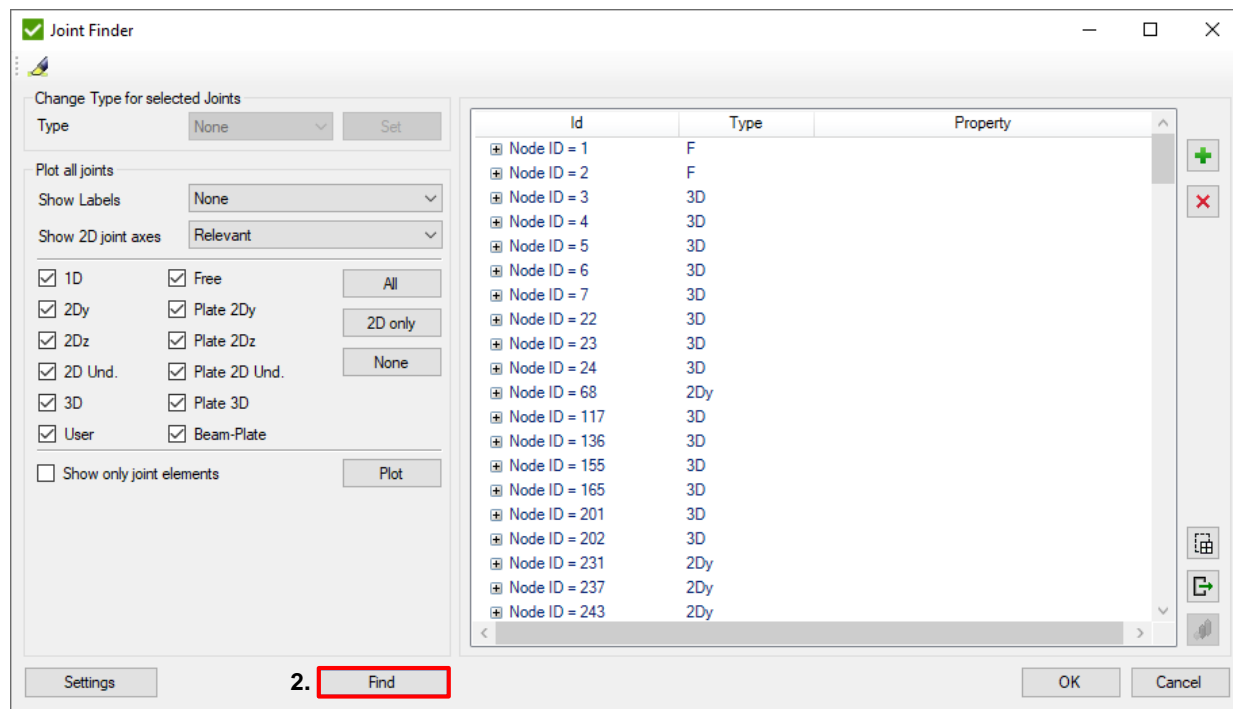
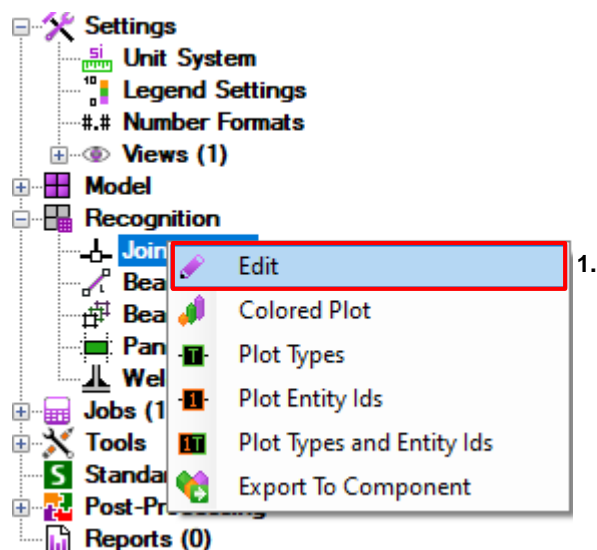
User Defined;



# Joint Recognition

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

2 Press *Find*.

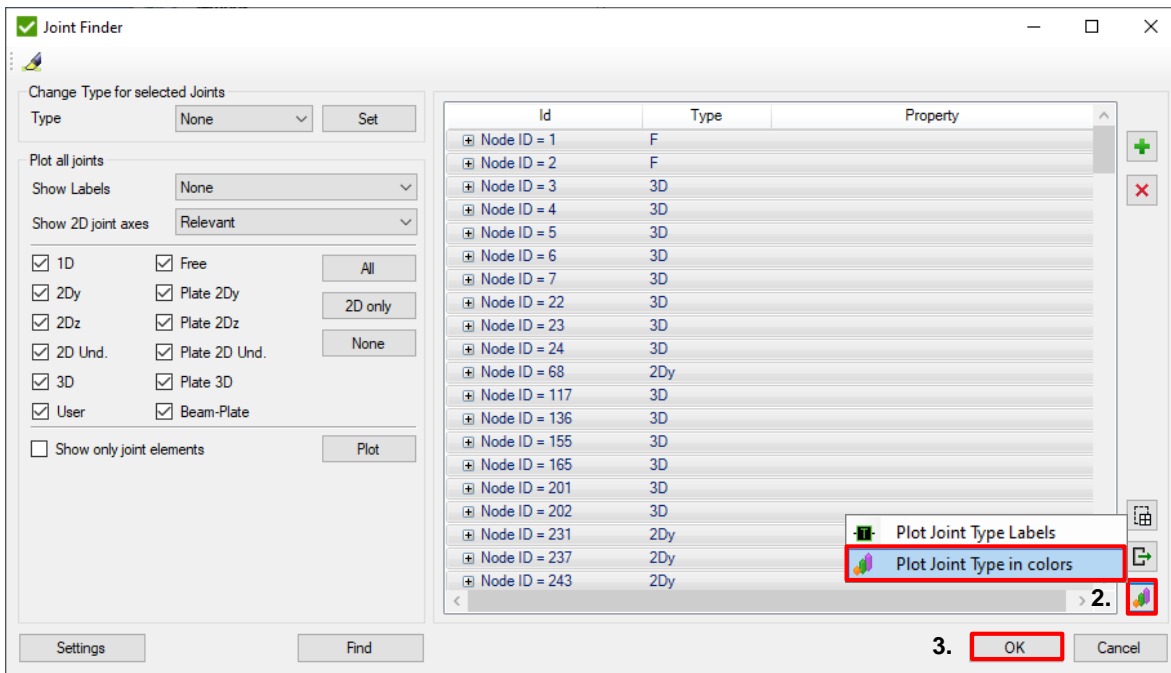
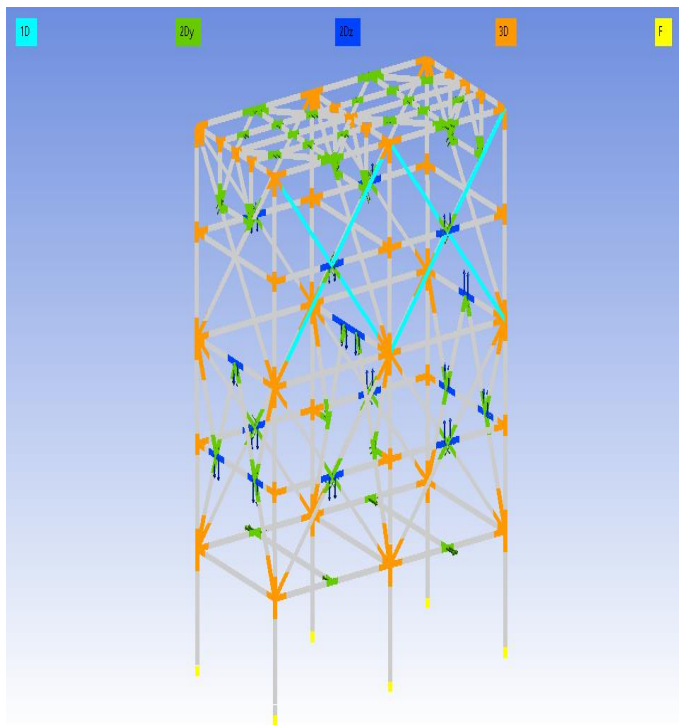


# Joints Plot

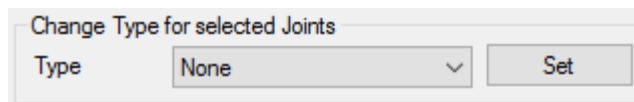
1 Select All Joints (Ctrl+A).

2 Press  and Execute  Plot Joint Type in colors

3 Press *OK*



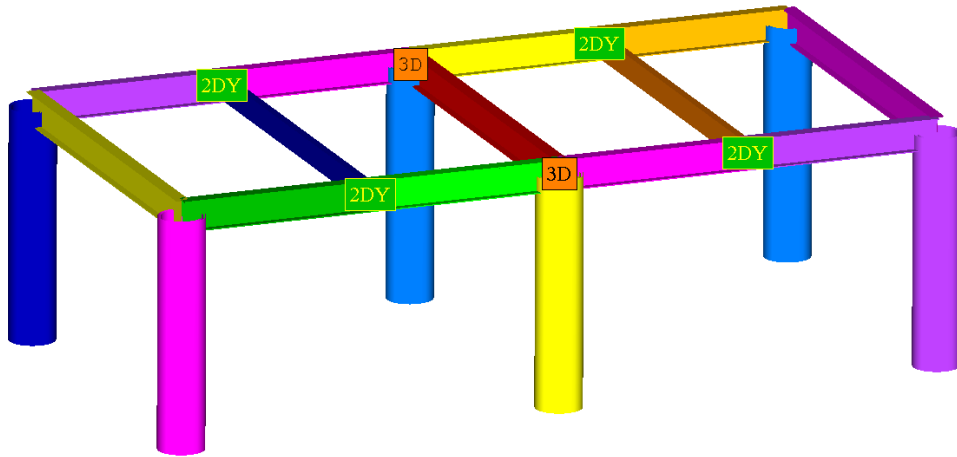
Modify Joint Type:



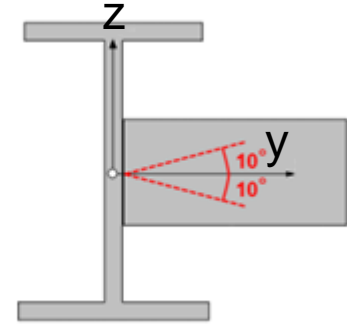


# Beam Member Lengths in 2 directions

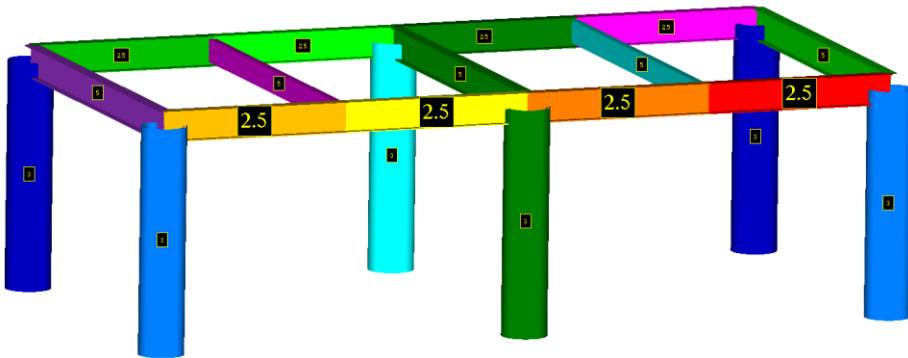
Beam Member Finder recognizes beam members and (buckling) lengths for different directions (Y, Z and Torsional).



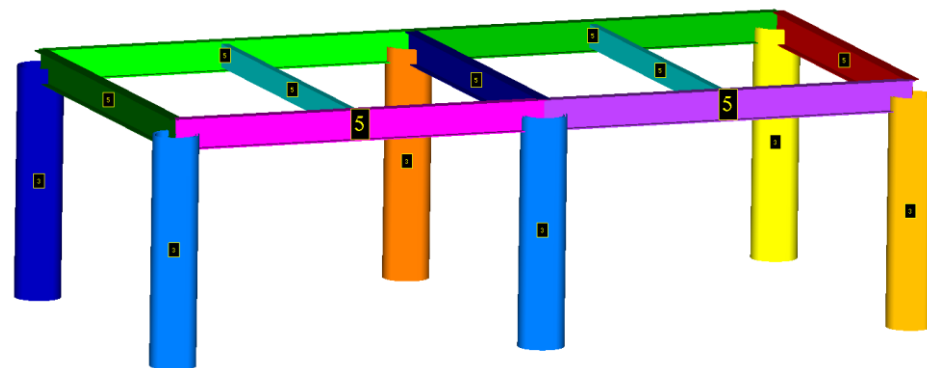
2DY  
Joint



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



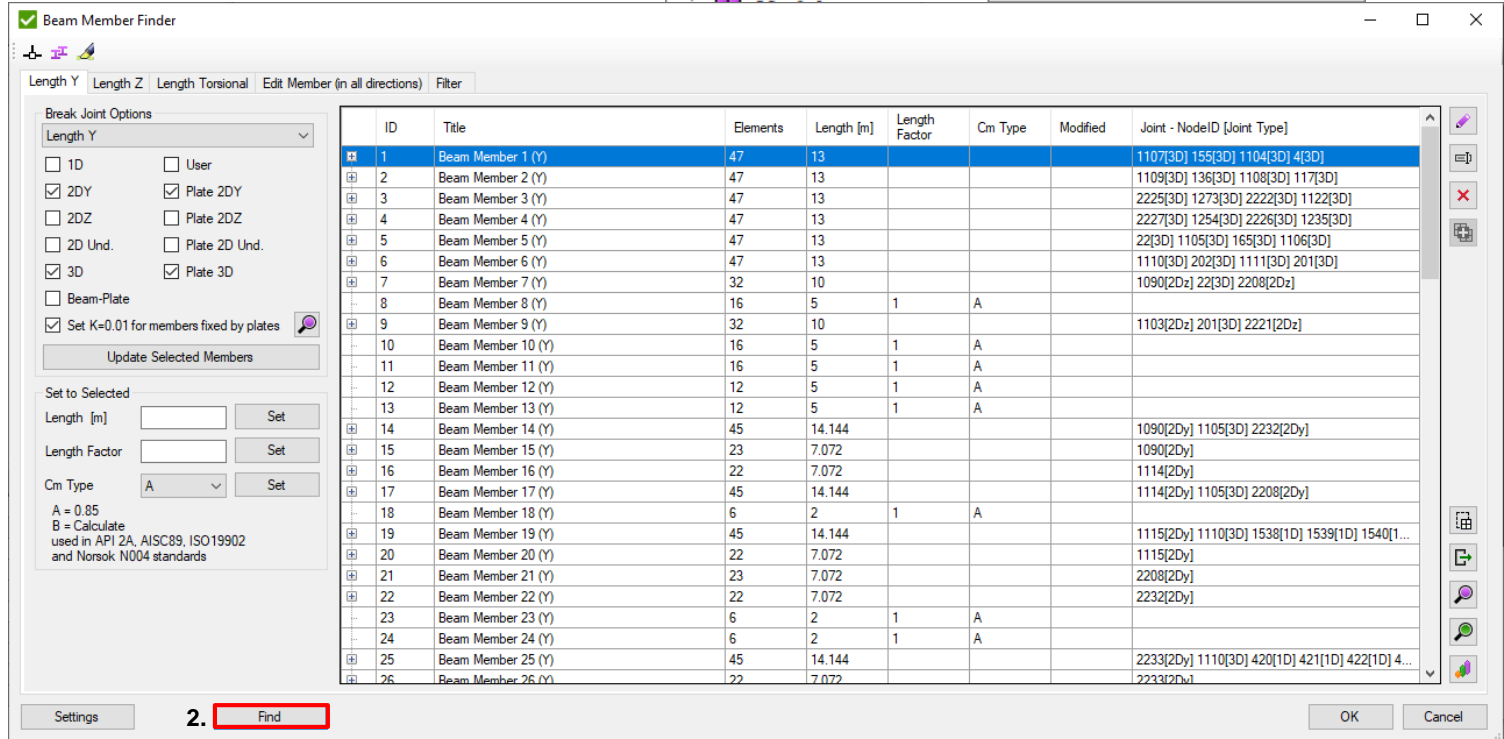
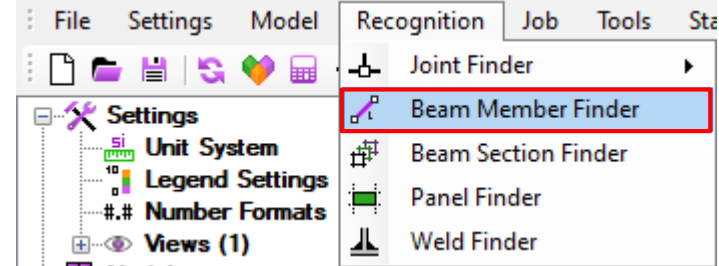
Length Z – 2 Beam Members with  $L = 5$



# Recognize Length

1 Execute Recognition – Beam Member Finder

2 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

# 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

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, AISC89, ISO19902  
and Norsok N004 standards

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] 423[1D]
26	Beam Member 26 (Y)	22	7.072				2232[2Dy]

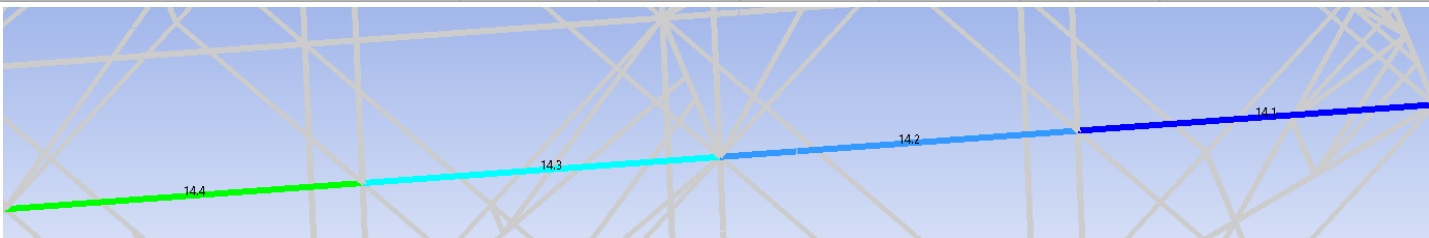
Settings Find OK Cancel

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

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



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

14	Beam Member 14 (Y)	45	14.144				1090[2Dy] 1105[3D] 2232[2Dy]
14.1	Beam Member 14.1 (Y)	12	3.536	1	A		
14.2	Beam Member 14.2 (Y)	11	3.536	1	A		
14.3	Beam Member 14.3 (Y)	11	3.536	1	A		
14.4	Beam Member 14.4 (Y)	11	3.536	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

**Beam Member Finder**

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

Break Joint Options

Length Y: ☐ 1D ☐ User ☐ 2D Y ☐ Plate 2D Y ☐ 2D Z ☐ Plate 2D Z ☐ 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 [in]:  Set

Length Factor:  Set

On Type:  A Set



A = 0.85  
B = Calculate  
used in API 2A, AISC89, ISO 19902  
and Norsok N004 standards

ID	Title	Elements	Length [in]	Length Factor	On Type	Modified	Joint - NodeID [Joint Type]
1	Beam Member 1 (Y)	47	13				1107(3D) 195(3D) 1104(3D) 4(3D)
2	Beam Member 2 (Y)	47	13				1108(3D) 196(3D) 1108(3D) 117(3D)
3	Beam Member 3 (Y)	47	13				2228(3D) 1229(3D) 2222(3D) 1129(3D)
4	Beam Member 4 (Y)	47	13				2227(3D) 1264(3D) 2226(3D) 1226(3D)
5	Beam Member 5 (Y)	47	13				22(2D) 1105(3D) 165(3D) 1106(3D)
6	Beam Member 6 (Y)	47	13				1110(3D) 203(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		
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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)

Settings Find

3. OK

2. 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

Also it is possible to display beam members IDs by pressing  and  Plot Members ID labels

## STEEL CONSTRUCTION



## MANUAL

AMERICAN INSTITUTE  
OF  
STEEL CONSTRUCTION  
INC.

THIRTEENTH EDITION

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

# 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	
<input checked="" type="radio"/> LRFD	<input type="radio"/> 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	
<input type="radio"/> LRFD	<input checked="" type="radio"/> 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:

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

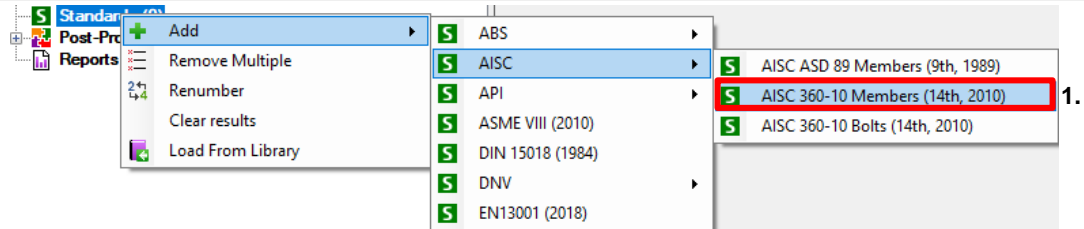
$$\phi_t = 0.90 \text{ (LRFD)} \quad \Omega_t = 1.67 \text{ (ASD)}$$

In SDC Verifier multiplication is always used ASD factor is converted to  $1 / S_f$  (ASD). For example: tensile resistance factor (F<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**



The screenshot shows the 'AISC 360-10 Members (14th, 2010)' dialog box. The 'ID' is 1 and the 'Title' is 'AISC 360-10 Members (14th, 2010)'. The 'Description' field is empty. The 'Settings' section includes 'Resistance Factors' (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), and 'Use API 2A RP for tubular shapes' (unchecked). The 'Selection' section includes 'ALL' and '+ 6 Shapes'. The 'Elements' field shows 1856. The 'Materials with Yield and Tensile = 0' field shows 1. The 'Second order effects (APPENDIX 8)' section includes 'Take into account second-order effects (B1 multiplier)' (unchecked), 'Use Cm = 1 (conservative)' (unchecked), and 'Calculate Cm: case a = 0.6 - 0.4 \* M1 / M2, case b = 1.0' (checked). The 'Torsion' section includes 'Include Torsion check' (unchecked). The 'Preview Not Supported Elements' button is at the bottom left. The 'OK' and 'Cancel' buttons are at the bottom right.

# 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

 AISC 360-10 Members (14th, 2010)

ID  Title   
Description

Settings  
Resistance Factors   
Section Build Type

Selection  
   
+ 6 Shapes

 Properties Characteristics

ID  Title   
Alias   
Description

Properties  
BuildType **3. Rolled** Apply To Selected **2. To All**

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
19..CrossSection:24	Rolled
20..CrossSection:25	Rolled
21..CrossSection:26	Rolled

**4. OK** Cancel

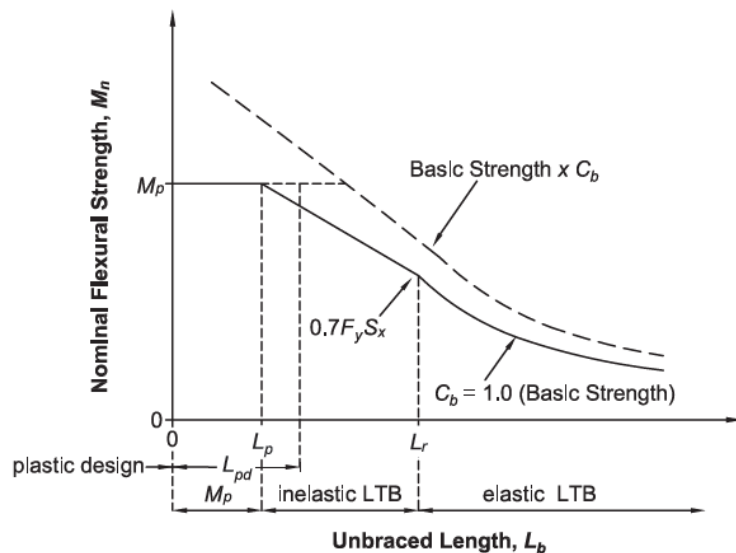


# Lateral-torsional buckling factor ( $C_b$ )

1

Select – Calculate  $C_b$ 

Go to the next slide to Continue



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

1.

✓ AISC 360-10 Members (14th, 2010)

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

Description:

Settings

Resistance Factors: LRFD

Section Build Type: Defined

1. ☒ 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

☐ Use API 2A RP for tubular shapes

Selection

+ 6 Shapes

Elements: 1856

Materials with Yield and Tensile = 0 1

Second order effects (APPENDIX 8)

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

☐ Use  $C_m = 1$  (conservative)

☒ Calculate  $C_m$ : case a =  $0.6 - 0.4 \cdot M1 / M2$ , 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

# 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

✓ AISC 360-10 Members (14th, 2010)

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

Description:

Settings

Resistance Factors: LRFD

Section Build Type: Defined

☐ 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

☐ Use API 2A RP for tubular shapes

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

7. OK Cancel

2.

✓ Material Fatigue Parameters

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

Properties

Tensile Strength [Pa]: 360e+6

Yield Stress [Pa]: 240e+6

Set

Update from Ansys

6. OK Cancel

3.

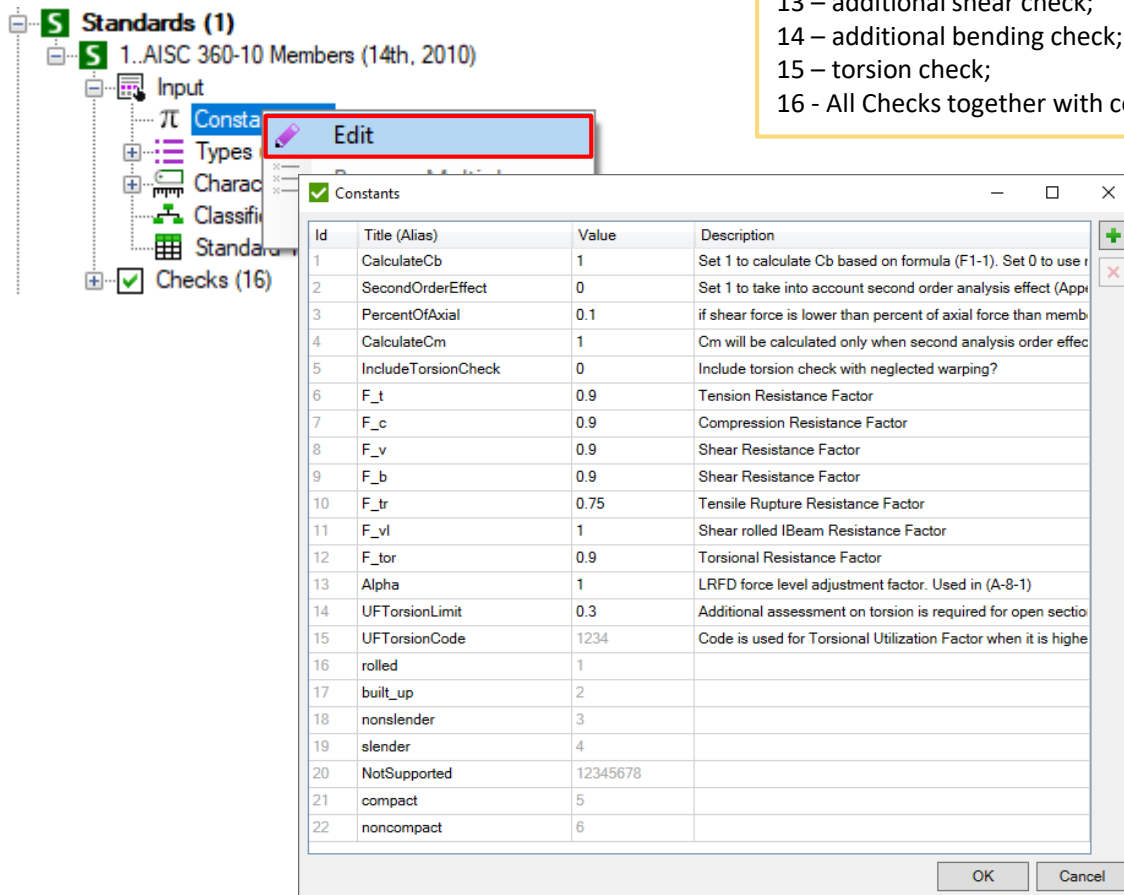
4.

5.

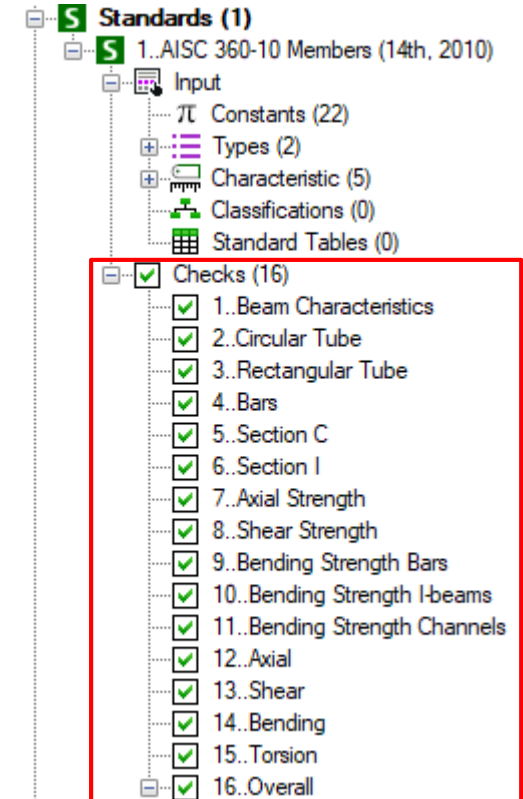
# Standard is created

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 section
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	



- 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

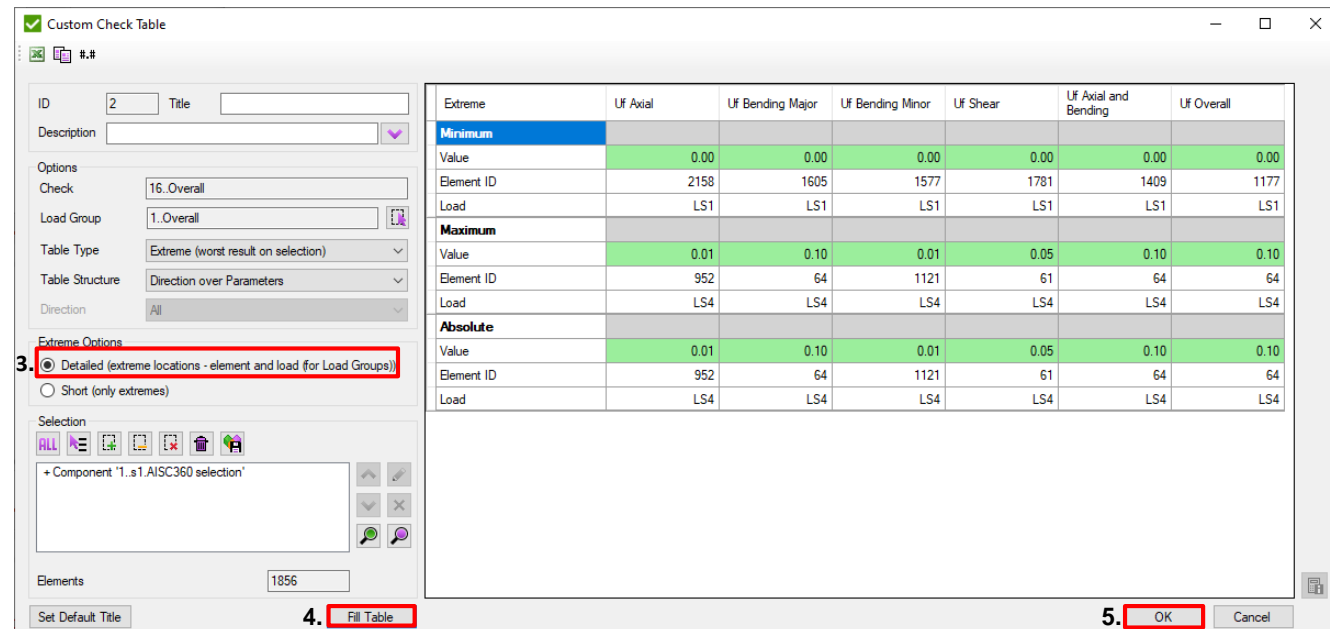
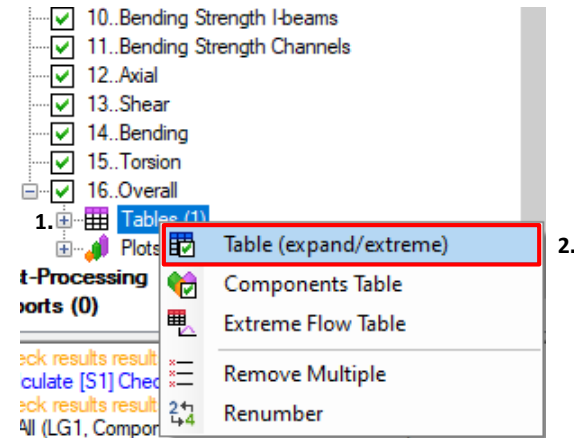
1 Select *Tables*

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

3 Select Extreme Options - *Detailed*

4 Press *Fill Table*

5 Press *Ok*



# Utilization Factor Plot

1 Select Plots

3 Press  to preview Plot

2 Execute *Criteria Plot* in context menu

4 Press *Ok*

- ☒ 11..Bending Strength Channels
- ☒ 12..Axial
- ☒ 13..Shear
- ☒ 14..Bending
- ☒ 15..Torsion
- ☒ 16..Overall


Tables (2)

1.  Criteria Plot

Post-Processing Reports (0)

check results result

..All (LG1. Compol

2.  Contour Plot

Remove Multiple

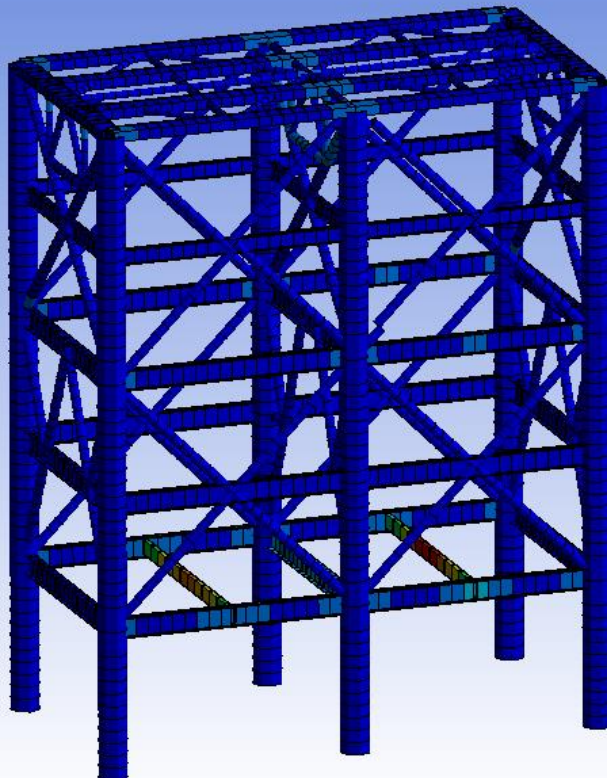
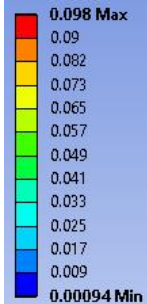
Renumber

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

Expression: RES6 (Scoped to Elements)

Time: 4

1/29/2020 12:55 PM



☒ Criteria Plot

ID  Title

Description

Options

Check

Load Group

Parameter







Direction

LG Parameter

Point Of Interest  Type

View

Selection

☒ ALL ☐      


+ Component '1..s1.AISC360 selection'

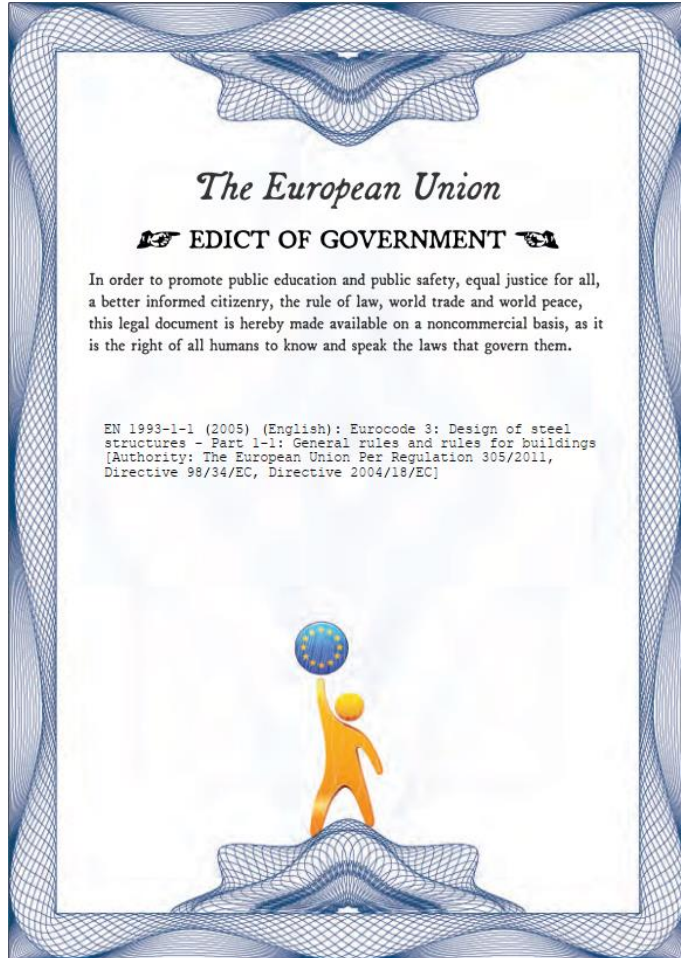
Elements

Labels

Limits

Set Default Title

3.   4.



## 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

**Options**

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

Materials with Yield and Tensile = 0 0

Selection 104 Properties

**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

**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:**  
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.

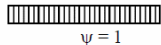




It is possible to choose the calculation method for Lateral Torsional Buckling: General Case (chapter 6.3.2.2), For rolled sections or equivalent welded sections (chapter 6.3.2.3) or the worst of two (min reduction factor is used from 2 methods):






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

A correction Factor  $K_c$  can be calculated using the  $C_m$  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:  Title:

Description:

Options

Partial Factor  $G_m0$ :

Partial Factor  $G_m1$ :

Partial Factor  $G_m2$ :

Lambda  $LT,0$ :

Beta:

Eta:

Fabrication Type:

Manufacture Method:

Fillet:

Section Net Area:

Material Type:

Correction Factor  $K_c$

☒ Calculate according to Table 6.6

☐ Set  $K_c = 1$  for all members

Materials with Yield and Tensile =

Selection:

Lengths for Torsional-Flexural and Lateral Torsional Buckling

☒  $LT = \max(L_y, L_z)$   
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)

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 user.

**Beam Member Finder**

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

Break Joint Options

Torsion (Lb)

☐ 1D ☐ User

☒ 2DY ☐ Plate 2DY

☒ 2DZ ☐ Plate 2DZ

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**

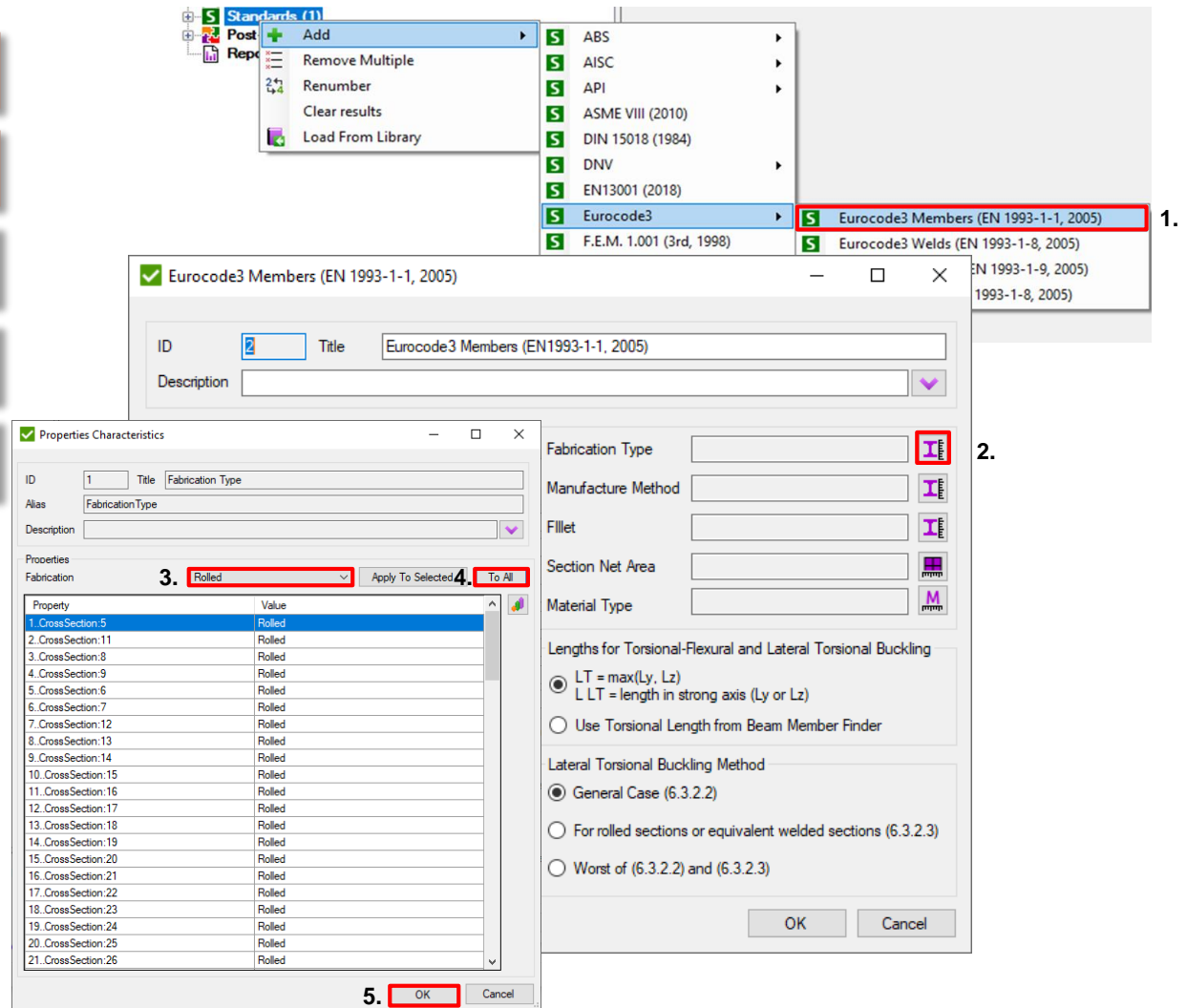
4

Press *To All*

5

Press *Ok*

Go to the next slide to Continue



The screenshot displays the SDC Verifier software interface with several windows open. The 'Standards (1)' window is at the top, showing a list of standards with 'Eurocode3 Members (EN 1993-1-1, 2005)' highlighted. The 'Eurocode3 Members (EN 1993-1-1, 2005)' window is open, showing the 'ID' field set to 2 and the 'Title' field set to 'Eurocode3 Members (EN1993-1-1, 2005)'. The 'Properties Characteristics' window is open, showing the 'Fabrication' dropdown set to 'Rolled' and the 'Apply To Selected' dropdown set to 'To All'. The 'Fabrication Type' window is open, showing the 'Fabrication Type' dropdown set to 'Rolled' and the 'Material Type' dropdown set to 'M'. The 'OK' button in the 'Fabrication Type' window is highlighted.

1. Standards (1)

- ABS
- AISC
- API
- ASME VIII (2010)
- DIN 15018 (1984)
- DNV
- EN13001 (2018)
- Eurocode3**
  - Eurocode3 Members (EN 1993-1-1, 2005)**
  - Eurocode3 Welds (EN 1993-1-8, 2005)
- F.E.M. 1.001 (3rd, 1998)

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

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

Description:

3. Properties Characteristics

ID: 1 Title: Fabrication Type

Alias: Fabrication Type


Description:


Properties


Fabrication: **3. Rolled** Apply To Selected: **4. To All**


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
19. CrossSection: 24	Rolled
20. CrossSection: 25	Rolled
21. CrossSection: 26	Rolled


5. OK Cancel

Fabrication Type:  2.

Manufacture Method: 

Fillet: 

Section Net Area: 

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

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)

OK Cancel

# 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)

Description:

Options

Partial Factor Gm0: 1.0

Partial Factor Gm1: 1.0

Fabrication Type: Defined

Manufacture Method: **I**

Fillet:

Section Net Area:

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

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)

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
19.CrossSection:24	Hot Finished
20.CrossSection:25	Hot Finished
21.CrossSection:26	Hot Finished

OK Cancel

1.

# Eurocode3. Fillet

1 Press  to set *Fillet*

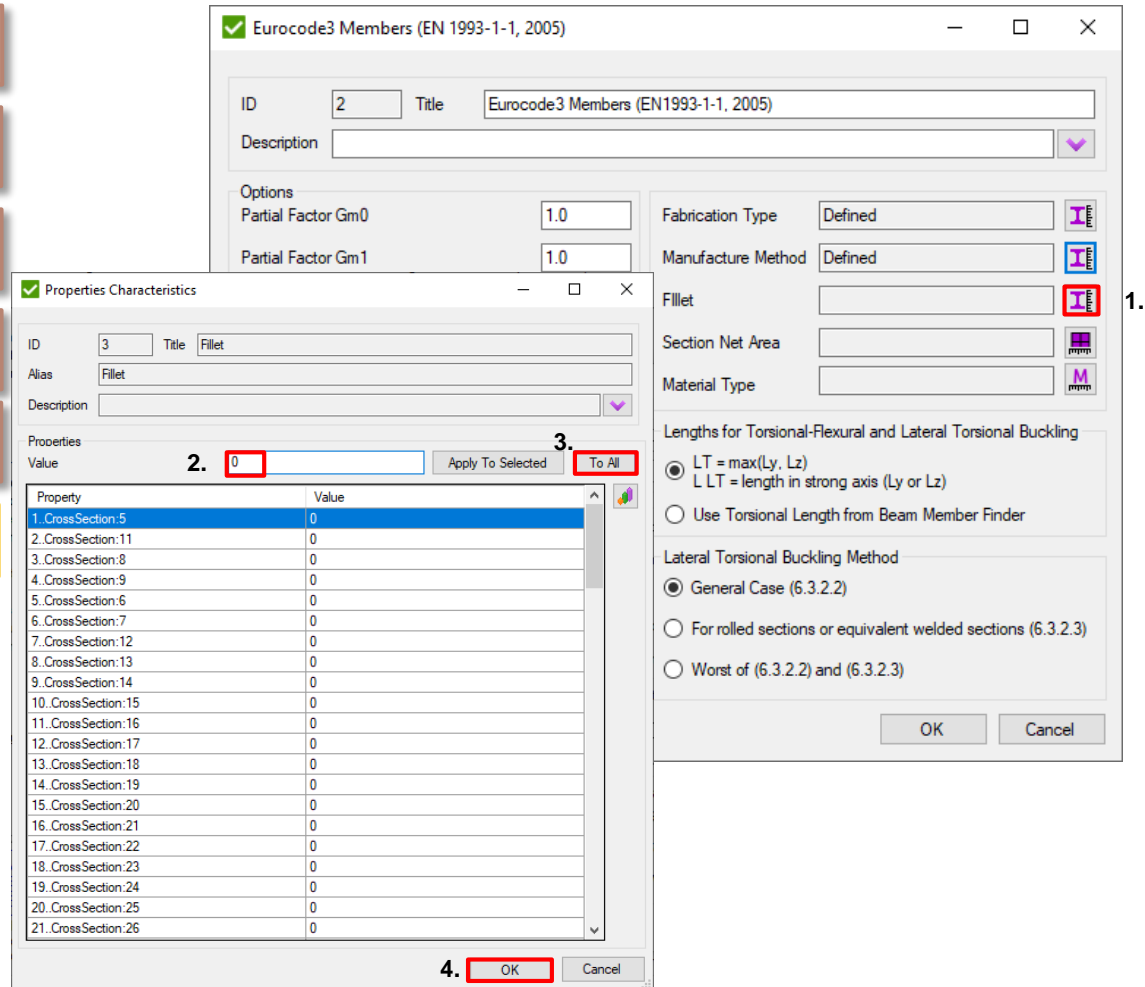
2 Properties Value - **0**

3 Press *To All*

4 Press *Ok*

Repeat Steps 1-4 for *Section Net Area*

Go to the next slide to Continue



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

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

Description:

Options

Partial Factor Gm0: 1.0

Partial Factor Gm1: 1.0

Fabrication Type: Defined

Manufacture Method: Defined

Fillet:

Section Net Area:

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

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)

OK Cancel

**Properties Characteristics**

ID: 3 Title: Fillet

Alias: Fillet

Description:


Properties Value: 0

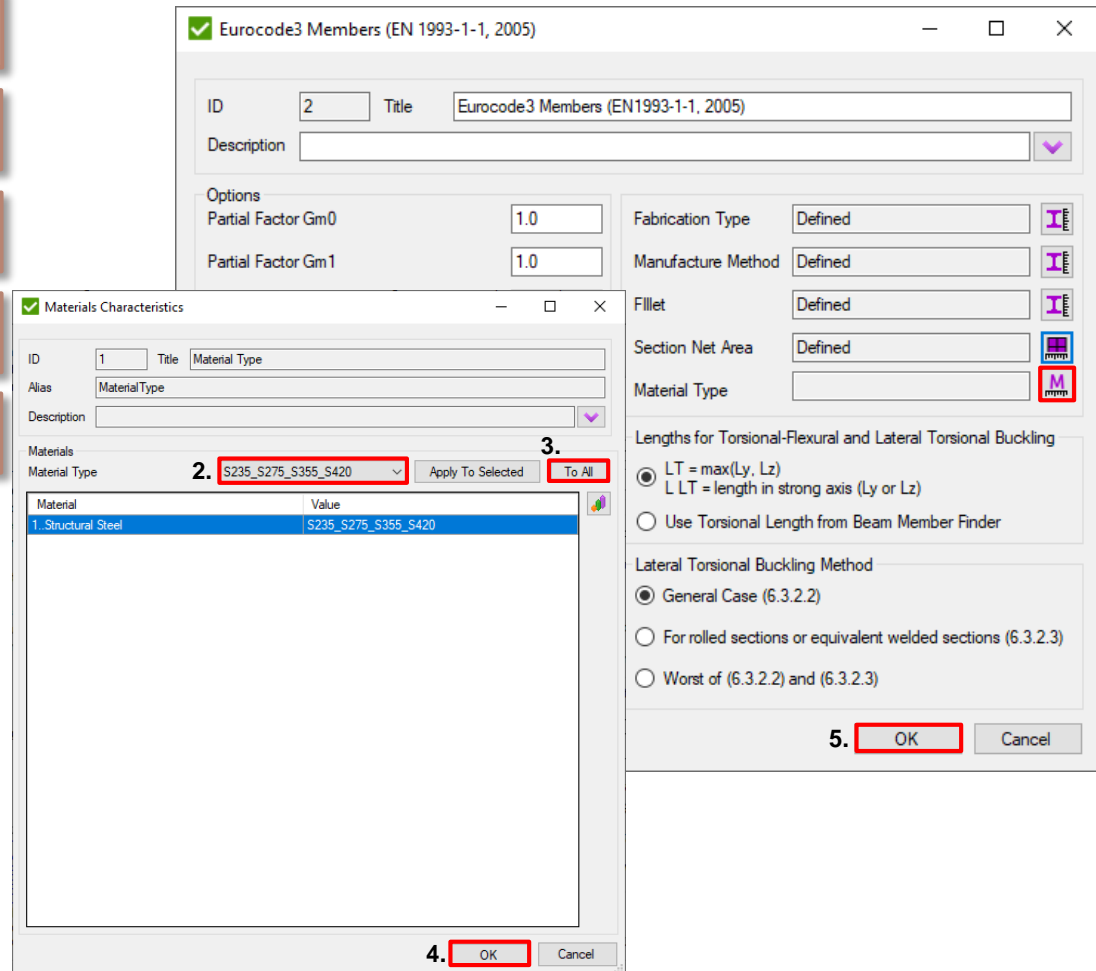
Apply To Selected To All

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

OK Cancel

# 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)

Description:

Options

Partial Factor Gm0: 1.0

Partial Factor Gm1: 1.0

Fabrication Type: Defined

Manufacture Method: Defined

Fillet: Defined

Section Net Area: Defined

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

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 Characteristics**

ID: 1 Title: Material Type

Alias: Material Type

Description:

Materials

Material Type: 2. S235\_S275\_S355\_S420

Apply To Selected: 3. To All

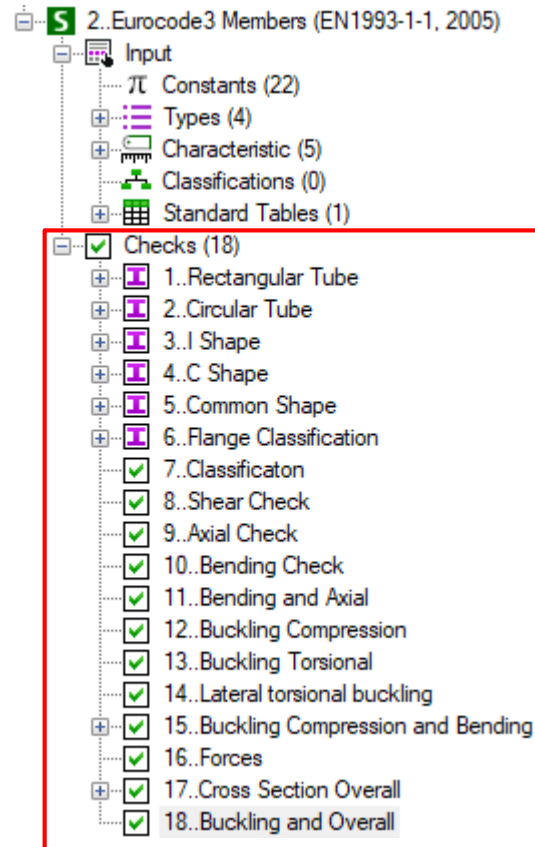
Material	Value
1. Structural Steel	S235_S275_S355_S420

4. OK

5. OK

1.

# Standard is created



Standard contains 18 checks:  
1-6 - calculation dimensions and factors for 5 different shapes;  
7 – cross section resistance;  
8 – shear strength check;  
9 – tension and compression strength check;  
10 – bending strength check;  
11 – bending, tension and compression strength check;  
12-14 – buckling strength checks ;  
15 – additional buckling compression and bending check;  
16 – forces;  
17 - cross section overall strength check;  
18 – buckling and overall strength check.

# Preview Table Results

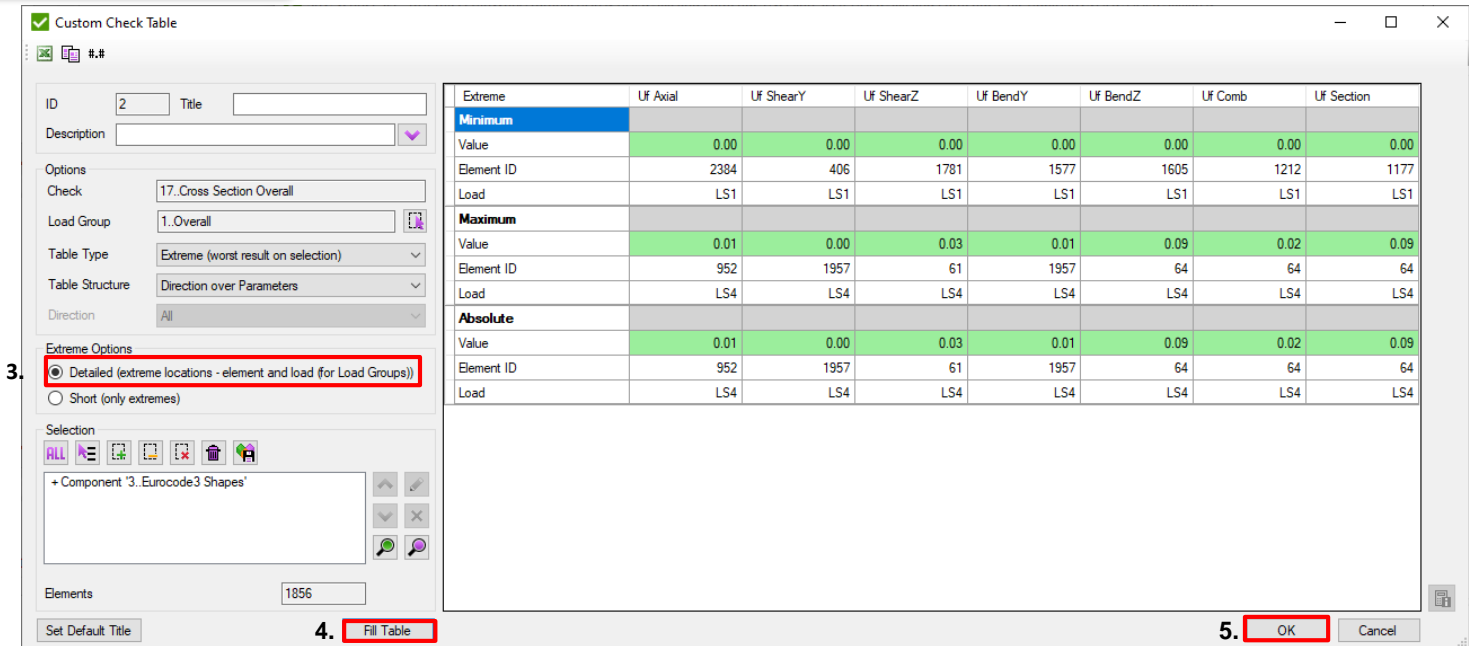
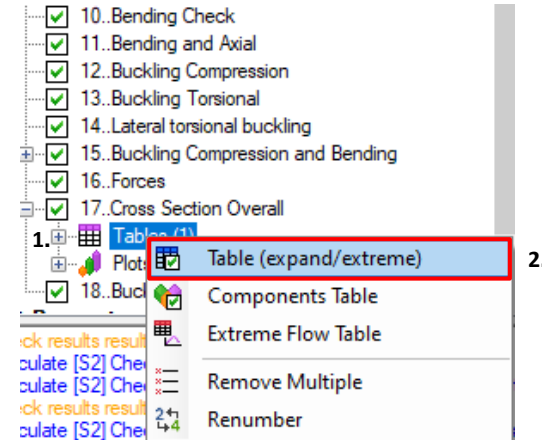
1 Select Tables

2 Execute Table (expand/extreme) in context menu

3 Select Extreme Options - Detailed

4 Press Fill Table

5 Press Ok



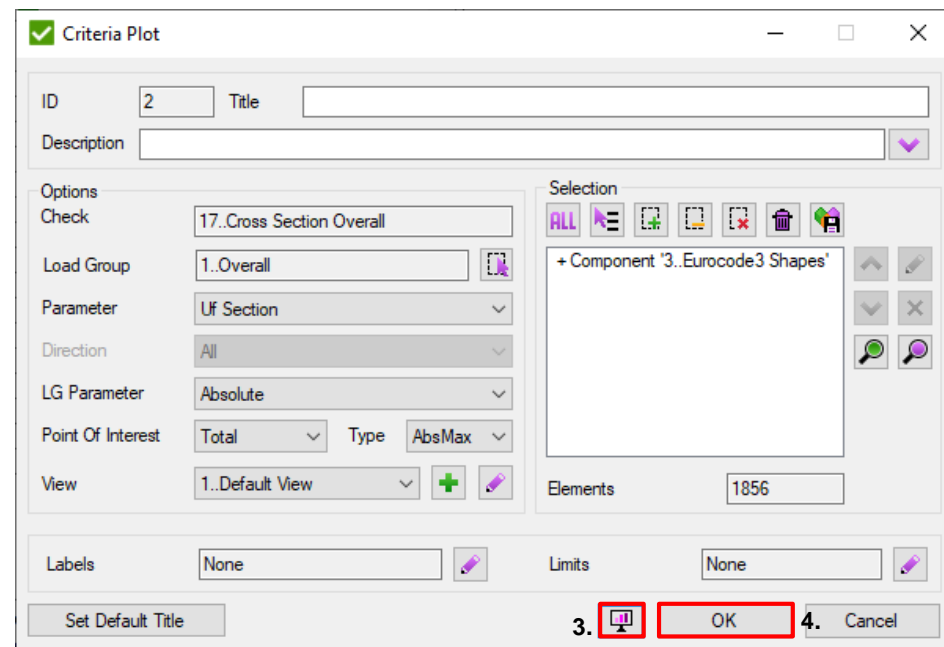
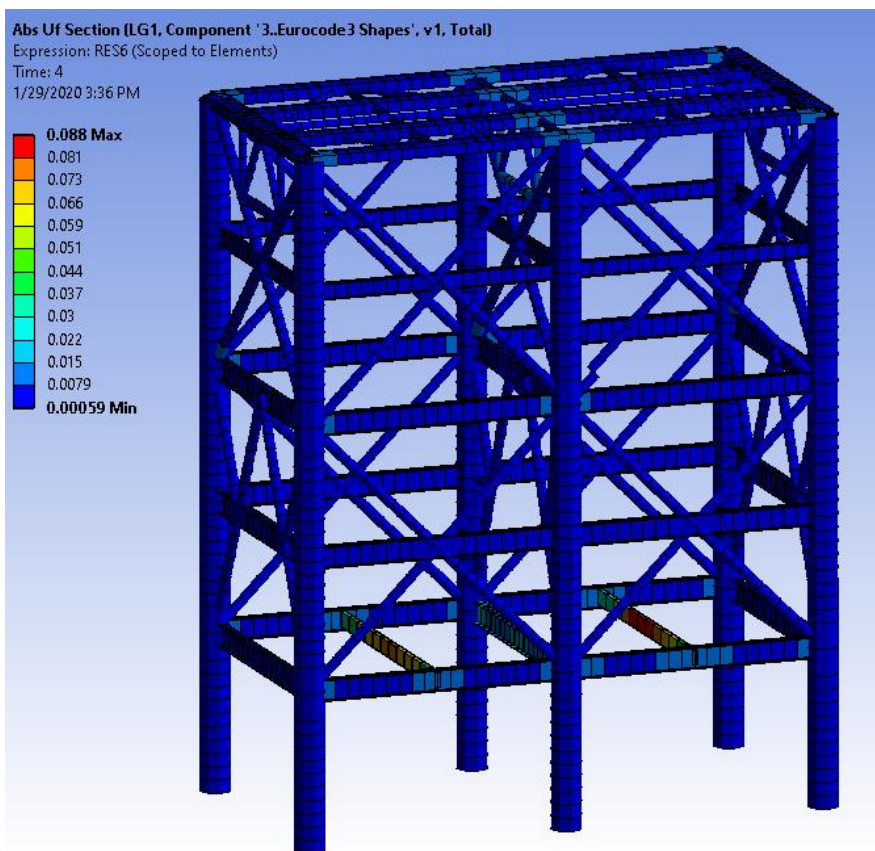
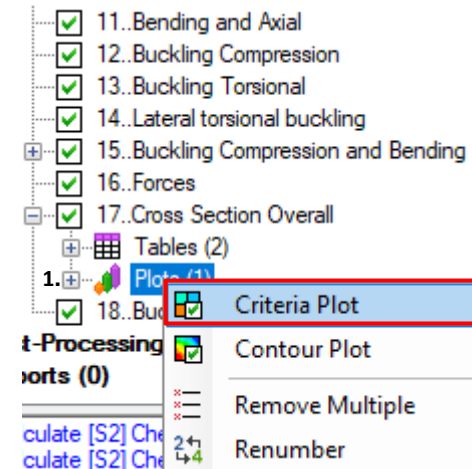
# Utilization Factor Plot

1 Select Plots

3 Press  to preview Plot

2 Execute *Criteria Plot* in context menu

4 Press *Ok*



# Create Predefined Report

1

Execute *Reports - Add - Designer-Results*.

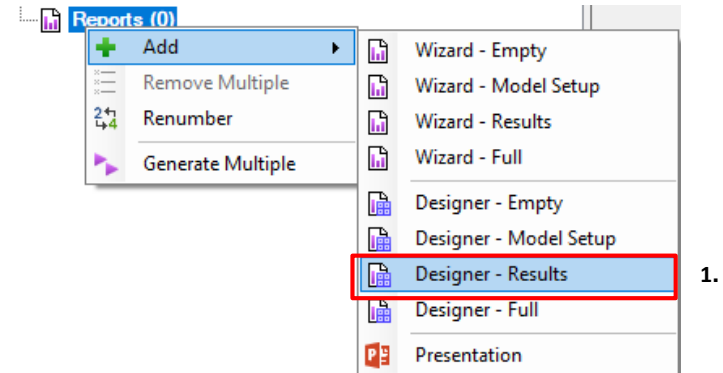
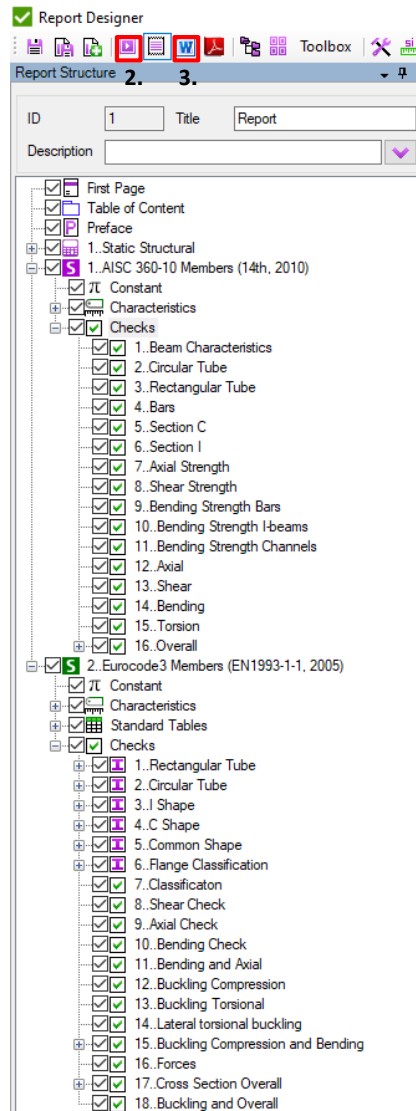
2

Press  to generate report

3

When report is generated press 

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



1.



## 16..Overall

Property	Value
Category	Elemental Custom Check
Selection	Component '1..s1.AISC360 selection'
Parameters	8

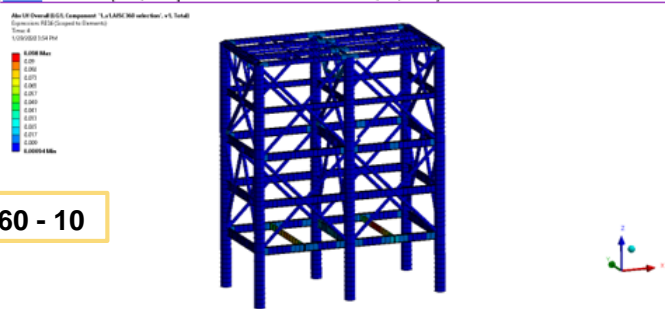
### 1..Over Load Groups

Check Selection	[S1] 16..Overall	Load Group	LG1..Overall
Load	6 Shapes		
Load Group		Uf Axial	Uf Bending Major
		Uf Bending Minor	Uf Shear
		Uf Axial and Bending	Uf Overall
		0.01	0.10
		0.01	0.05
		0.10	0.10

### 2..All (LG1, Component '1..s1.AISC360 selection')

Standard	1..AISC 360-10 Members (14th, 2010)	Check Selection	[S1] 16..Overall
Load Group	LG1..Overall		Component '1..s1.AISC360 selection'
Extreme		Uf Axial	Uf Bending Major
		Uf Bending Minor	Uf Shear
		Uf Axial and Bending	Uf Overall
Minimum		0.00	0.00
Value		0.00	0.00
Element ID		2158	1605
Load		LS1	LS1
Maximum		0.01	0.10
Value		0.01	0.10
Element ID		952	64
Load		LS4	LS4
Absolute		0.01	0.10
Value		0.01	0.10
Element ID		952	64
Load		LS4	LS4

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



AISC 360 - 10

Check Load Group	[S1] 16..Overall	Point Parameter	Total Absolute Uf Overall
	LG1..Overall		

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SDC Verifier



Prepared for  
company

Company

## 17..Cross Section Overall

Property	Value
Category	Elemental Custom Check
Selection	Component '3..Eurocode3 Shapes'
Parameters	7

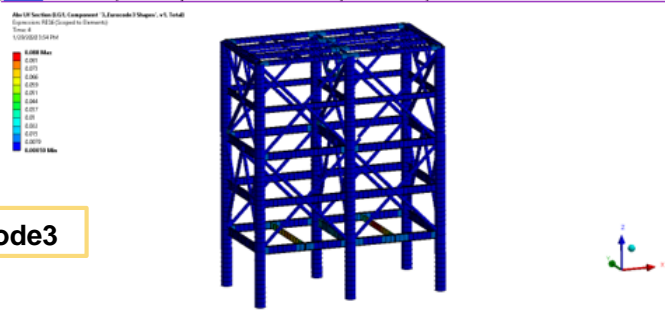
### 1..Over Load Groups

Check Selection	[S2] 17..Cross Section Overall	Load Group	LG1..Overall
Load	104 Properties		
Load Group		Uf Axial	Uf ShearY
		Uf ShearZ	Uf BendY
		Uf BendZ	Uf Comb
		0.01	0.00
		0.03	0.01
		0.09	0.02
		0.09	0.09

### 2..All (LG1, Component '3..Eurocode3 Shapes')

Standard	2..Eurocode3 Members (EN1993-1-1, 2005)	Check Selection	[S2] 17..Cross Section Overall
Load Group	LG1..Overall		Component '3..Eurocode3 Shapes'
Extreme		Uf Axial	Uf ShearY
		Uf ShearZ	Uf BendY
		Uf BendZ	Uf Comb
Minimum		0.00	0.00
Value		0.00	0.00
Element ID		2384	406
Load		LS1	LS1
Maximum		0.01	0.03
Value		0.01	0.03
Element ID		952	61
Load		LS4	LS4
Absolute		0.01	0.03
Value		0.01	0.03
Element ID		952	61
Load		LS4	LS4

### 2..Abs Uf Section (LG1, Component '3..Eurocode3 Shapes', v1, Total)



Check Load Group	[S2] 17..Cross Section Overall	Point Parameter	Total Absolute Uf Section
Selection	LG1..Overall		1..Default View
	Component '3..Eurocode3 Shapes'		

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SDC Verifier



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company

Company