



Tutorial

AISC 360-10 & Eurocode3

ANSYS[®]

25 Nov 2020
version 2020.0.2

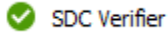

- ▶ In this tutorial, AISC 360-10 & Eurocode3 Beam Design Checks are reviewed in details.
- ▶ A beam model structure has been used as a start FEM model.
- ▶ Beam member finder was used to recognize beam member dimensions.
- ▶ Report was automatically generated in SDC Verifier Report to represent beam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

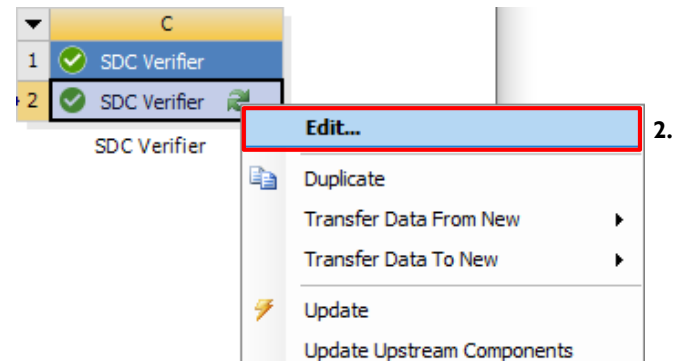
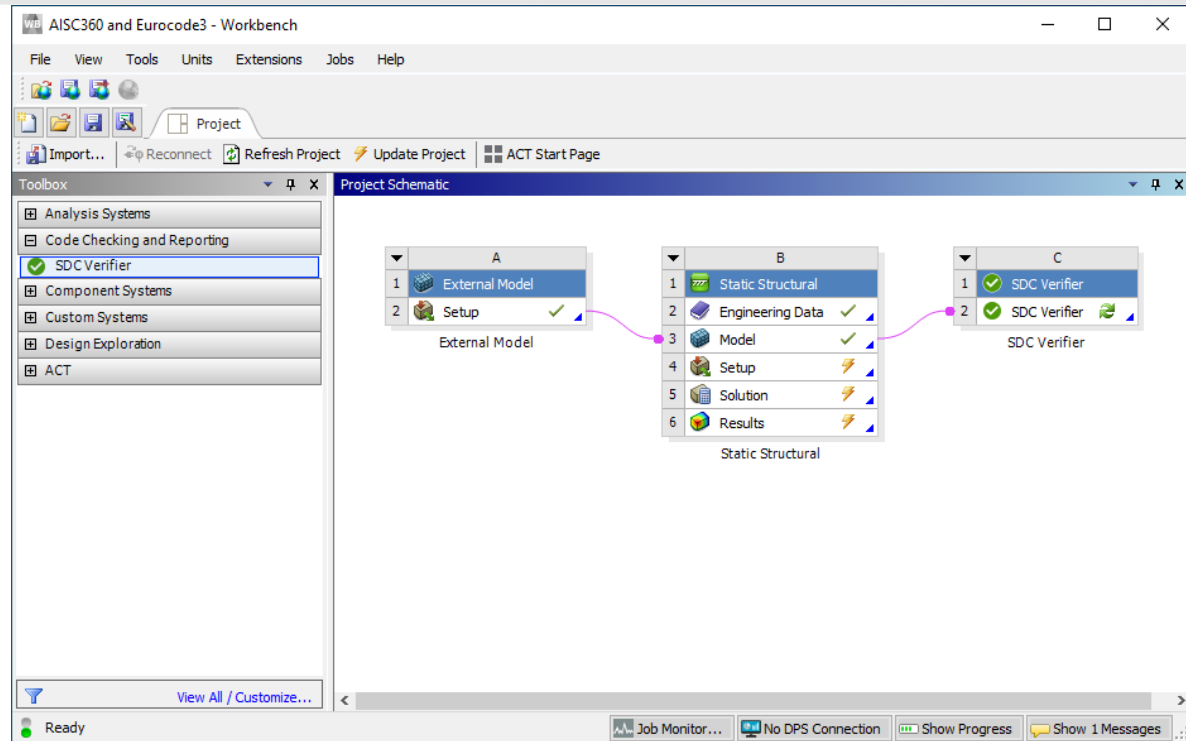
Launch SDC Verifier

1

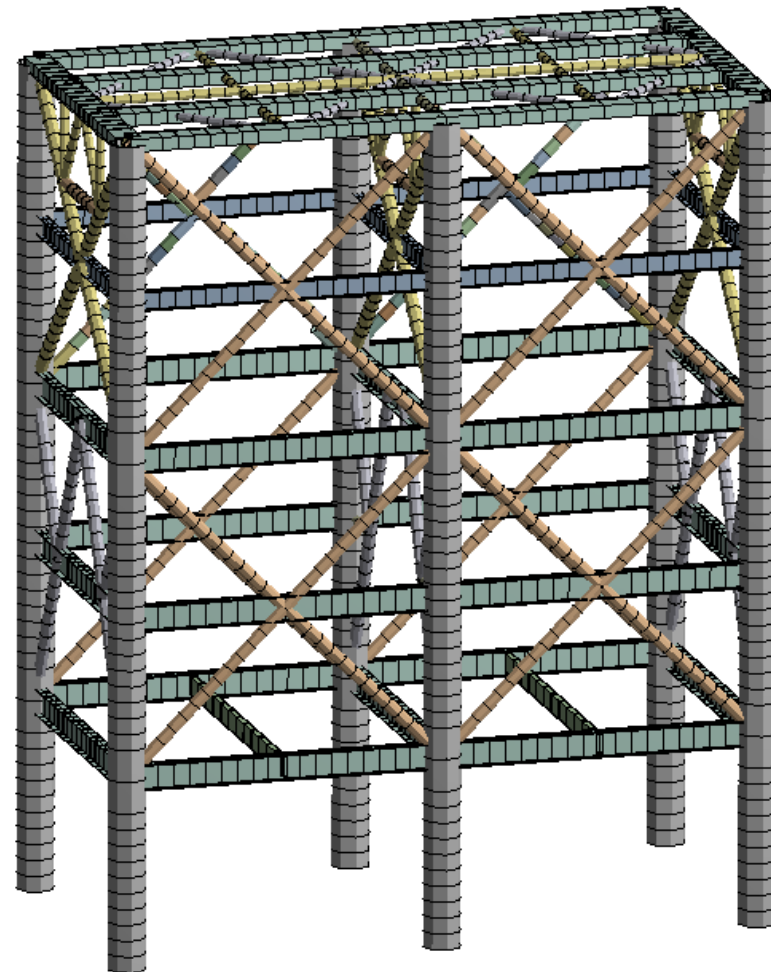
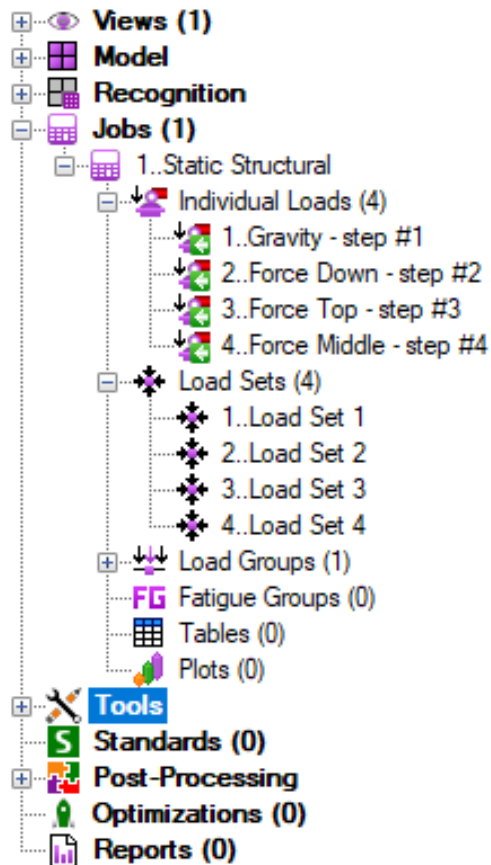
Open in **Ansys Workbench** 
AISC360 and Eurocode3.wbpj

2

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



Predefined project

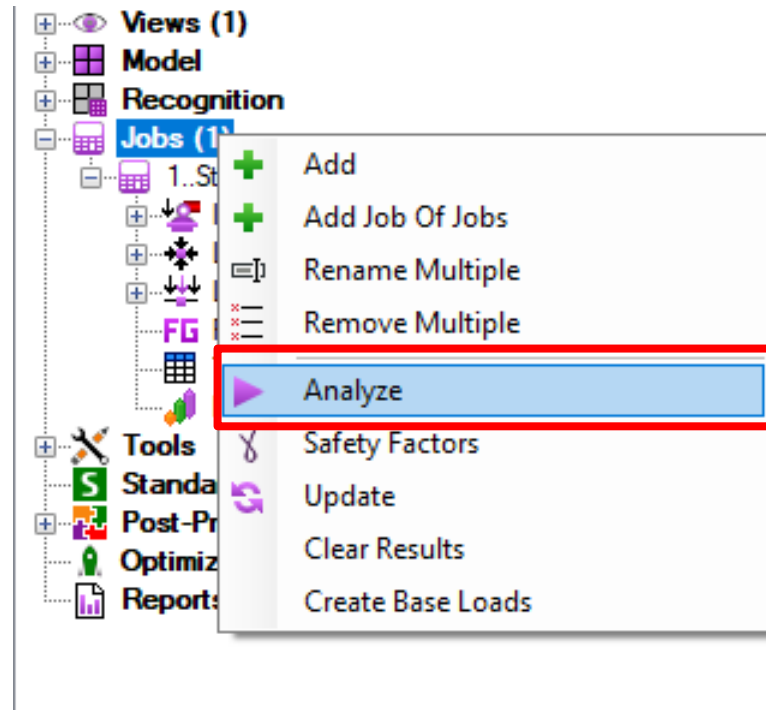


This tutorial uses project with predefined boundary condition, load combinations and load group.
The model contains only beam elements of the following types: I-Beam, Circular and Rectangular Tubes

Analyze Job

1

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



1

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;

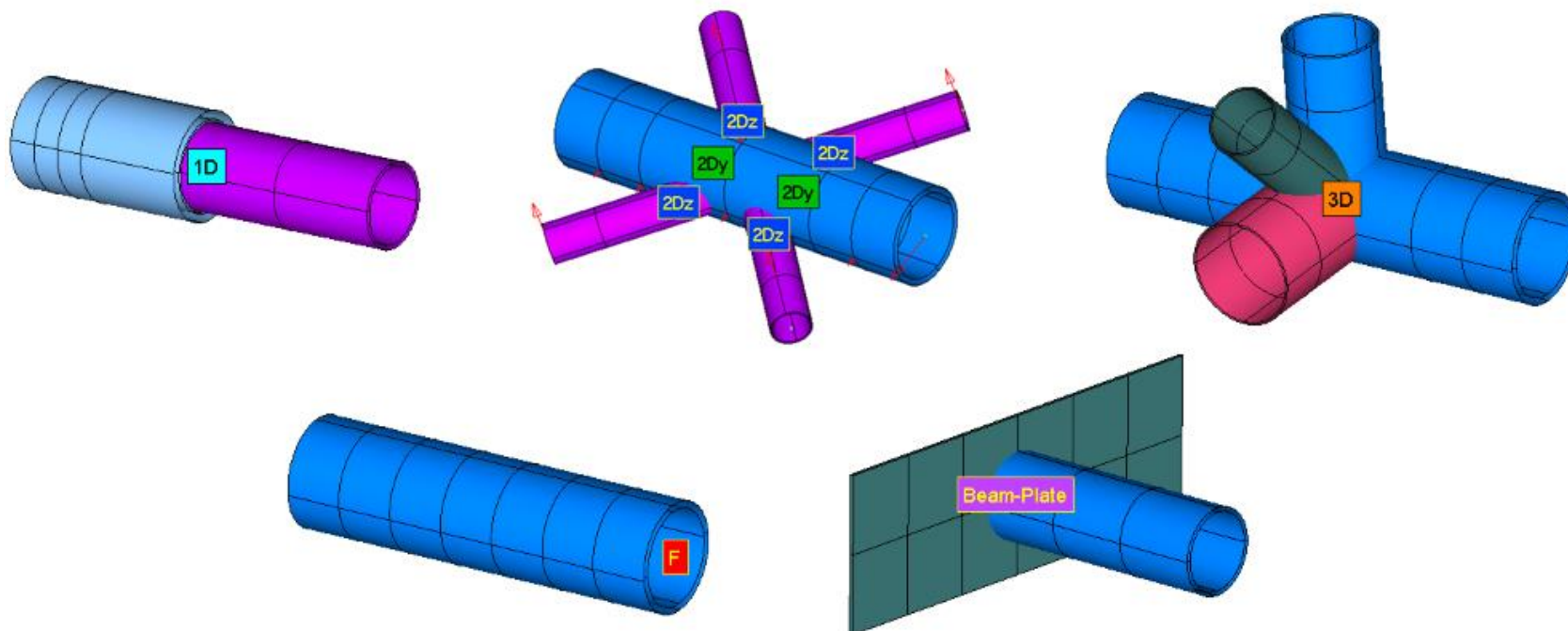
2D Joint – beam members connected in one plane;

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);

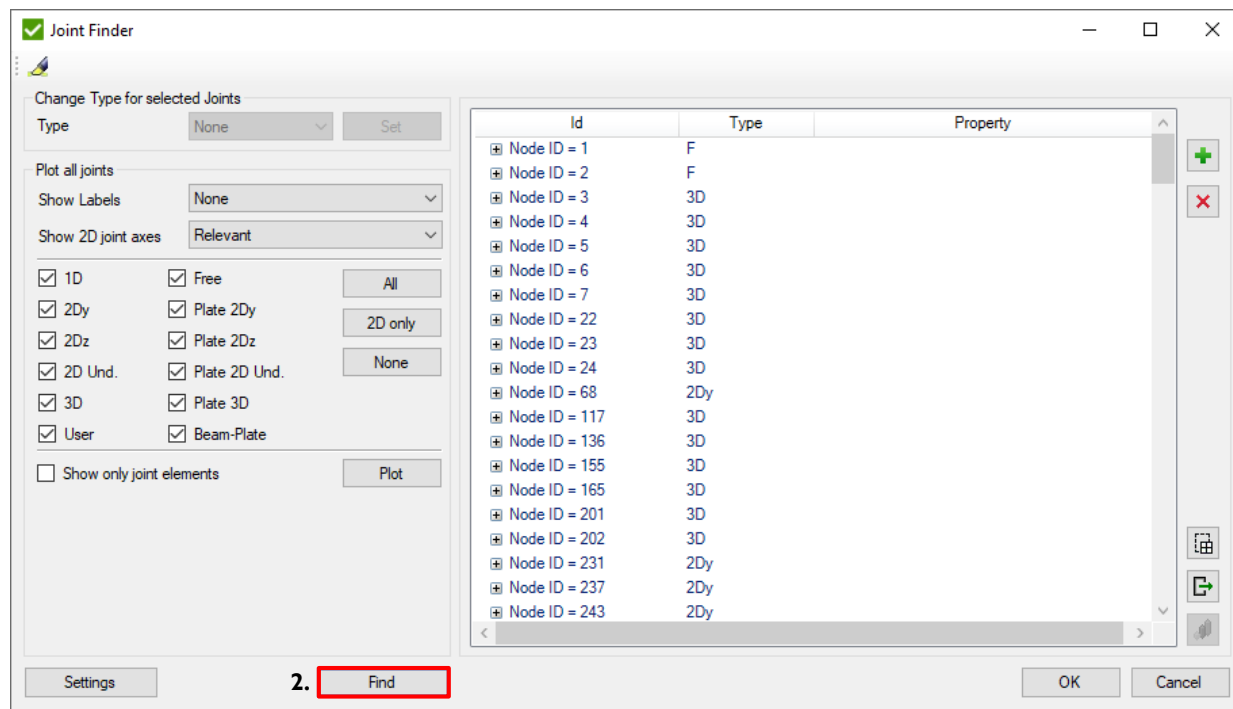
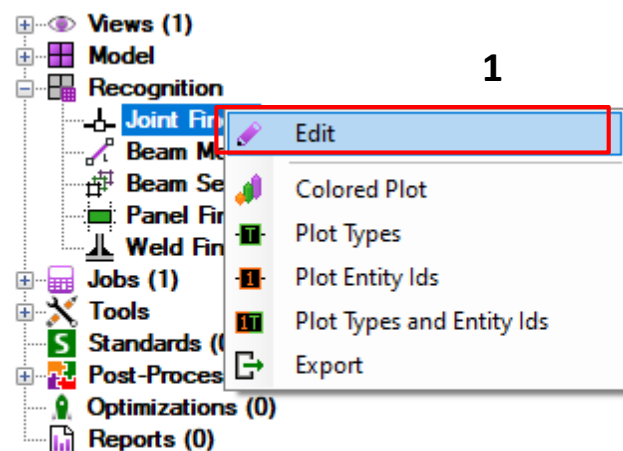
User Defined;



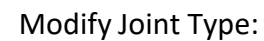
Joint Recognition

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

2 Press *Find*.

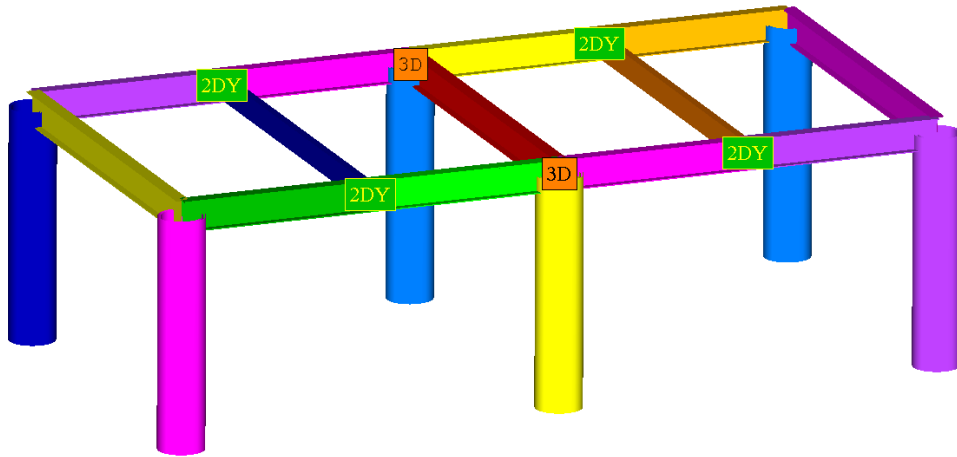


-
- A 3D visualization of a cubic lattice structure. The lattice is composed of nodes and connecting lines. Nodes are represented by small colored squares: cyan (labeled '10'), green (labeled '20y'), blue (labeled '20z'), orange (labeled '30'), and yellow (labeled 'F'). The lattice is shown in a perspective view, with the front face being a grid of nodes and lines. The lines are colored in a way that matches the nodes they connect. The background is a light blue gradient. The lattice is oriented such that the front face is a square, and the depth is represented by lines receding into the distance. The nodes are arranged in a regular grid pattern. The lines connect nodes in a way that forms a 3D grid. The overall structure is a complex network of interconnected nodes and lines, representing a 3D lattice or a data structure.

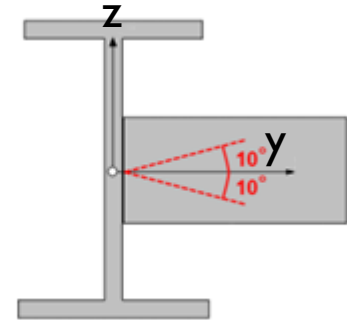


Beam Member Lengths in 2 directions

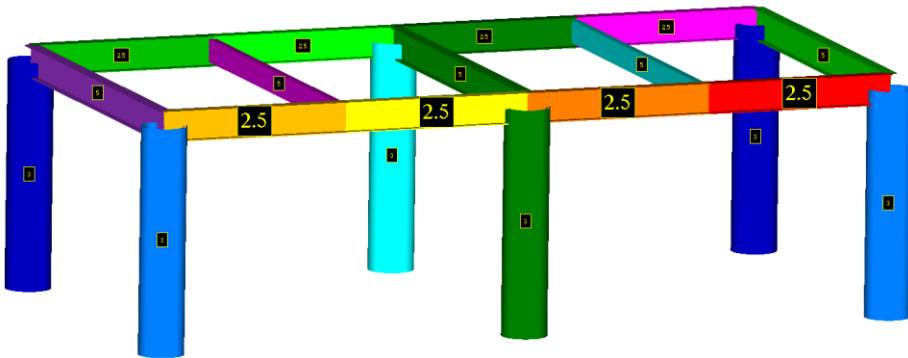
Beam Member Finder recognizes beam members and (buckling) lengths for different directions (Y, Z and Torsional).



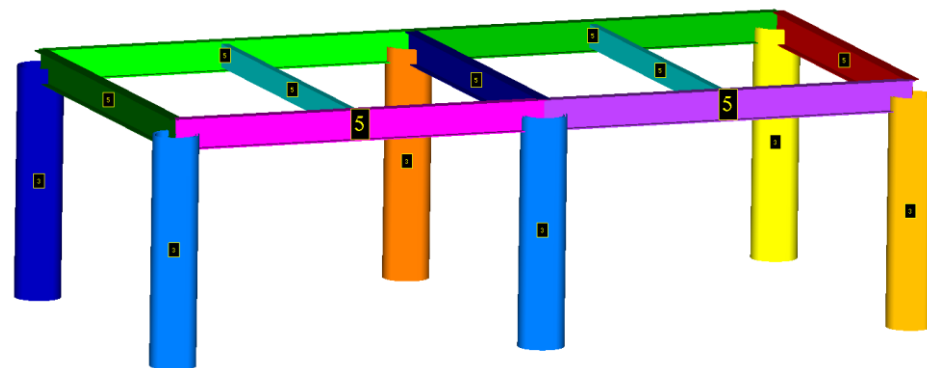
2DY
Joint



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



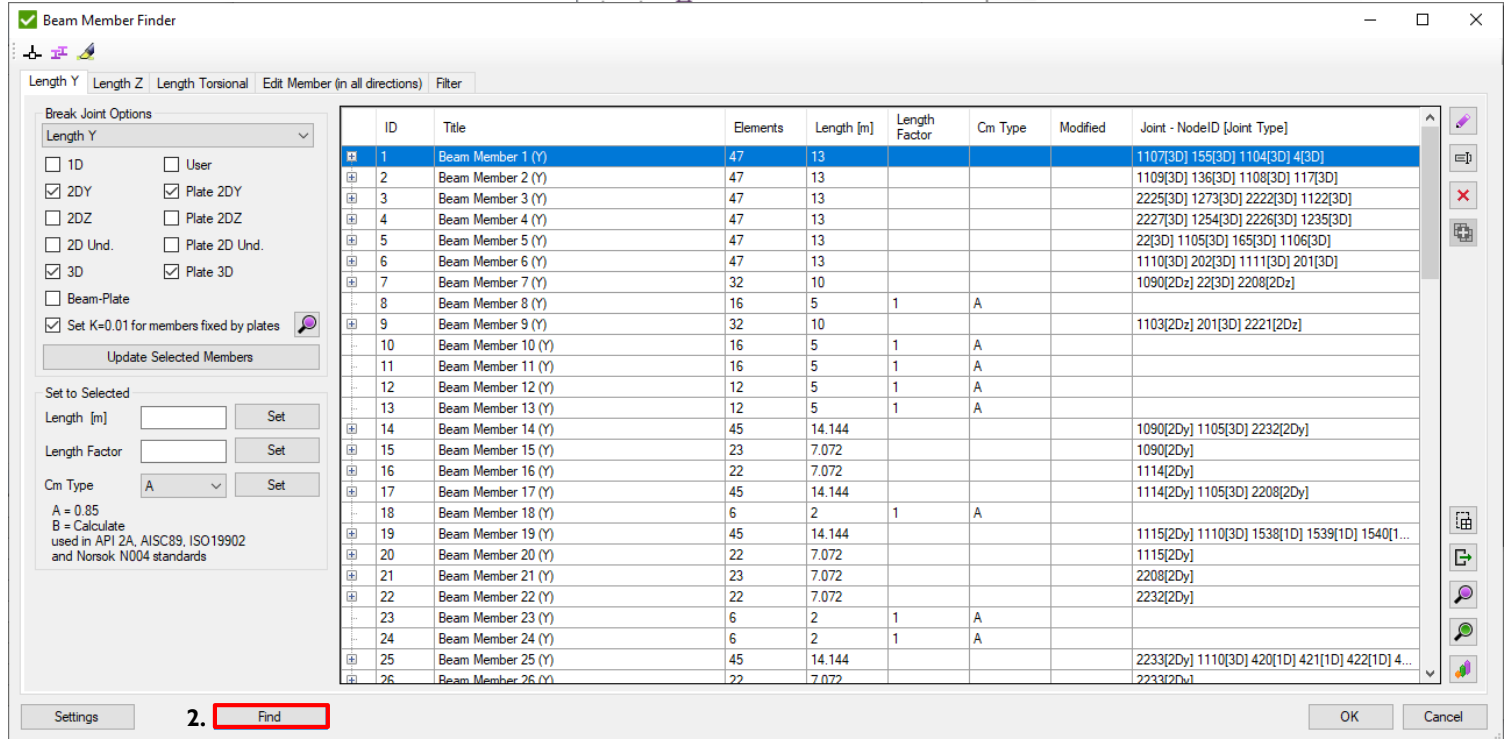
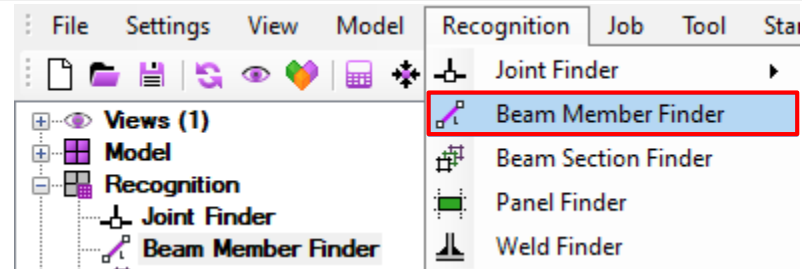
Length Z – 2 Beam Members with $L = 5$



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]

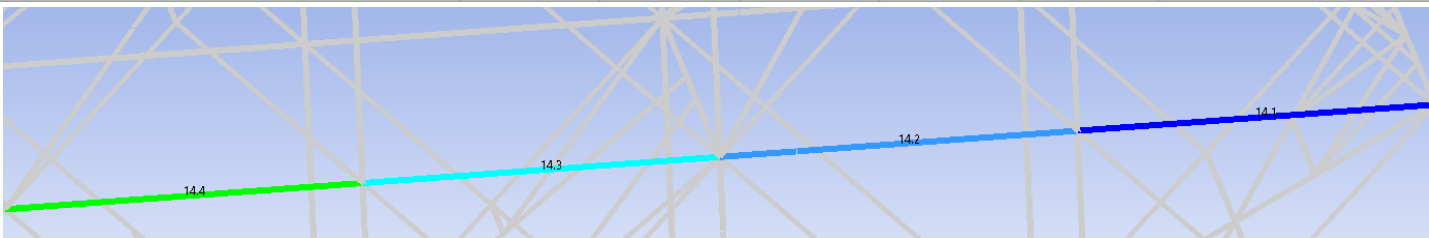
Settings Find OK Cancel

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

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



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

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 ☒ 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 [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		
19	Beam Member 19 (Y)	45	14.144				1115(2D) 1110(3D) 1538(1D) 1539(1D) 1540(1D)
20	Beam Member 20 (Y)	22	7.072				1115(2D)
21	Beam Member 21 (Y)	23	7.072				2208(2D)
22	Beam Member 22 (Y)	22	7.072				2232(2D)
23	Beam Member 23 (Y)	6	2	1	A		
24	Beam Member 24 (Y)	6	2	1	A		
25	Beam Member 25 (Y)	45	14.144				2233(2D) 1110(3D) 420(1D) 421(1D) 422(1D) 423(1D)
26	Beam Member 26 (Y)	22	7.072				2233(2D)

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

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

where:

R_u = required strength using LRFD load combinations;

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

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

ϕR_n = design strength.

Design for Strength Using Allowable Strength Design (ASD)

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

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

where:

R_a = required strength using ASD load combinations;

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

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

R_n / Ω = allowable strength.

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

For tensile yielding in the gross section:

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

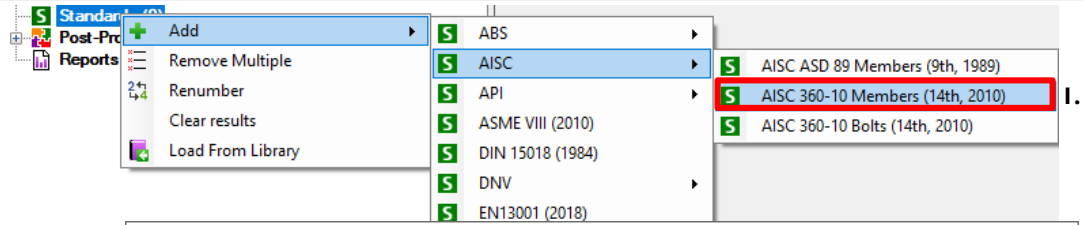
$$\phi_t = 0.90 \text{ (LRFD)} \quad \Omega_t = 1.67 \text{ (ASD)}$$

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

Add AISC360-10 standard


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

2 Resistance Factors: **LRFD**



The screenshot shows the 'AISC 360-10 Members (14th, 2010)' configuration dialog box. The 'ID' is 1 and the 'Title' is 'AISC 360-10 Members (14th, 2010)'. The 'Alias' is 'Standard1'. The 'Description' field is empty. The 'Settings' section includes 'Resistance Factors' set to 'LRFD', 'Section Build Type' set to 'User defined Cb', and various other parameters like 'Stiffener Distance', 'Net Area', and 'Shear Lag Factor' all set to 'Defined'. The 'Selection' section shows '+ 6 Shapes' and 'Elements' set to '1856'. The 'Second order effects (APPENDIX 8)' section has 'Take into account second-order effects (B1 multiplier)' checked, with 'Calculate Cm: case a = 0.6 - 0.4 * M1 / M2, case b = 1.0' selected. The 'Torsion' section has 'Include Torsion check' unchecked. The 'OK' button is highlighted with a blue border.

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.** Apply To Selected **2.**

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

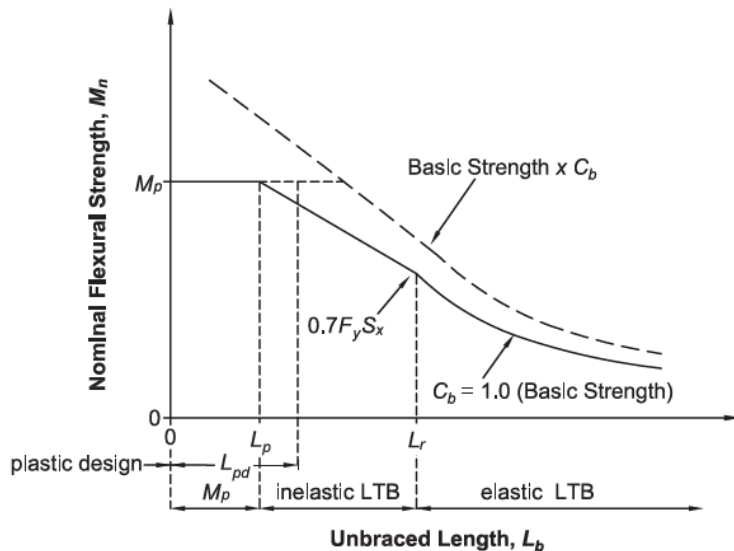
4.

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)

Alias: Standard1

Description:

Settings

Resistance Factors: LRFD

Section Build Type: Defined

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

☐ User defined C_b : Defined

Stiffener Distance (Chapter G2.1): Defined

Net Area (Chapter D2.2): Defined

Shear Lag Factor (Table D3.1): Defined

☐ Calculate asymmetric shapes as symmetric

Selection

+ 6 Shapes

Elements: 1856

☐ Use API 2A RP for tubular shapes

Materials with Yield and Tensile = 0 1

Second order effects (APPENDIX 8)

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

☐ Use $C_m = 1$ (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)

Alias: Standard1

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

☐ Calculate asymmetric shapes as symmetric

☐ Use API 2A RP for tubular shapes

Materials with Yield and Tensile = 0 1 

Second order effects (APPENDIX 8)

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

☐ Use Cm = 1 (conservative)


☒ Calculate Cm: case a = 0.6 - 0.4 * M1 / M2, case b = 1.0

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

Torsion

☐ Include Torsion check

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

 Preview Not Supported Elements

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

1.

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.

The screenshot shows the 'Standards (1)' tree on the left with '1..AISC 360-10 Members (14th, 2010)' selected. The 'Checks (16)' item is highlighted. The 'Constants' dialog box is open, displaying a table of constants.

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	

The screenshot shows the 'Standards (1)' tree with '1..AISC 360-10 Members (14th, 2010)' selected. The 'Checks (16)' section is highlighted with a red box, showing a list of 16 checks, all of which are checked.

- 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

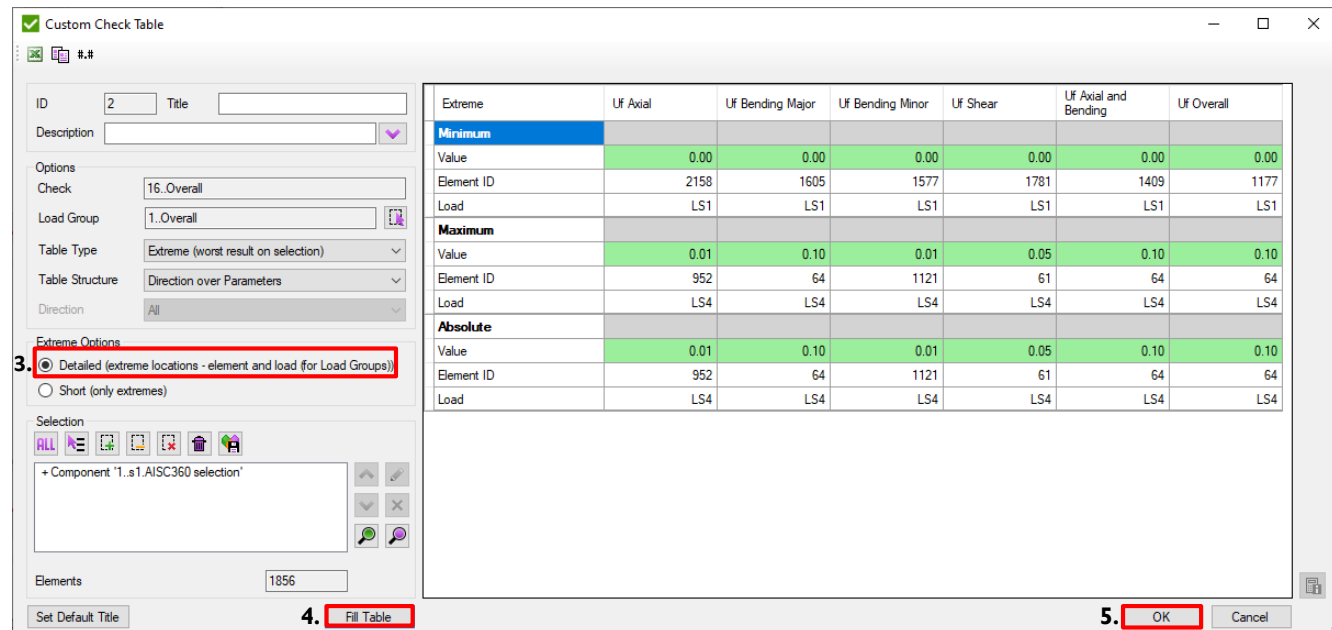
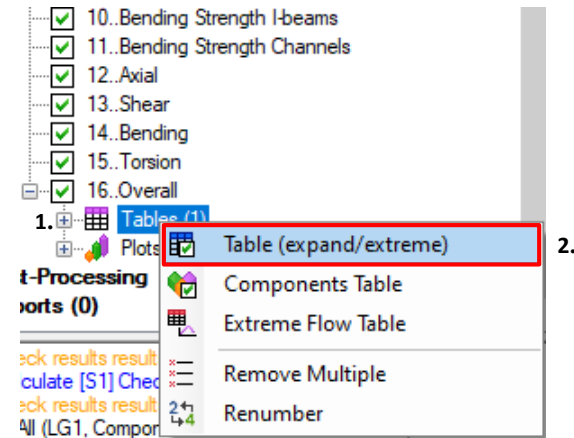
1 Select *Tables*

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

3 Select Extreme Options - *Detailed*

4 Press *Fill Table*

5 Press *Ok*



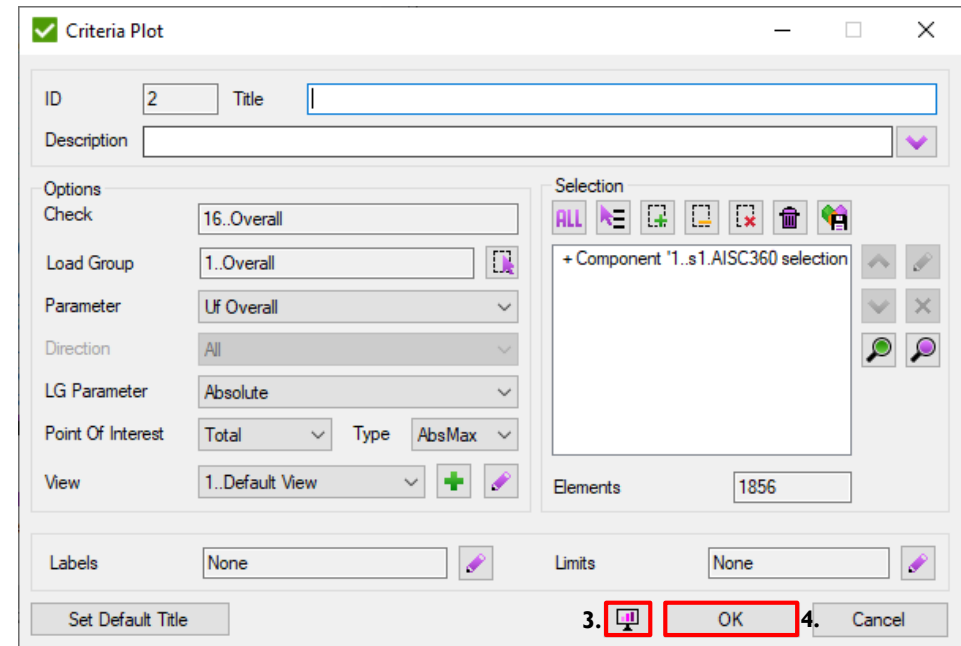
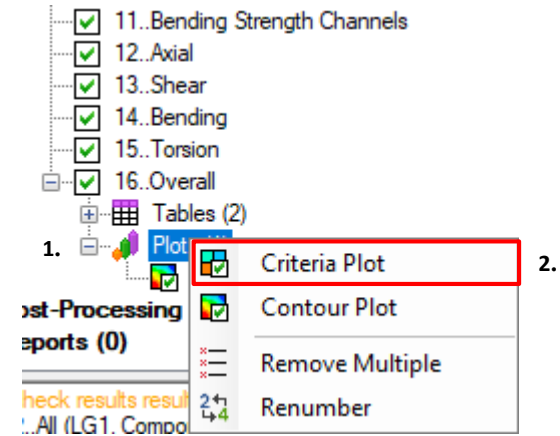
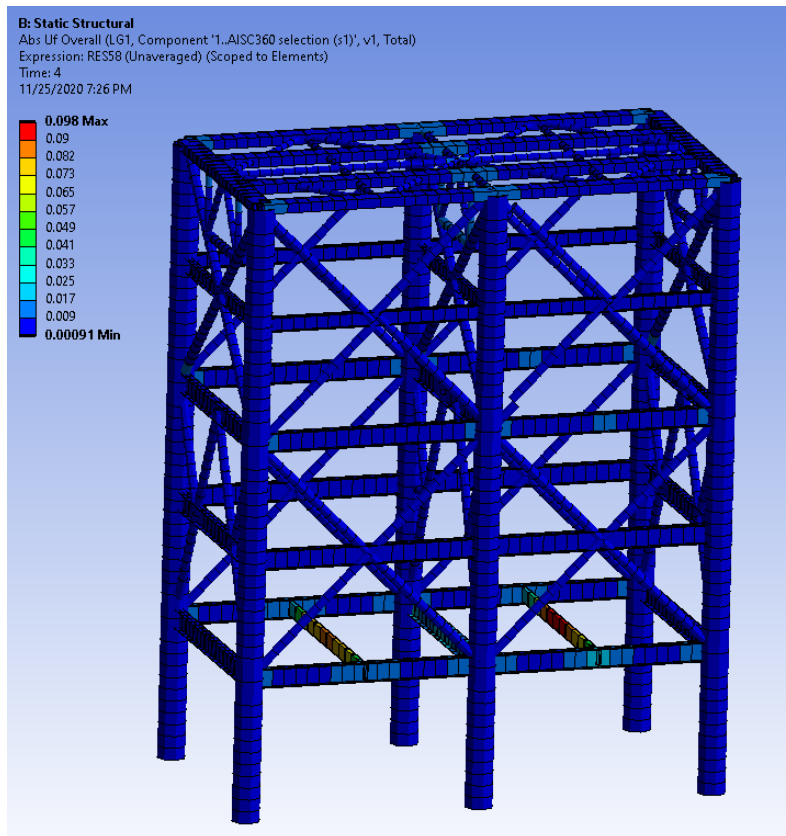
Utilization Factor Plot

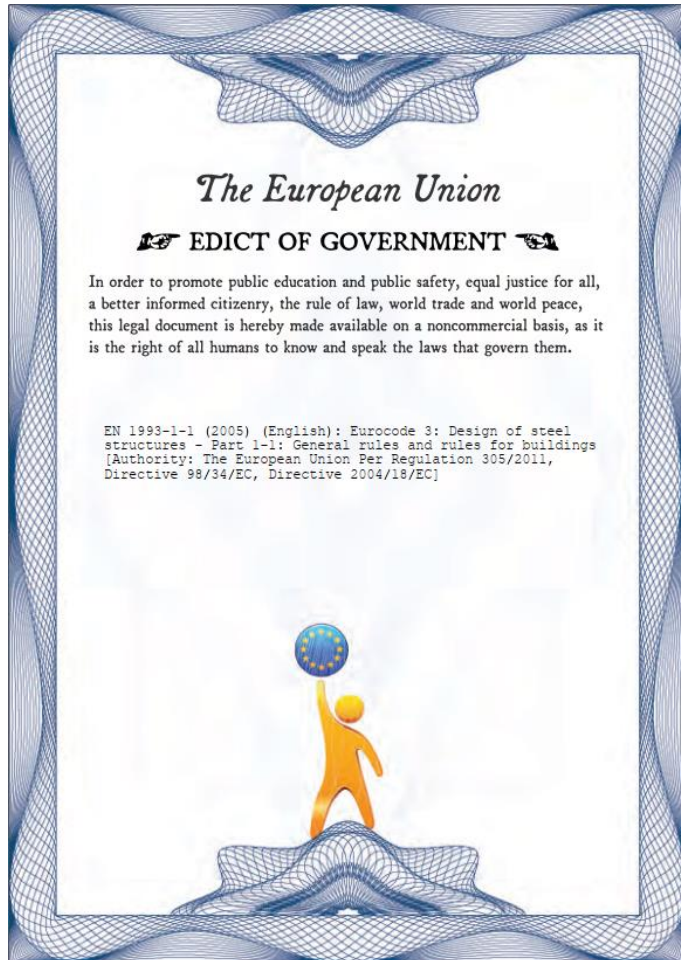
1 Select Plots

3 Press  to preview Plot

2 Execute *Criteria Plot* in context menu

4 Press *Ok*





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



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

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

Note: All parameters may be taken from the National Annex

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

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

Factors

Partial Factor Gm0: 1.0
Partial Factor Gm1: 1.0
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

☐ Calculate asymmetric shapes as symmetric

Materials with Yield and Tensile = 0: 0
Selection: 104 Properties

Fabrication Type

Fabrication Type:
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)

Preview Not Supported OK Cancel

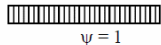




Fabrication Type:
Rolled/Welded;
Manufacture Type: Hot
Finished/Cold Formed
Fillet has to be defined in the characteristic (they are missing in the model);
Section Net Area - for fasteners with holes net area has to be defined;
Material Type - the buckling curve (Table 6.2) depends on the material type.

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: Eurocode3 Members (EN1993-1-1, 2005)

Description:

Options

Partial Factor G_m0 : Fabrication Type:

Partial Factor G_m1 : Manufacture Method:

Partial Factor G_m2 : Fillet:

Lambda $LT,0$: Section Net Area:

Beta: Material Type:

Eta:

Correction Factor K_c

☒ Calculate according to Table 6.6

☐ Set $K_c = 1$ for all members

Materials with Yield and Tensile =

Selection:

Preview Not Supported

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**

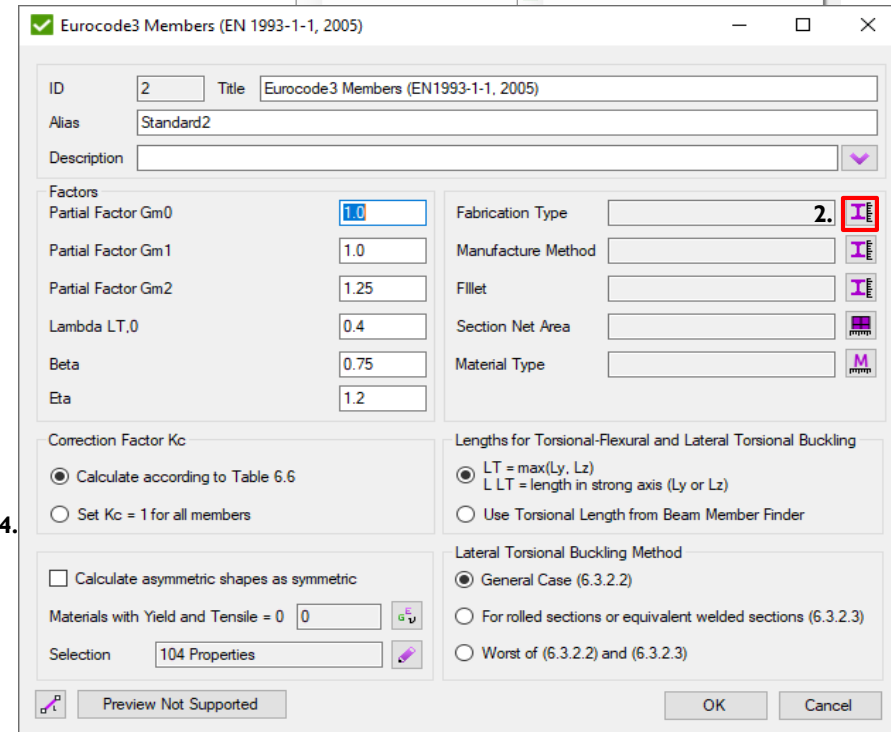
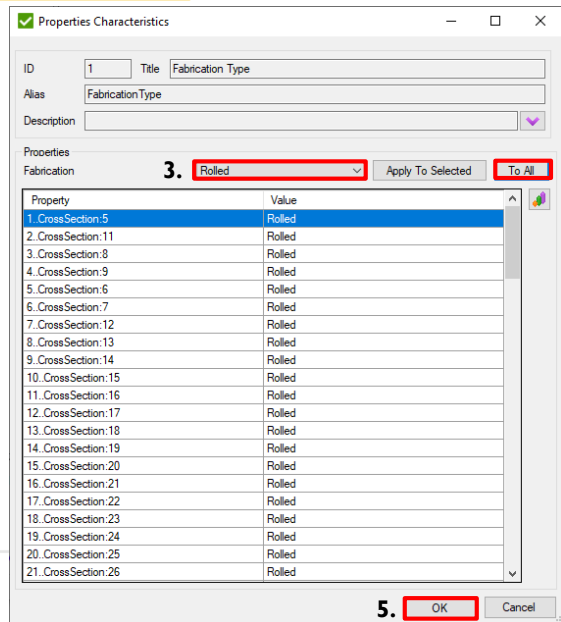
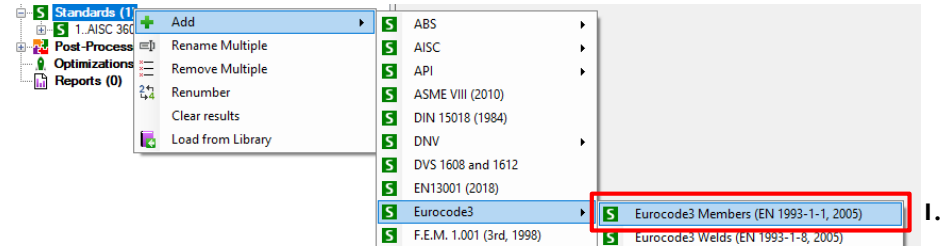
4

Press *To All*

5

Press *Ok*

Go to the next slide to Continue



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: **2. Hot Finished** Apply To Selected: **3. 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

4. **OK** Cancel

Eurocode3. Fillet

1 Press  to set *Fillet*

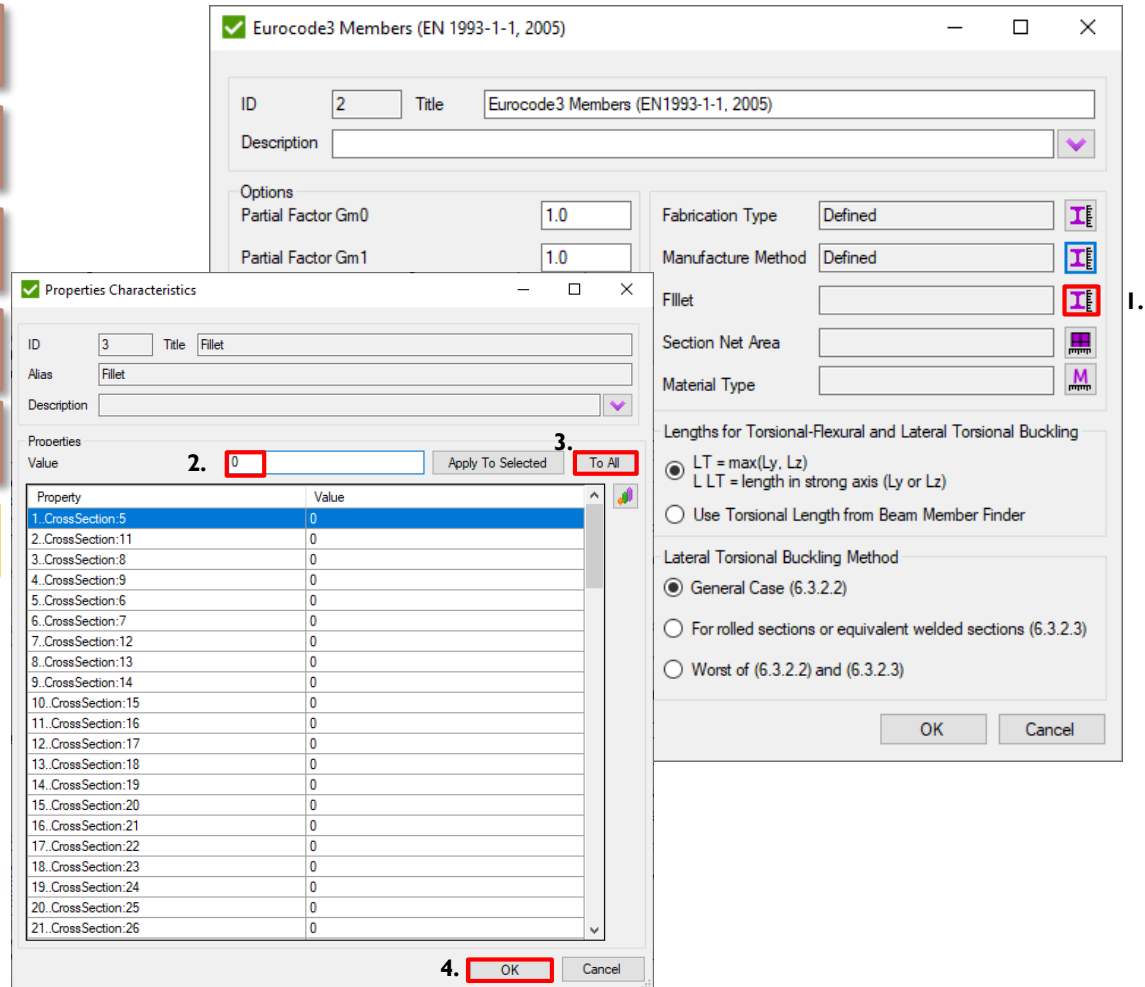
2 Properties Value - **0**

3 Press *To All*

4 Press *Ok*

Repeat Steps 1-4 for *Section Net Area*

Go to the next slide to Continue



The screenshot displays the 'Eurocode3 Members (EN 1993-1-1, 2005)' window. The 'Properties Characteristics' dialog box is open, showing the 'Fillet' property. The 'Value' field is set to 0, and the 'To All' button is highlighted. The 'Properties' table lists various cross-sections and their corresponding values.

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:

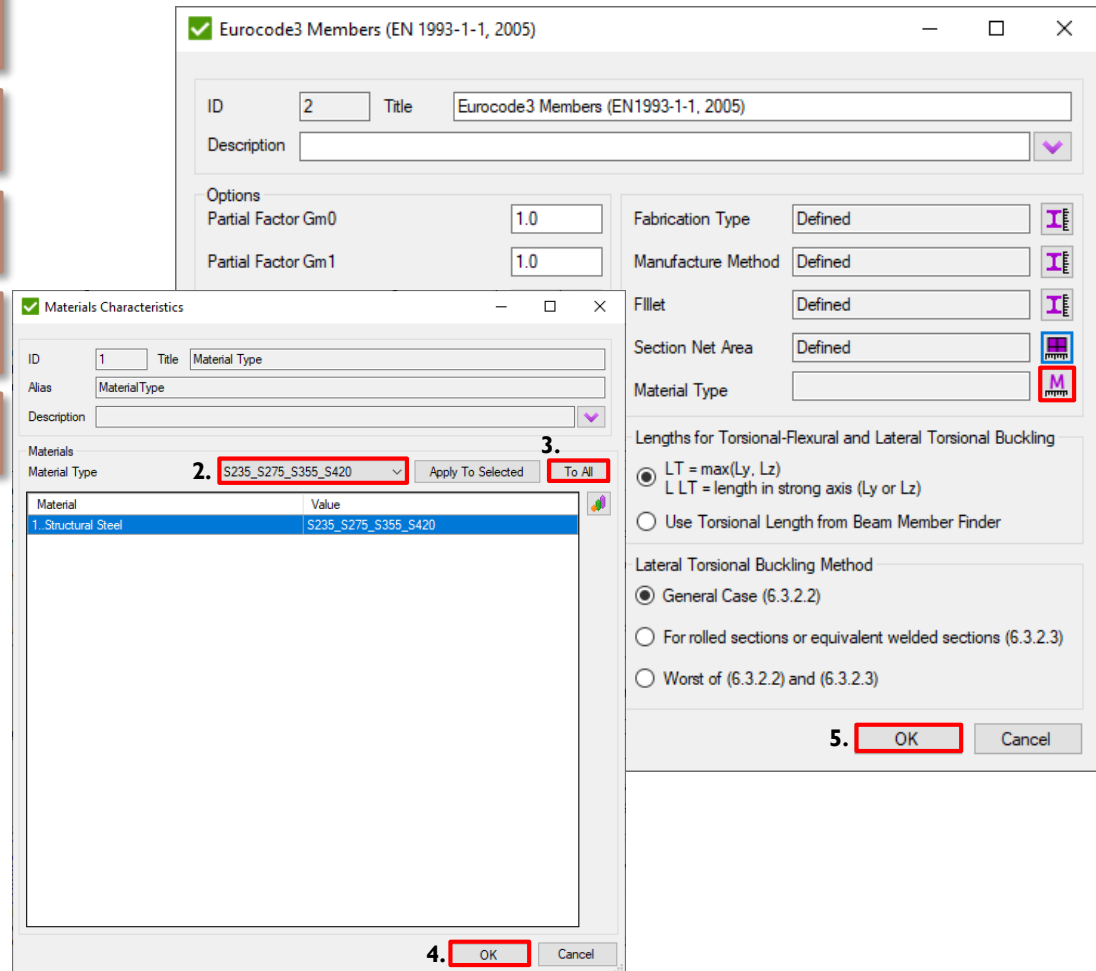
Properties Value: 0 Apply To Selected To All

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*



The screenshot shows two overlapping dialog boxes. The top dialog is titled "Eurocode3 Members (EN 1993-1-1, 2005)". It has fields for ID (2), Title (Eurocode3 Members (EN1993-1-1, 2005)), and Description. Below these are options for Partial Factor Gm0 (1.0) and Partial Factor Gm1 (1.0). On the right, there are dropdowns for Fabrication Type (Defined), Manufacture Method (Defined), Fillet (Defined), and Section Net Area (Defined). At the bottom right, there is a "Material Type" dropdown with a material icon. The bottom dialog is titled "Materials Characteristics". It has fields for ID (1), Title (Material Type), Alias (Material Type), and Description. Below these are buttons for "Apply To Selected" and "To All". A table lists materials with columns "Material" and "Value". The first row is "1. Structural Steel" with the value "S235_S275_S355_S420". At the bottom, there are "OK" and "Cancel" buttons. Red boxes and numbers 1 through 5 highlight specific steps in the process: 1. Material icon in the top dialog, 2. Material Type dropdown, 3. To All button, 4. OK button in the bottom dialog, and 5. OK button in the top dialog.

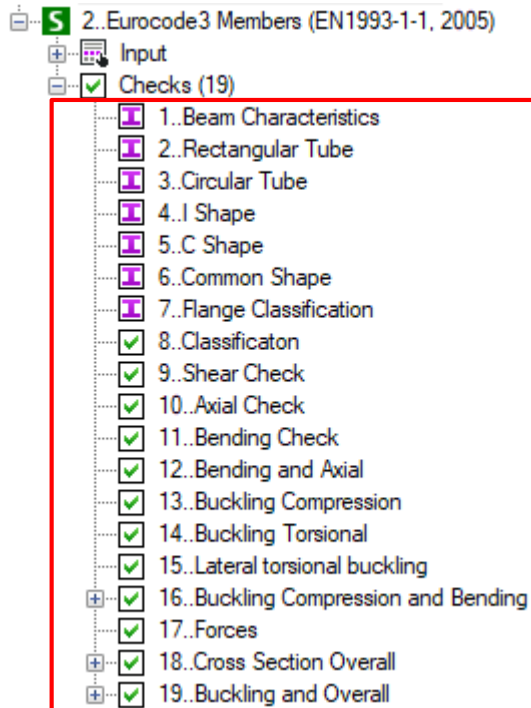
1. Press  to set *Material Type*

2. Execute – *S235_S275_S355_S420*

3. Press *To All*

4. Press *Ok*

5. Press *Ok*



Standard contains 19 checks:

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

Preview Table Results

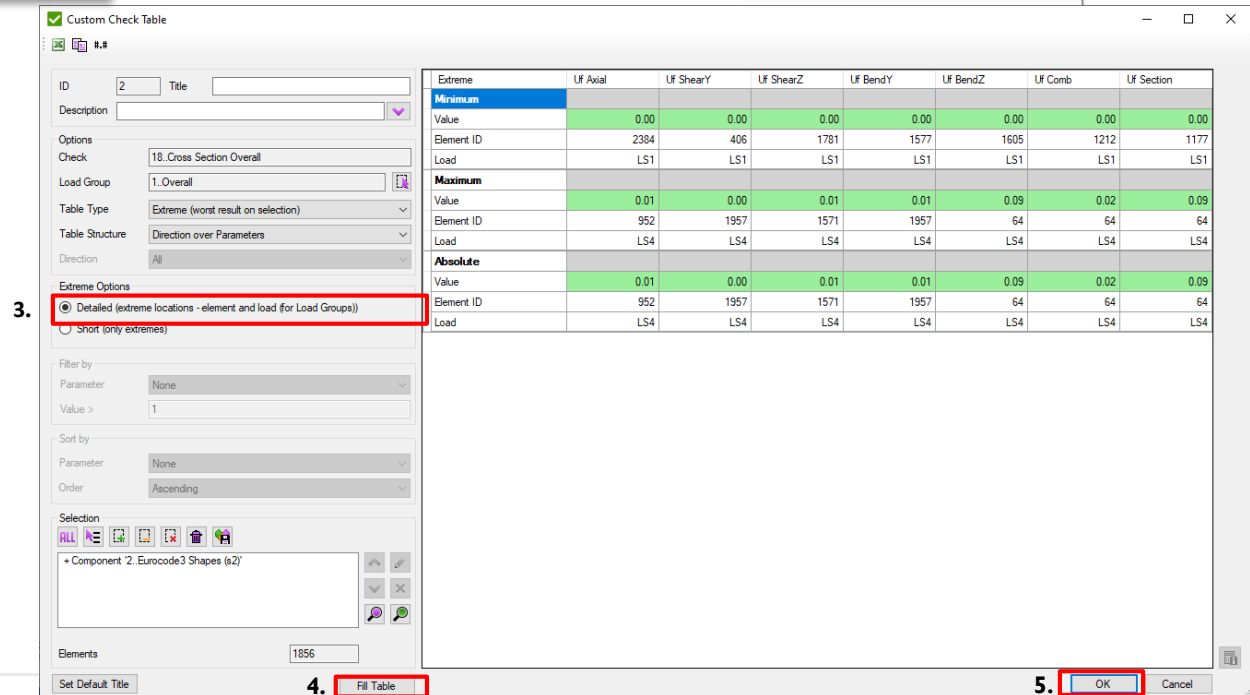
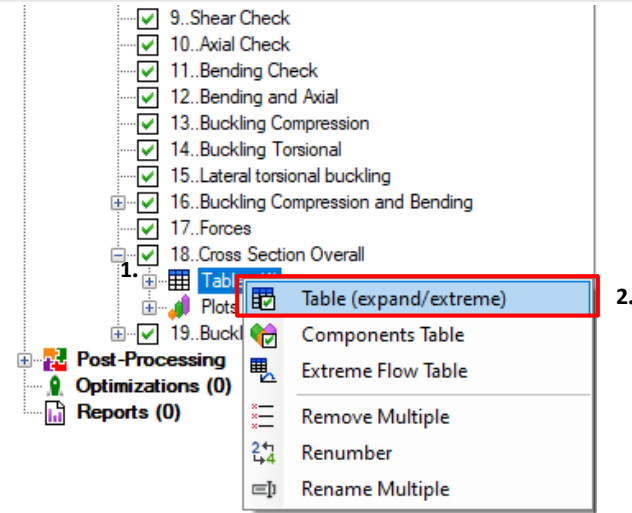
1 Select Tables

2 Execute Table (expand/extreme) in context menu

3 Select Extreme Options - Detailed

4 Press Fill Table

5 Press Ok



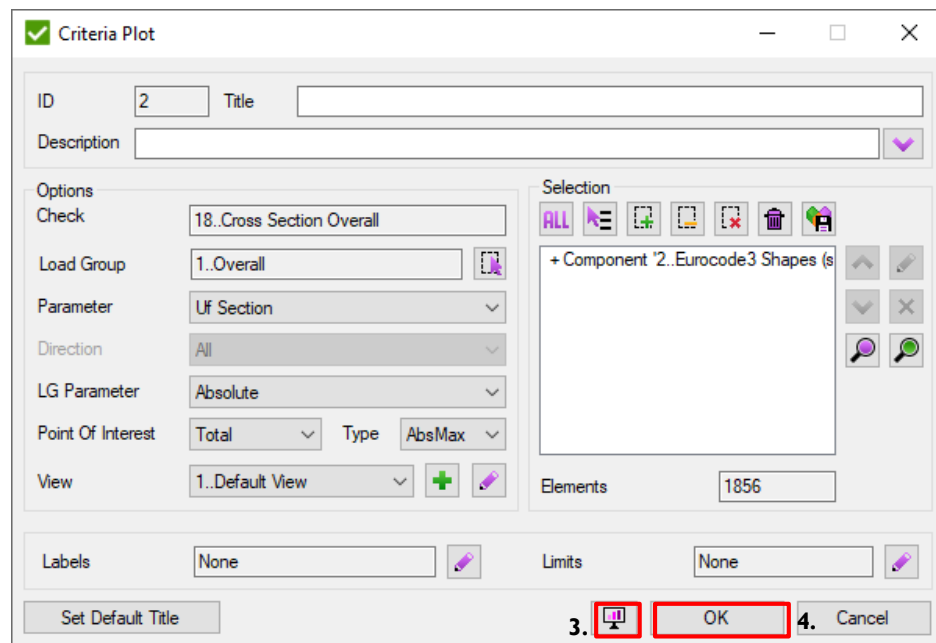
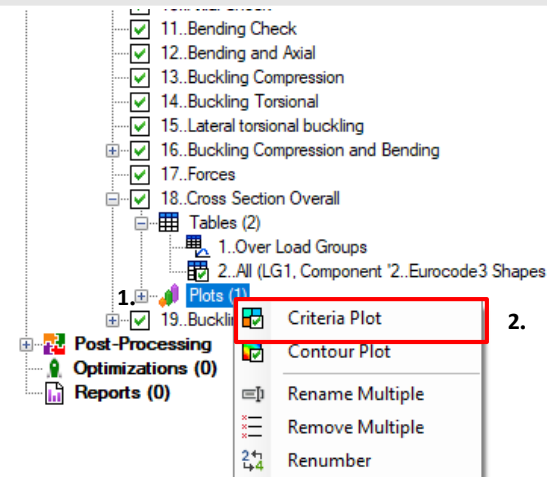
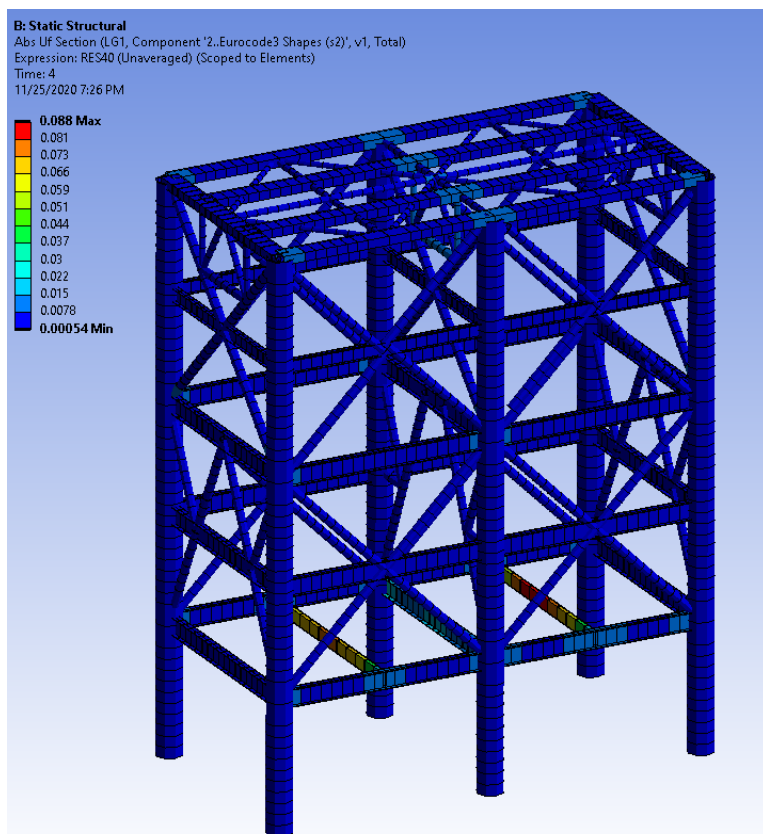
Utilization Factor Plot

1 Select *Plots*

2 Execute *Criteria Plot* in context menu

3 Press  to preview Plot

4 Press *Ok*




Create Predefined Report


1

Execute *Reports - Add - Designer-Results.*

2

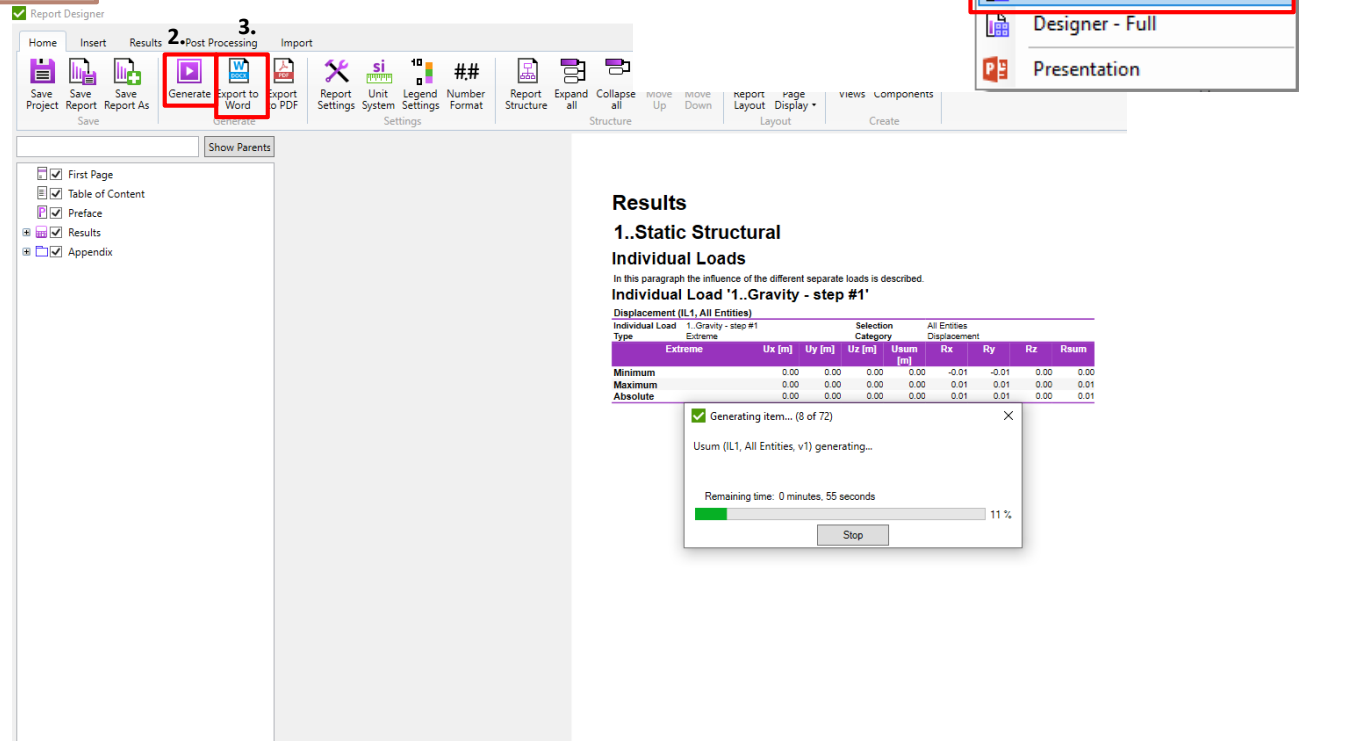
Press  to generate report

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.



The screenshot shows the SDC Verifier software interface. The 'Reports (0)' menu is open, displaying options like 'Add', 'Remove Multiple', 'Renummer', 'Generate Multiple', and a list of report types. The 'Designer - Results' option is highlighted with a red box. Below the menu, the 'Report Designer' window is visible, showing the 'Generate' button (highlighted with a red box) and the 'Export to Word' button (highlighted with a red box). The 'Results' window is also open, displaying the '1..Static Structural' report. The report includes a table of displacements for 'Individual Load *1..Gravity - step #1'.

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

Generating item... (8 of 72)

Usum (IL1, All Entities, v1) generating...

Remaining time: 0 minutes, 55 seconds

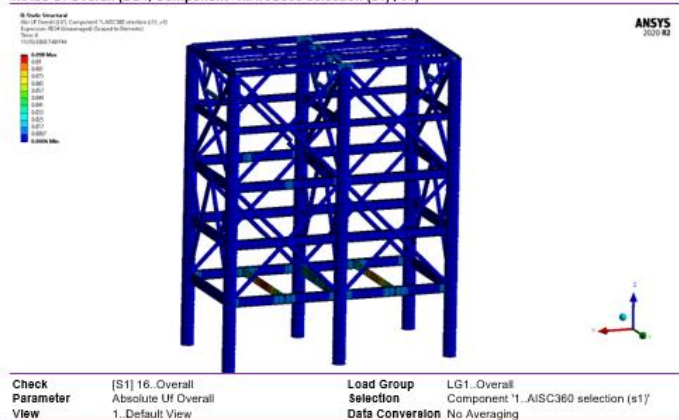
11 %

Stop

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

Standard	1..AISC 360-10 Members (14th, 2010)			Check	[S1] 16..Overall		
Load Group	LG1..Overall			Selection	Component '1..AISC360 selection (s1)'		
	Extreme	Uf Axial	Uf Bending Major	Uf Bending Minor	Uf Shear	Uf Axial and Bending	Uf Overall
Minimum							
Value		0.00	0.00	0.00	0.00	0.00	0.00
Element ID		2158	1605	1577	1781	1317	1177
Load		LS1	LS1	LS1	LS1	LS1	LS1
Maximum							
Value		0.01	0.10	0.01	0.02	0.10	0.10
Element ID		952	64	1121	1571	64	64
Load		LS4	LS4	LS4	LS4	LS4	LS4
Absolute							
Value		0.01	0.10	0.01	0.02	0.10	0.10
Element ID		952	64	1121	1571	64	64
Load		LS4	LS4	LS4	LS4	LS4	LS4

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



AISC 360 - 10

2.All (LG1, Component '2..Eurocode3 Shapes (s2)')

Standard	2..Eurocode3 Members (EN1993-1-1, 2005)			Check	[S2] 18..Cross Section Overall		
Load Group	LG1..Overall			Selection	Component '2..Eurocode3 Shapes (s2)'		
	Extreme	Uf Axial	Uf ShearY	Uf ShearZ	Uf BendY	Uf BendZ	Uf Comb
Minimum							
Value		0.00	0.00	0.00	0.00	0.00	0.00
Element ID		2384	406	1781	1577	1605	1212
Load		LS1	LS1	LS1	LS1	LS1	LS1
Maximum							
Value		0.01	0.00	0.01	0.01	0.09	0.09
Element ID		952	1957	1571	1957	64	64
Load		LS4	LS4	LS4	LS4	LS4	LS4
Absolute							
Value		0.01	0.00	0.01	0.01	0.09	0.09
Element ID		952	1957	1571	1957	64	64
Load		LS4	LS4	LS4	LS4	LS4	LS4

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



Eurocode3