



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.

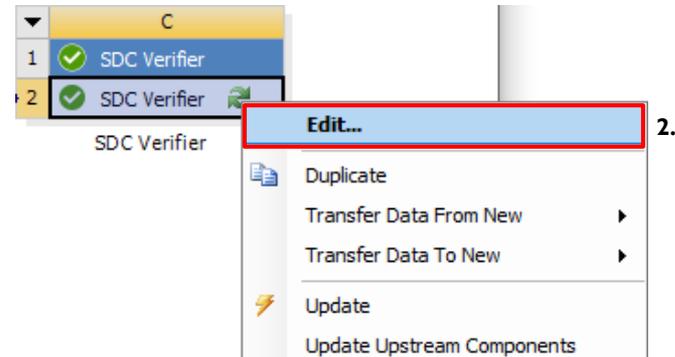
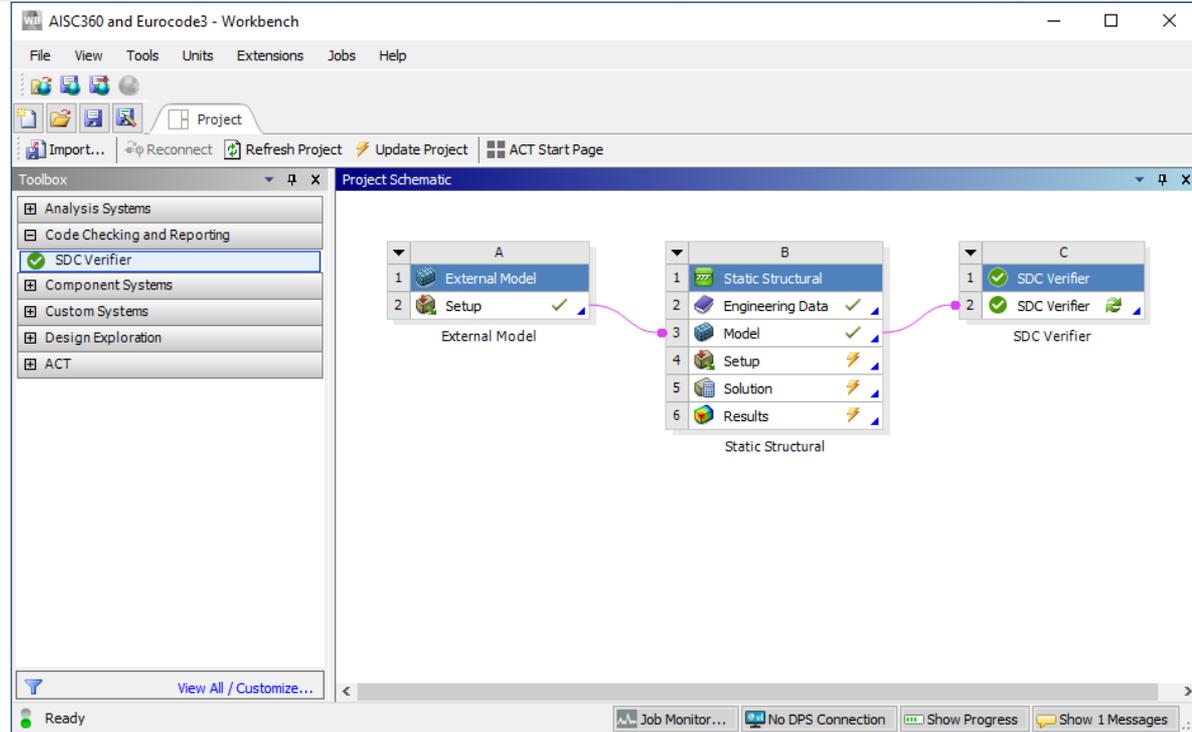
Launch SDC Verifier

1

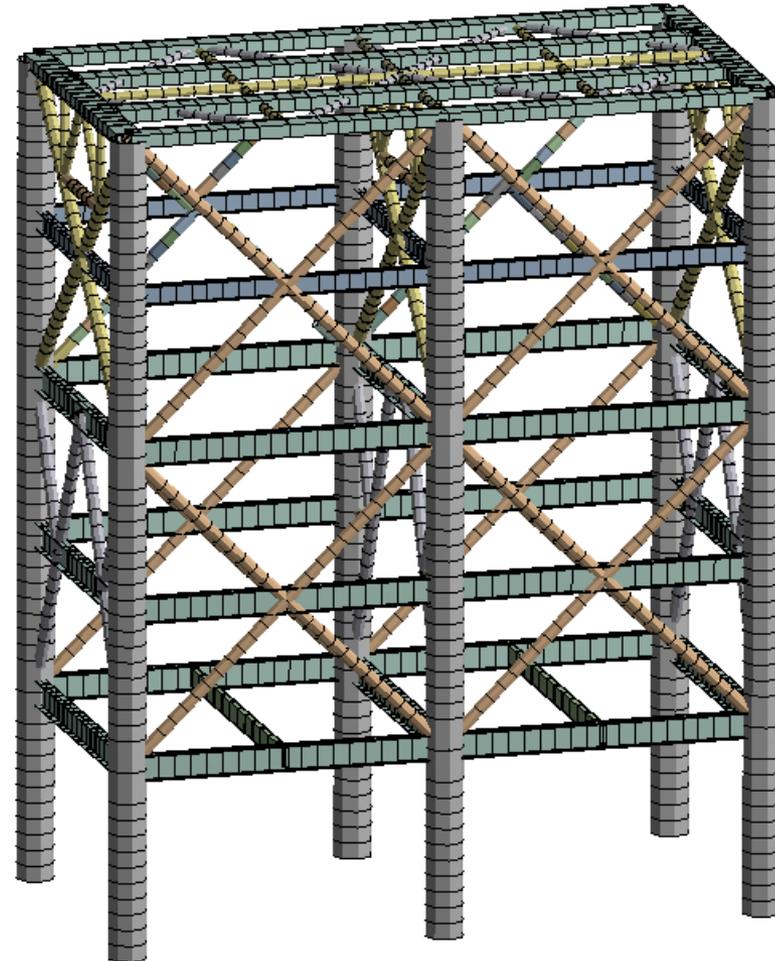
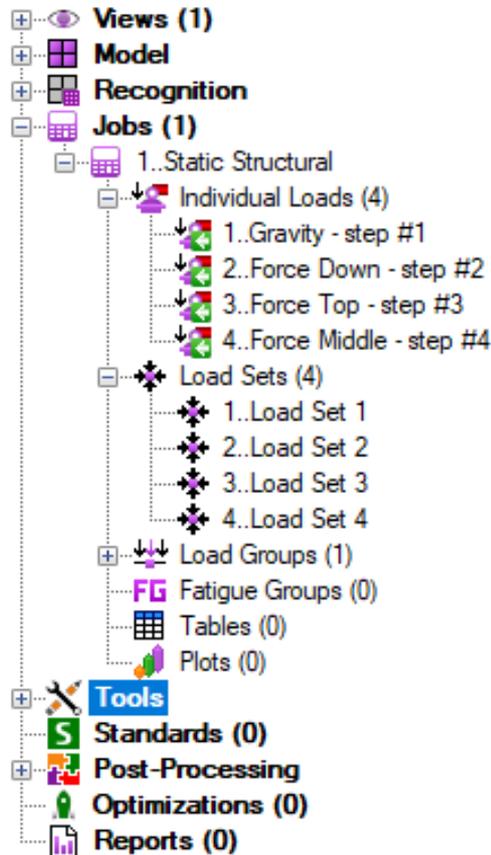
Open in **Ansys Workbench**
AISC360 and Eurocode3.wbpj

2

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



Predefined project

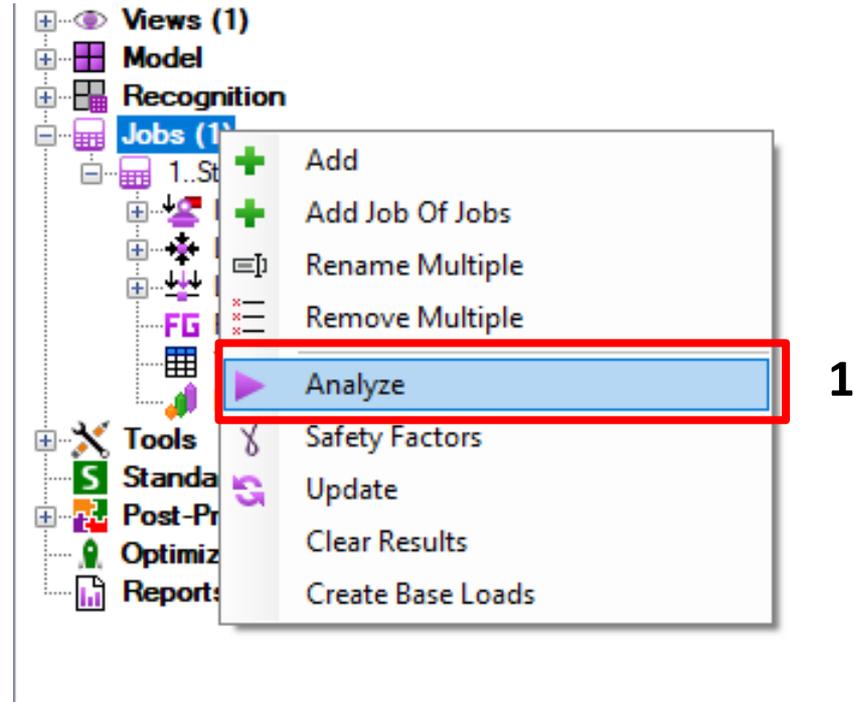


This tutorial uses project with predefined boundary condition, load combinations and load group. The model contains only beam elements of the following types: I-Beam, Circular and Rectangular Tubes

Analyze Job

1

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



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;

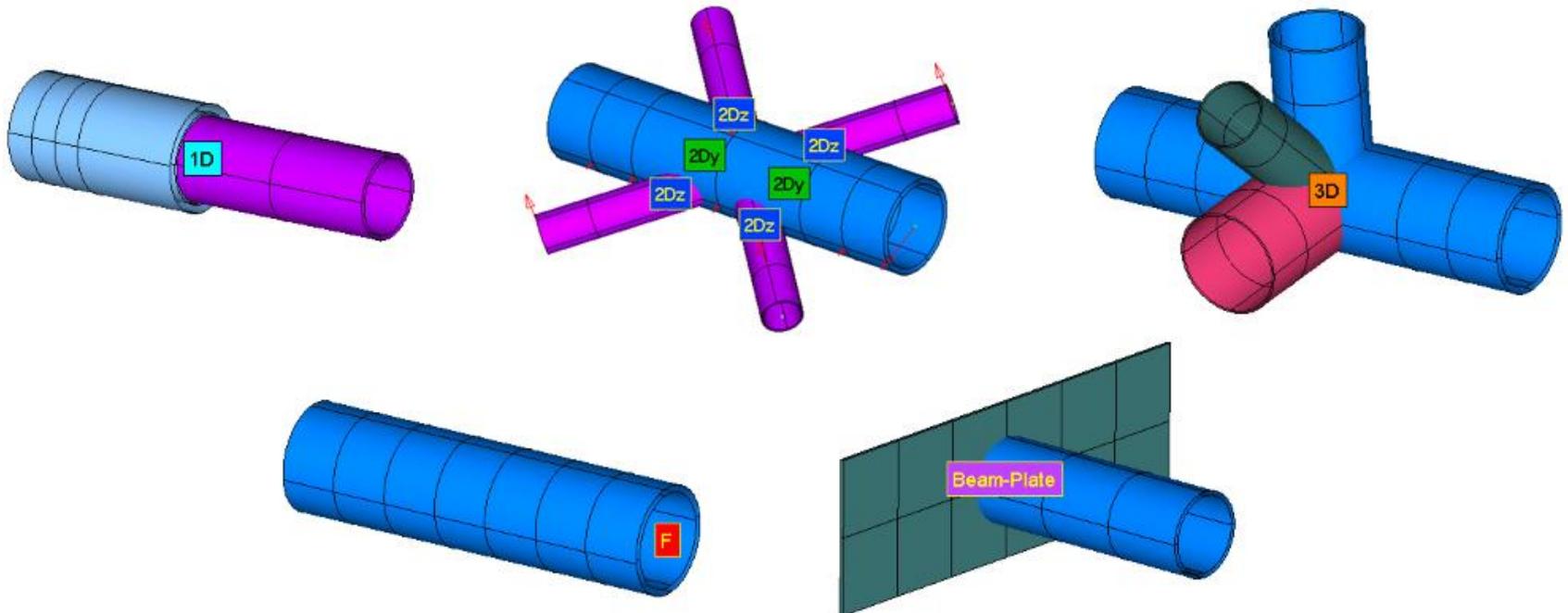
2D Joint – beam members connected in one plane;

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);

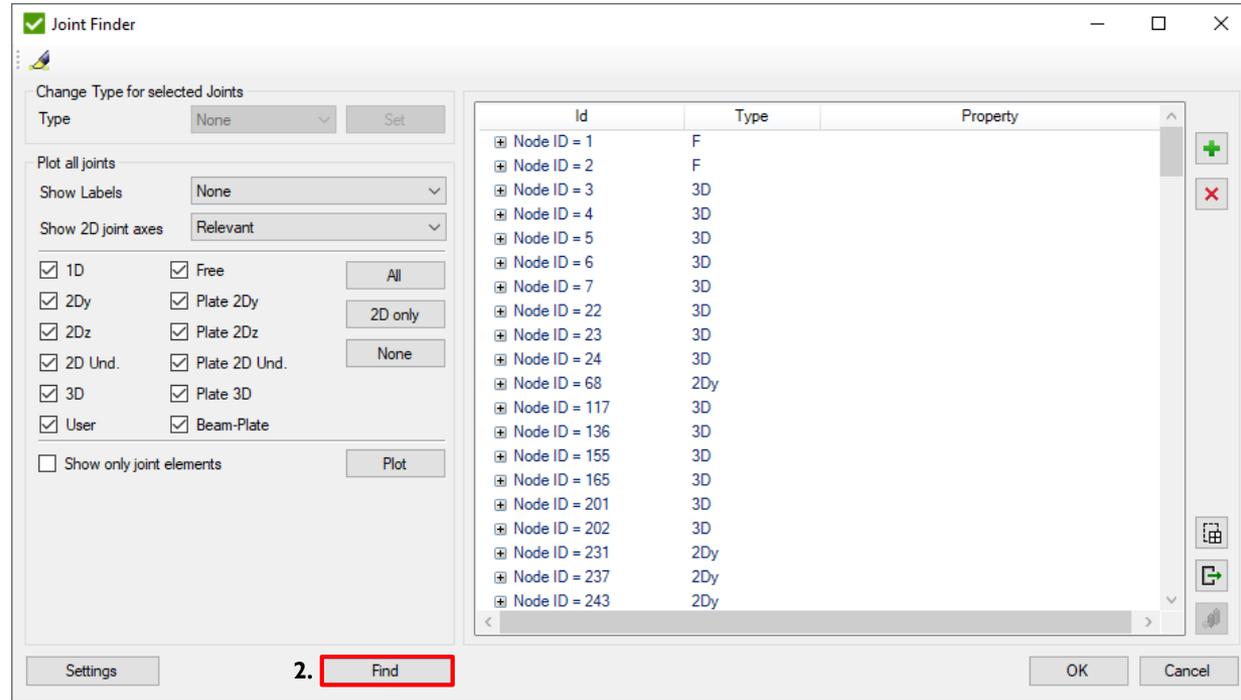
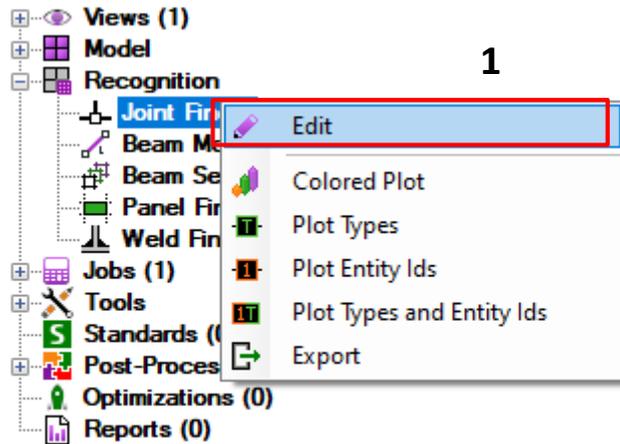
User Defined;



Joint Recognition

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

2 Press *Find*.

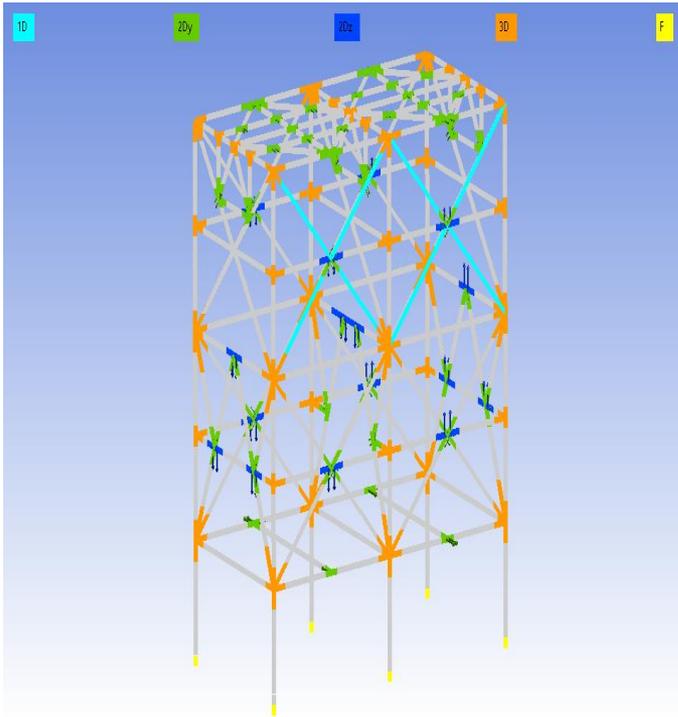


Joints Plot

1 Select All Joints (Ctrl+A).

2 Press  and Execute  Plot Joint Type in colors

3 Press *OK*



Joint Finder

Change Type for selected Joints
Type: None [Set]

Plot all joints
Show Labels: None [v]
Show 2D joint axes: Relevant [v]

<input checked="" type="checkbox"/> 1D	<input checked="" type="checkbox"/> Free	All
<input checked="" type="checkbox"/> 2Dy	<input checked="" type="checkbox"/> Plate 2Dy	2D only
<input checked="" type="checkbox"/> 2Dz	<input checked="" type="checkbox"/> Plate 2Dz	None
<input checked="" type="checkbox"/> 2D Und.	<input checked="" type="checkbox"/> Plate 2D Und.	
<input checked="" type="checkbox"/> 3D	<input checked="" type="checkbox"/> Plate 3D	
<input checked="" type="checkbox"/> User	<input checked="" type="checkbox"/> Beam-Plate	

Show only joint elements [Plot]

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

Plot Joint Type Labels
Plot Joint Type in colors

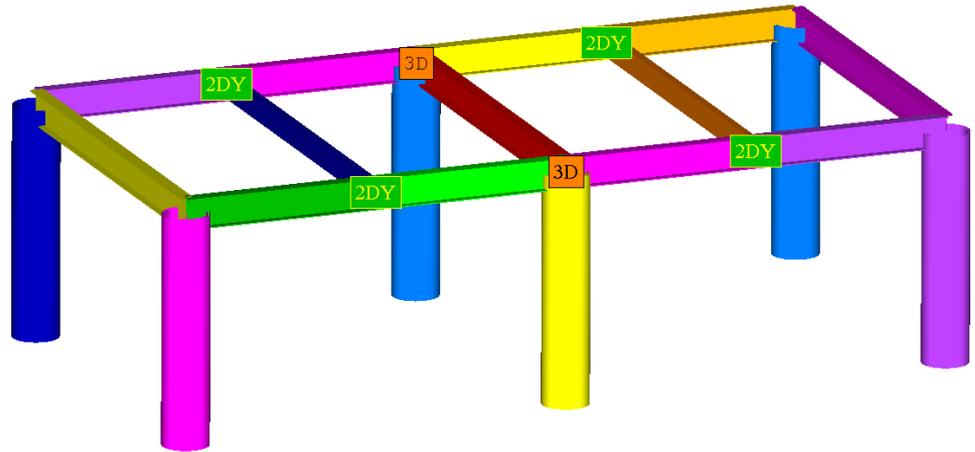
3. **OK** Cancel

Modify Joint Type:

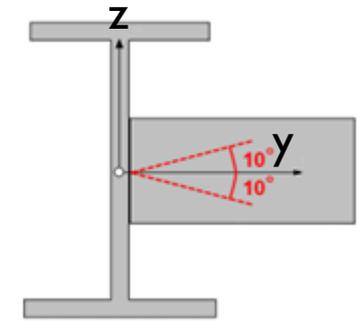
Change Type for selected Joints
Type: None [v] [Set]

Beam Member Lengths in 2 directions

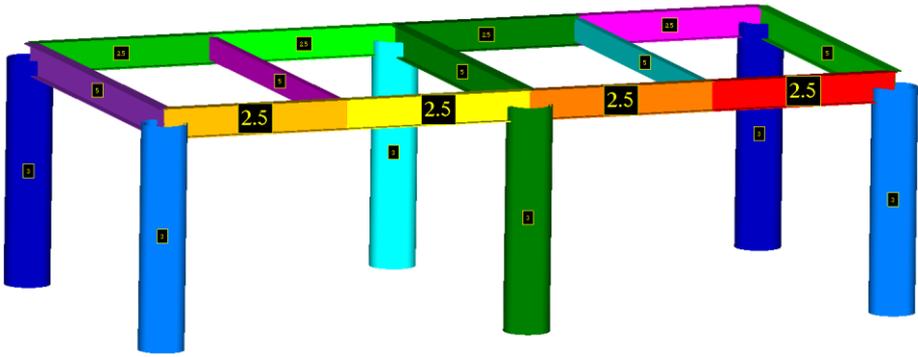
Beam Member Finder recognizes beam members and (buckling) lengths for different directions (Y, Z and Torsional).



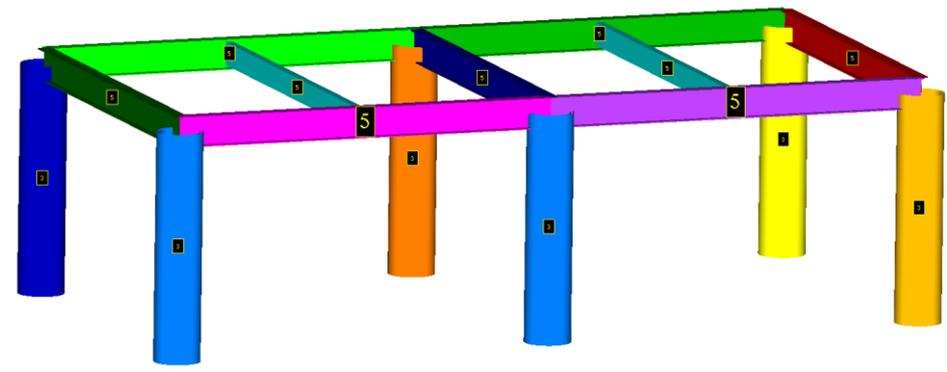
2DY
Joint



Length Y – 4 Beam Members with L = 2.5



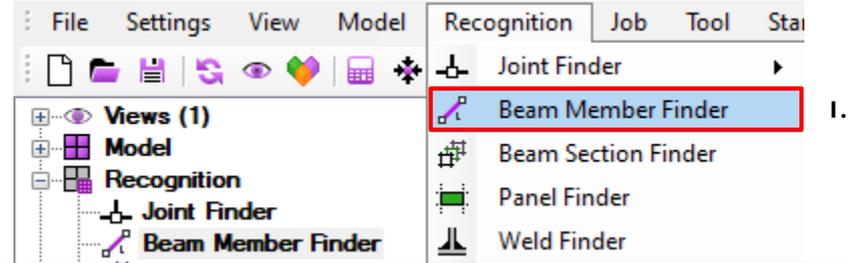
Length Z – 2 Beam Members with L = 5



Recognize Length

1 Execute *Recognition – Beam Member Finder*

2 Press *Find*.



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				2233[2Dy]

Settings 2. Find OK Cancel

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

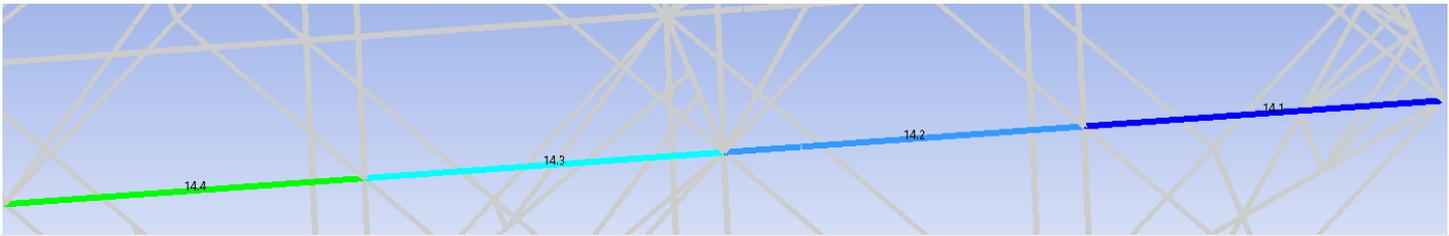
Change Length/Factor for selected beam members

Cm Type is used in API 2A, ISO 1902 and Norsok N004 standards

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

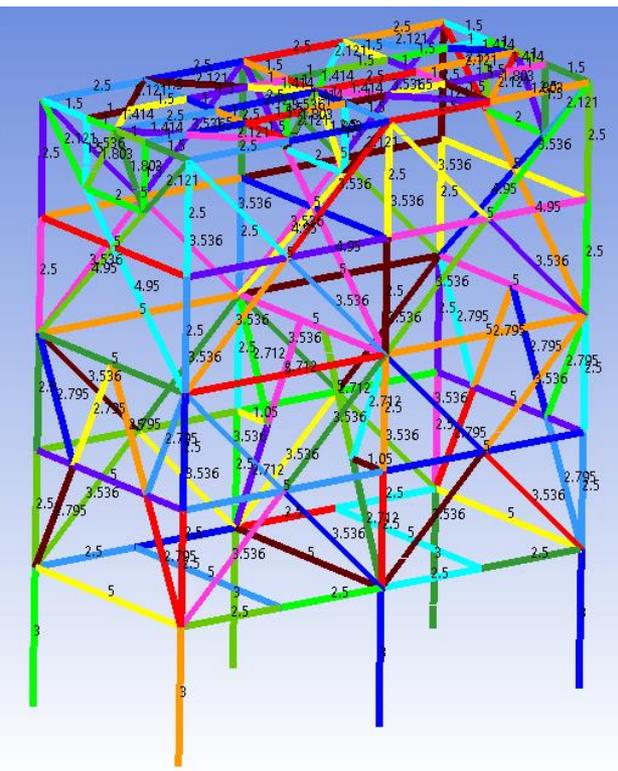
14	Beam Member 14 (Y)	45	14.144				1090[2Dy] 1105[3D] 2232[2Dy]
14.1	Beam Member 14.1 (Y)	12	3.536	1	A		
14.2	Beam Member 14.2 (Y)	11	3.536	1	A		
14.3	Beam Member 14.3 (Y)	11	3.536	1	A		
14.4	Beam Member 14.4 (Y)	11	3.536	1	A		



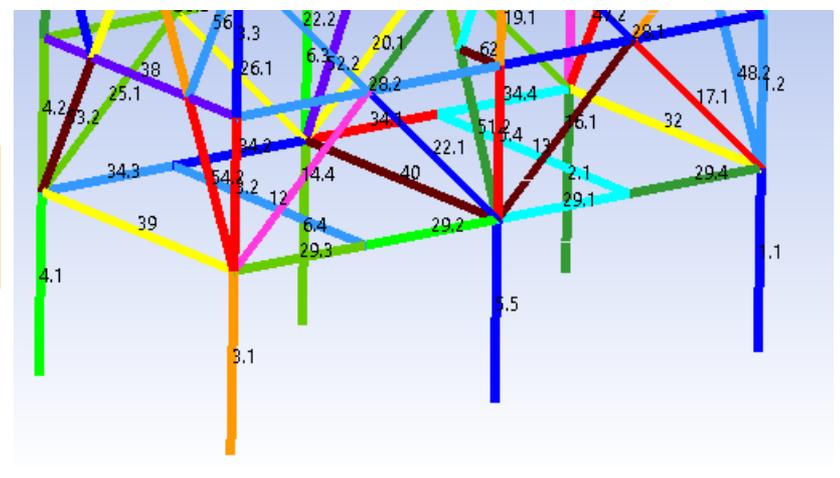
Beam Member's Length Plot

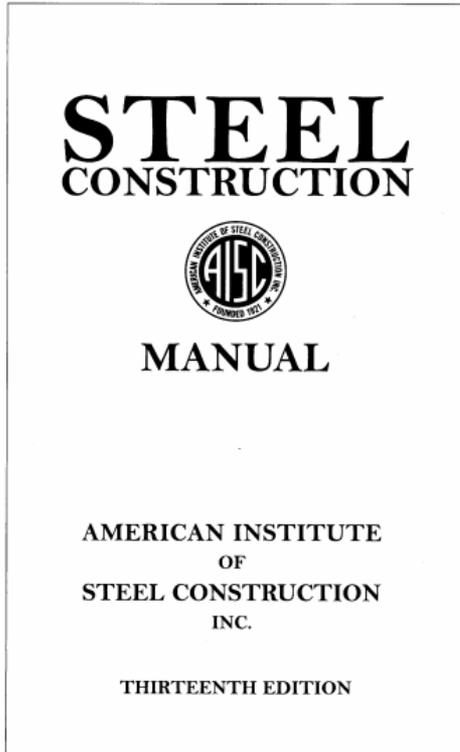
- 1 Select All Beam Members (Ctrl+A)
- 2 Press and Plot Length labels to display Length Plot
- 3 Press OK

ID	Title	Elements	Length [m]	Length Factor	Cm Type	Modified	Joint-NodeID [Joint Type]
1	Beam Member 1 (Y)	47	13				1107[3D] 156[3D] 1104[3D] 4[3D]
2	Beam Member 2 (Y)	47	13				1108[3D] 156[3D] 1108[3D] 117[3D]
3	Beam Member 3 (Y)	47	13				2228[3D] 1273[3D] 2222[3D] 1172[3D]
4	Beam Member 4 (Y)	47	13				2227[3D] 1254[3D] 2226[3D] 1236[3D]
5	Beam Member 5 (Y)	47	13				2226[3D] 1105[3D] 165[3D] 1106[3D]
6	Beam Member 6 (Y)	47	13				1110[3D] 202[3D] 1111[3D] 201[3D]
7	Beam Member 7 (Y)	32	10				1090[2D] 22[3D] 2208[2D]
8	Beam Member 8 (Y)	16	5	1	A		
9	Beam Member 9 (Y)	32	10				1103[2D] 201[3D] 2221[2D]
10	Beam Member 10 (Y)	16	5	1	A		
11	Beam Member 11 (Y)	16	5	1	A		
12	Beam Member 12 (Y)	12	5	1	A		
13	Beam Member 13 (Y)	12	5	1	A		
14	Beam Member 14 (Y)	45	14.144				1090[2D] 1105[3D] 2232[2D]
15	Beam Member 15 (Y)	23	7.072				1090[2D]
16	Beam Member 16 (Y)	22	7.072				1114[2D]
17	Beam Member 17 (Y)	45	14.144				1114[2D] 1105[3D] 2208[2D]
18	Beam Member 18 (Y)	6	2	1	A		
19	Beam Member 19 (Y)	45	14.144				1115[2D] 1110[3D] 1538[1D] 1539[1D] 1540[1D]
20	Beam Member 20 (Y)	22	7.072				1115[2D]
21	Beam Member 21 (Y)	23	7.072				2208[2D]
22	Beam Member 22 (Y)	22	7.072				2232[2D]
23	Beam Member 23 (Y)	6	2	1	A		
24	Beam Member 24 (Y)	6	2	1	A		
25	Beam Member 25 (Y)	45	14.144				2233[2D] 1110[3D] 420[1D] 421[1D] 422[1D] 423[1D]
26	Beam Member 26 (Y)	22	7.072				2233[2D]



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





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"/> 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:

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

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

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

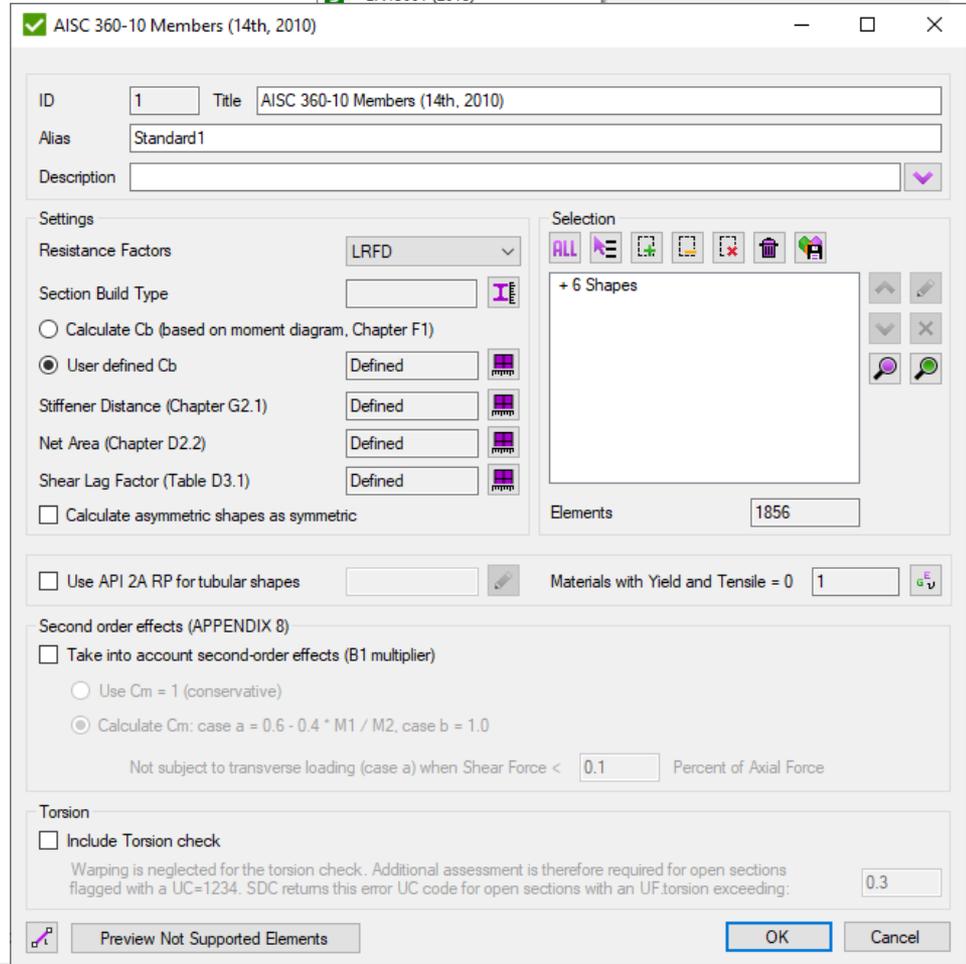
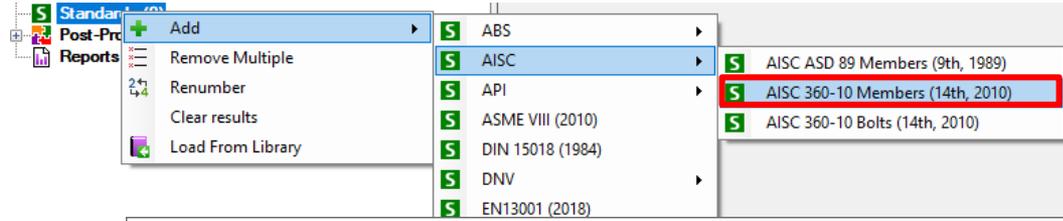
Add AISC360-10 standard

1

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

2

Resistance Factors: **LRFD**



Section Build Type

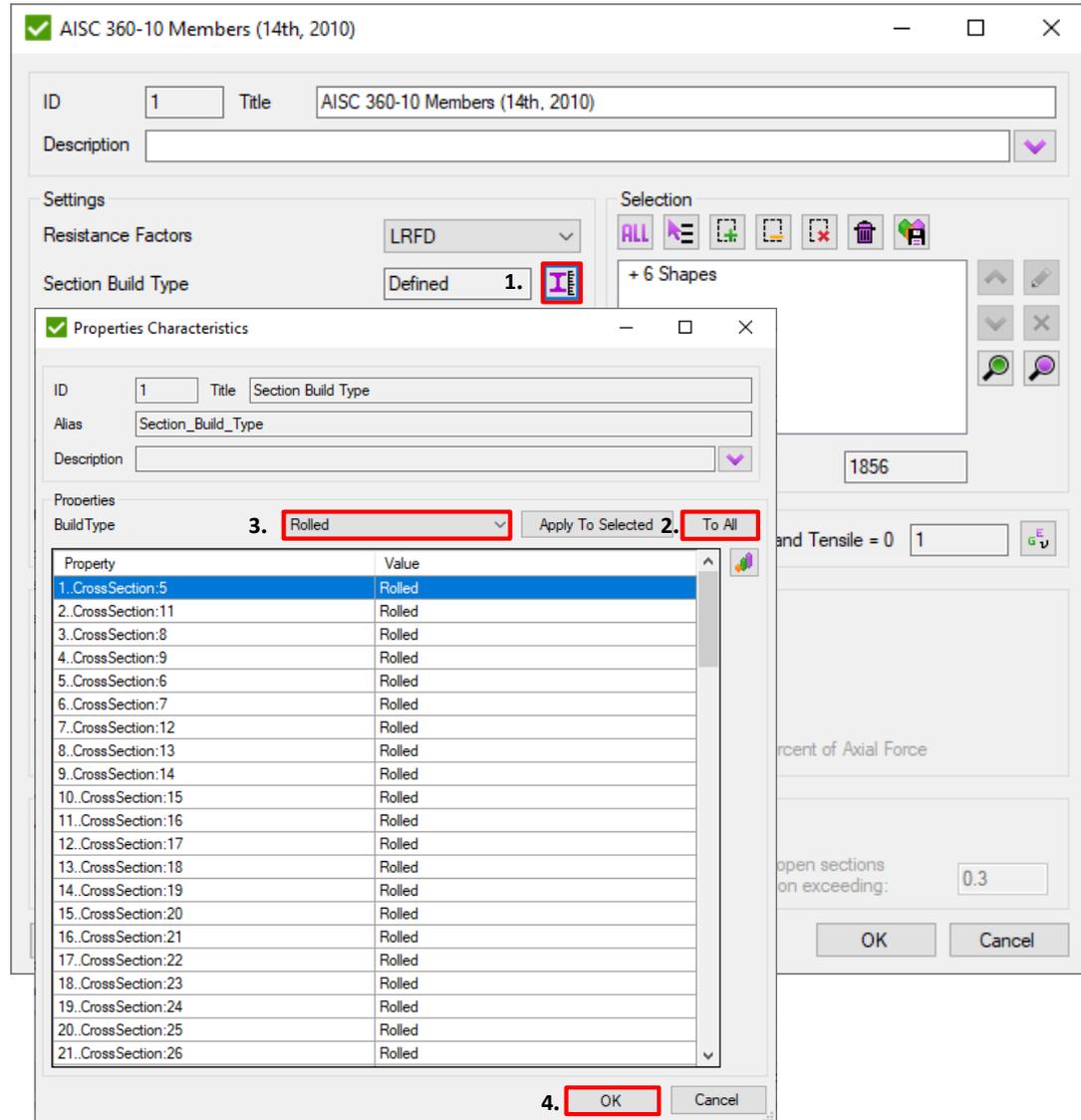
1 Press  for Section Build Type

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

Description: [Empty]

Settings

Resistance Factors: LRFD

Section Build Type: Defined 1. 

Selection: ALL [Icons]

+ 6 Shapes

Properties Characteristics

ID: 1 Title: Section Build Type

Alias: Section_Build_Type

Description: [Empty]

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

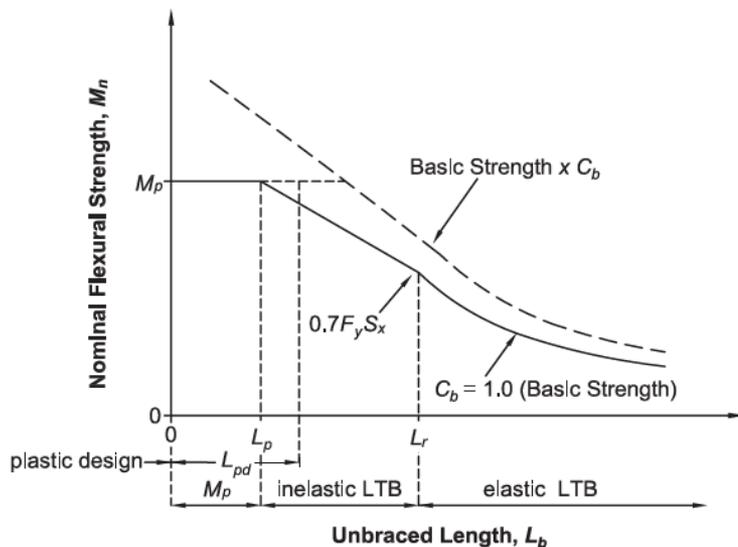
4. **OK** Cancel

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.

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 'Alias' is 'Standard1'. Under 'Settings', 'Resistance Factors' is set to 'LRFD'. 'Section Build Type' is set to 'Defined'. The 'Calculate Cb (based on moment diagram, Chapter F1)' radio button is selected and highlighted with a red box. Other options include 'User defined Cb', 'Stiffener Distance (Chapter G2.1)', 'Net Area (Chapter D2.2)', and 'Shear Lag Factor (Table D3.1)', all set to 'Defined'. There are also checkboxes for 'Calculate asymmetric shapes as symmetric', 'Use API 2A RP for tubular shapes', and 'Second order effects (APPENDIX 8)'. The 'Torsion' section has 'Include Torsion check' checked. The 'OK' and 'Cancel' buttons are at the bottom right.

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: [Empty]

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

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 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

1.

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.

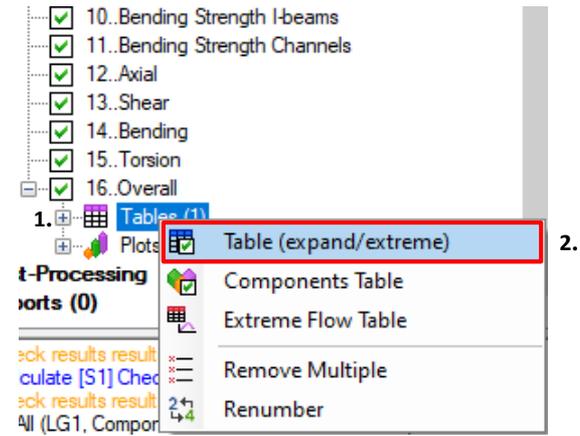
Standard contains 16 checks:
1 - Beam member characteristics;
2-6 - calculation dimensions and factors for 5 different shapes;
7-11 – strength for different shapes ;
12 – tension and compression check;
13 – additional shear check;
14 – additional bending check;
15 – torsion check;
16 - All Checks together 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 sectio
15	UFTorsionCode	1234	Code is used for Torsional Utilization Factor when it is highe
16	rolled	1	
17	built_up	2	
18	nonslender	3	
19	slender	4	
20	NotSupported	12345678	
21	compact	5	
22	noncompact	6	

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

Preview Table Results

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



Custom Check Table

ID: 2 Title: []

Description: []

Options

Check: 16..Overall

Load Group: 1..Overall

Table Type: Extreme (worst result on selection)

Table Structure: Direction over Parameters

Direction: All

Extreme Options

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

Short (only extremes)

Selection

+ Component '1..s1.AISC360 selection'

Elements: 1856

4. **Fill Table**

5. **OK** Cancel

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	1409	1177
Load	LS1	LS1	LS1	LS1	LS1	LS1
Maximum						
Value	0.01	0.10	0.01	0.05	0.10	0.10
Element ID	952	64	1121	61	64	64
Load	LS4	LS4	LS4	LS4	LS4	LS4
Absolute						
Value	0.01	0.10	0.01	0.05	0.10	0.10
Element ID	952	64	1121	61	64	64
Load	LS4	LS4	LS4	LS4	LS4	LS4

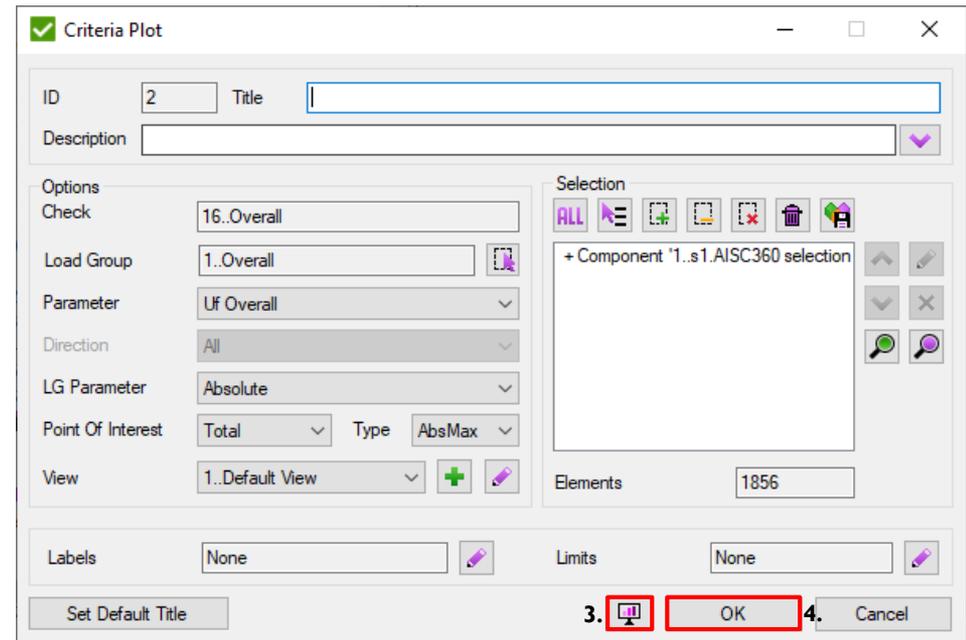
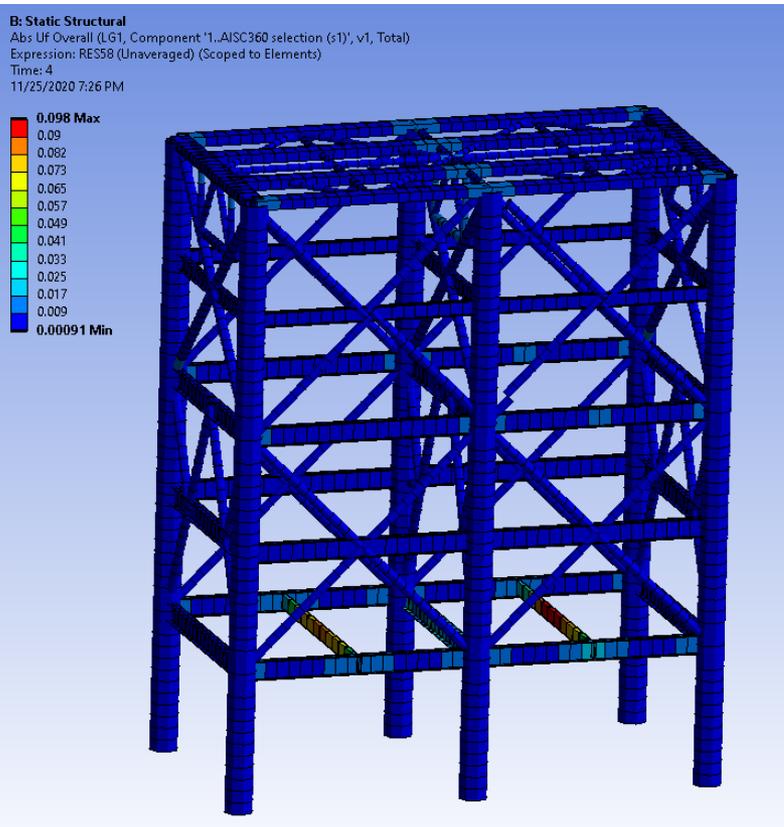
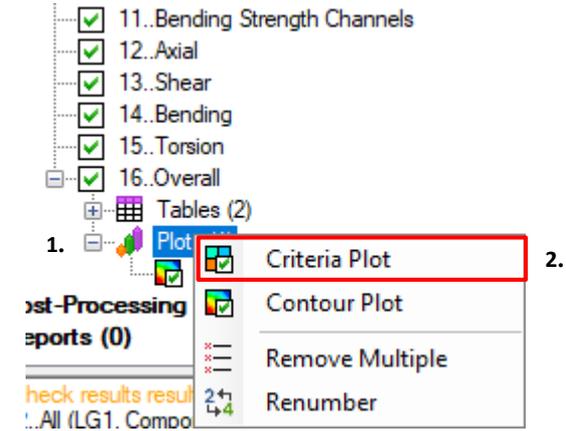
Utilization Factor Plot

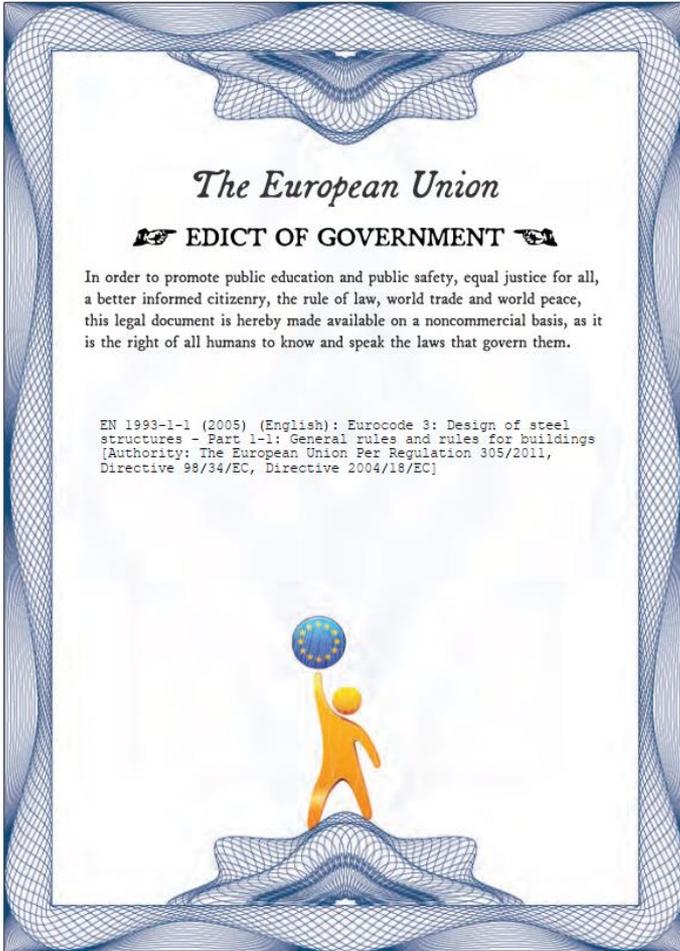
1 Select Plots

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

The screenshot shows the 'Eurocode3 Members (EN 1993-1-1, 2005)' dialog box. The 'Factors' section is highlighted with a red box and contains the following values: Partial Factor Gm0: 1.0, Partial Factor Gm1: 1.0, Partial Factor Gm2: 1.25, Lambda LT,0: 0.4, Beta: 0.75, and Eta: 1.2. The 'Fabrication Type' section is also highlighted with a red box and contains fields for Fabrication Type, Manufacture Method, Fillet, Section Net Area, and Material Type. The 'Lengths for Torsional-Flexural and Lateral Torsional Buckling' section has radio buttons for 'Calculate according to Table 6.6', 'Set Kc = 1 for all members', 'LT = max(Ly, Lz)', and 'Use Torsional Length from Beam Member Finder'. The 'Lateral Torsional Buckling Method' section is highlighted with a red box and has radio buttons for 'General Case (6.3.2.2)', 'For rolled sections or equivalent welded sections (6.3.2.3)', and 'Worst of (6.3.2.2) and (6.3.2.3)'. There are also checkboxes for 'Calculate asymmetric shapes as symmetric' and a 'Materials with Yield and Tensile = 0' field. At the bottom, there is a 'Selection' field with '104 Properties' and 'Preview Not Supported' button.

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

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

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

ID	Title	Elements	Length [m]	Length Factor	Cm Type	Modified
1	Beam Member 1 (T)	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*

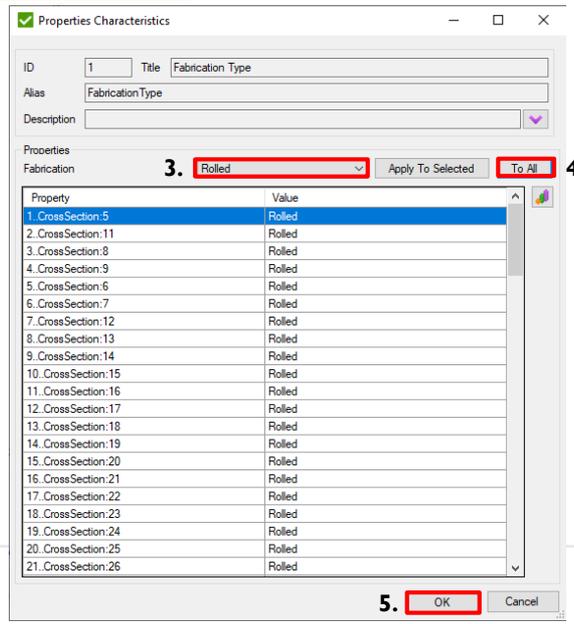
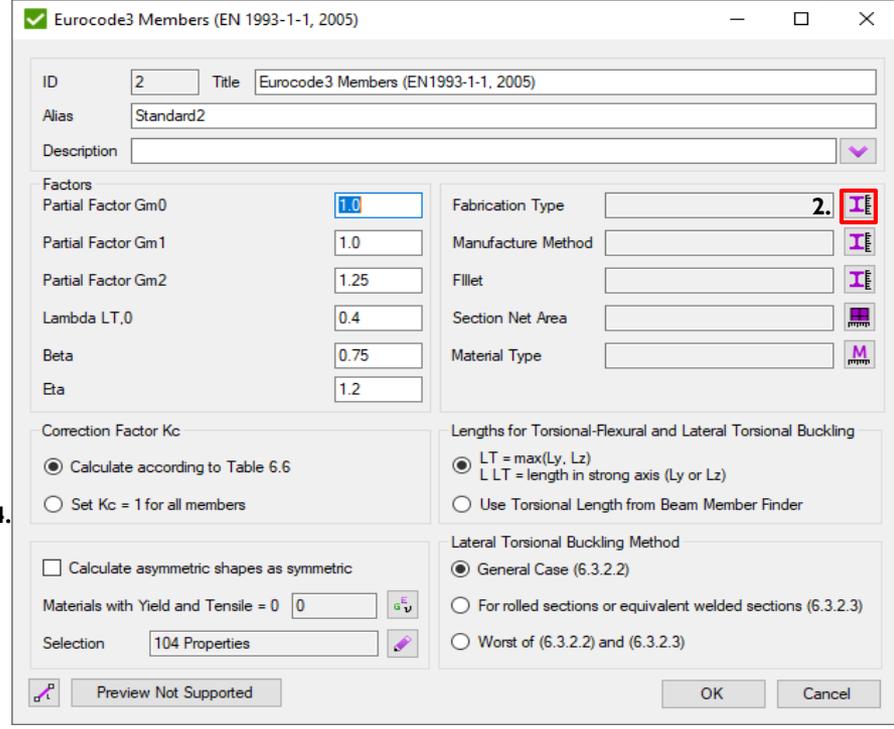
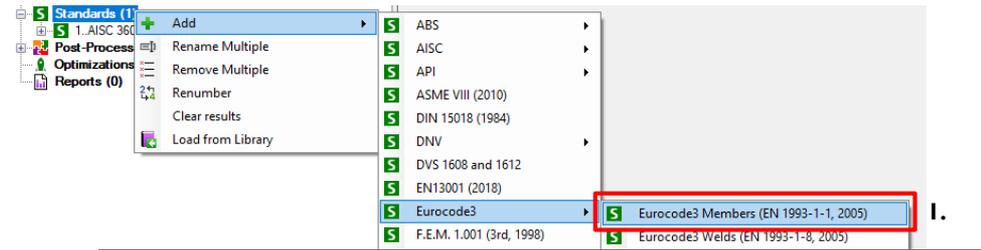
2 Press to set *Fabrication Type*

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

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. Under "Options", Partial Factor Gm0 and Gm1 are both set to 1.0. On the right, "Fabrication Type" is "Defined", "Manufacture Method" is empty, "Fillet" is empty, "Section Net Area" is empty, and "Material Type" is empty. The bottom dialog is titled "Properties Characteristics". It has fields for ID (2), Title (Manufacture Method), Alias (Hollow), and Description. Under "Properties", "Hollow Manufacturing Method" is set to "Hot Finished" (highlighted with a red box and labeled "2."). The "Apply To Selected" button is disabled, and the "To All" button is highlighted with a red box and labeled "3.". Below this is a table with 21 rows, each representing a cross-section with a value of "Hot Finished". At the bottom right, the "OK" button is highlighted with a red box and labeled "4.". The "Cancel" button is also visible.

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

Eurocode3. Fillet

1 Press  to set *Fillet*

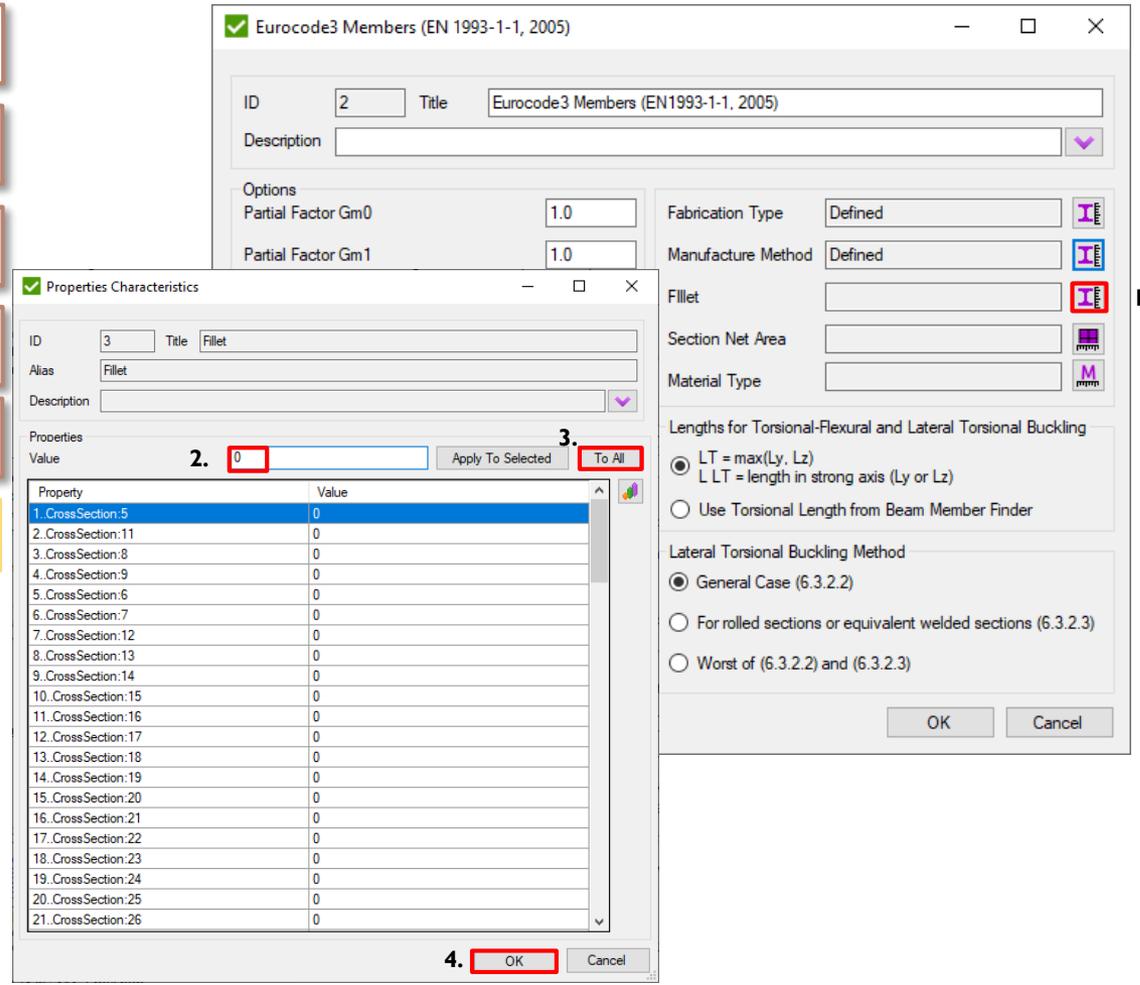
2 Properties Value - **0**

3 Press *To All*

4 Press *Ok*

Repeat Steps 1-4 for *Section Net Area*

Go to the next slide to Continue

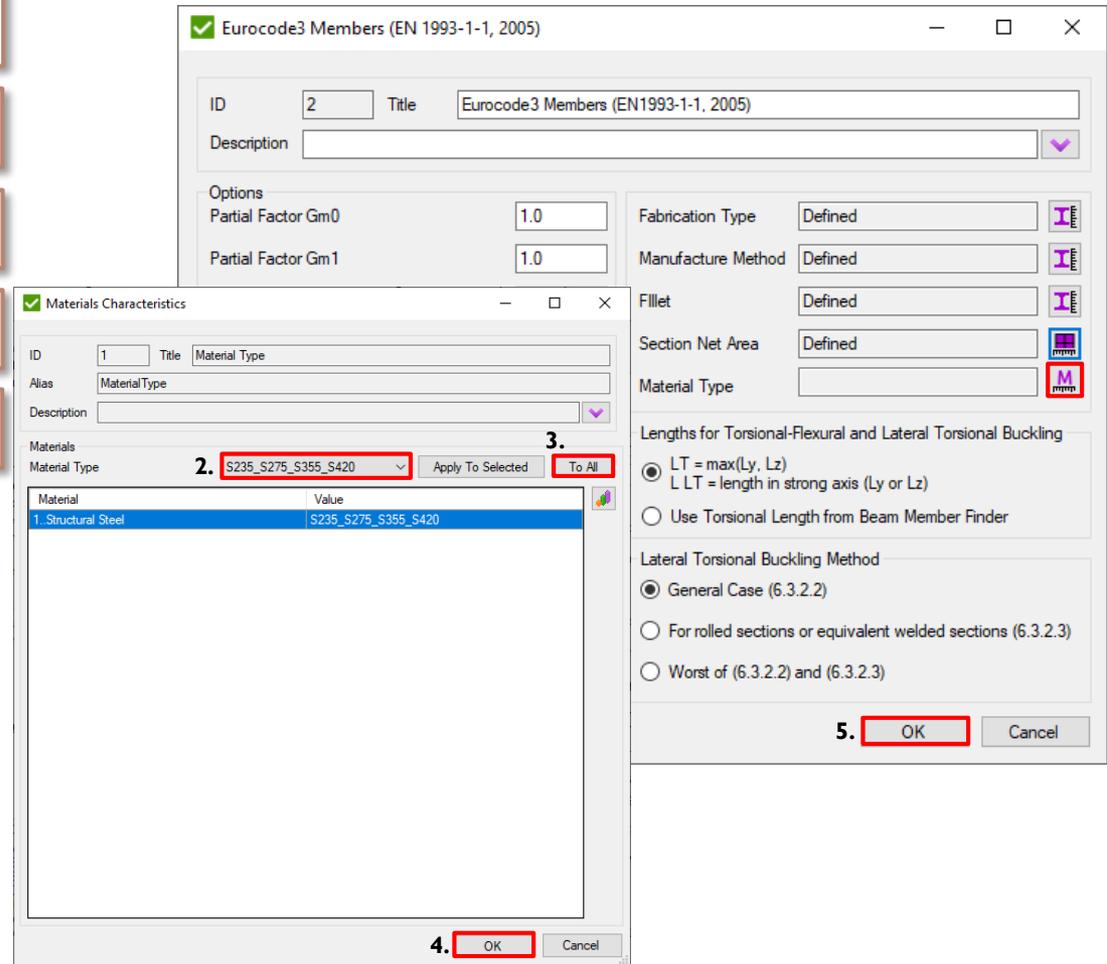


The image shows two overlapping dialog boxes from the SDC Verifier software. The top dialog is titled "Eurocode3 Members (EN 1993-1-1, 2005)" and contains fields for ID (2), Title (Eurocode3 Members (EN1993-1-1, 2005)), and Description. It also has options for Partial Factor Gm0 and Gm1, both set to 1.0. The bottom dialog is titled "Properties Characteristics" and shows a list of properties for "Fillet". The "Value" column for all properties is set to 0. The "Apply To Selected" button is set to "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

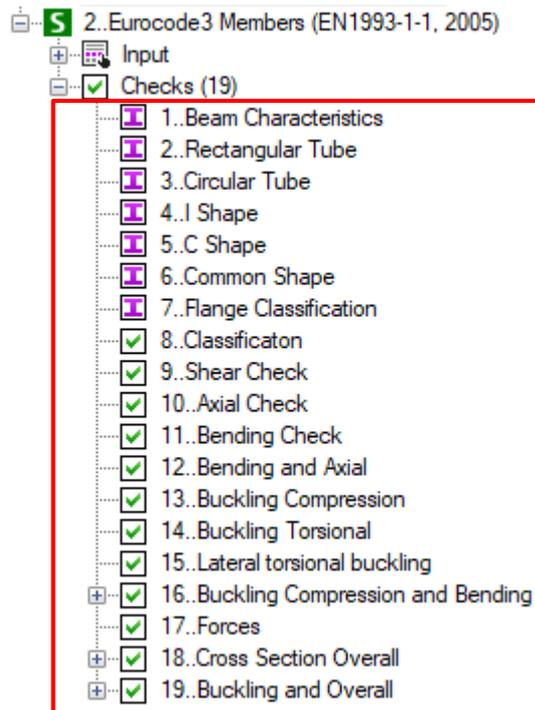
Eurocode3. Material Type

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



The image shows two overlapping dialog boxes from a software application. 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 dropdown menus for Fabrication Type, Manufacture Method, Fillet, and Section Net Area, all set to "Defined". A "Material Type" dropdown is highlighted with a red box and a red '1.' next to it. Below these are radio buttons for "Lengths for Torsional-Flexural and Lateral Torsional Buckling" (selected: LT = max(Ly, Lz)) and "Lateral Torsional Buckling Method" (selected: General Case (6.3.2.2)). At the bottom right, an "OK" button is highlighted with a red box and a red '5.' next to it.

The bottom dialog is titled "Materials Characteristics". It has fields for ID (1), Title (Material Type), Alias (Material Type), and Description. Below these are "Materials" and "Material Type" sections. The "Material Type" dropdown is highlighted with a red box and a red '2.' next to it. Below it is a table with two columns: "Material" and "Value". The first row is "1. Structural Steel" with the value "S235_S275_S355_S420". To the right of the table are "Apply To Selected" and "To All" buttons. The "To All" button is highlighted with a red box and a red '3.' next to it. At the bottom right, an "OK" button is highlighted with a red box and a red '4.' next to it.



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

1. List of checks:

- 9..Shear Check
- 10..Axial Check
- 11..Bending Check
- 12..Bending and Axial
- 13..Buckling Compression
- 14..Buckling Torsional
- 15..Lateral torsional buckling
- 16..Buckling Compression and Bending
- 17..Forces
- 18..Cross Section Overall
- 19..Buckling

2. Context menu options:

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

3. Extreme Options:

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

Extreme	UF Axial	UF ShearY	UF ShearZ	UF BendY	UF BendZ	UF Comb	UF Section
Minimum							
Value	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Element ID	2384	406	1781	1577	1605	1212	1177
Load	LS1	LS1	LS1	LS1	LS1	LS1	LS1
Maximum							
Value	0.01	0.00	0.01	0.01	0.09	0.02	0.09
Element ID	952	1957	1571	1957	64	64	64
Load	LS4	LS4	LS4	LS4	LS4	LS4	LS4
Absolute							
Value	0.01	0.00	0.01	0.01	0.09	0.02	0.09
Element ID	952	1957	1571	1957	64	64	64
Load	LS4	LS4	LS4	LS4	LS4	LS4	LS4

4. Fill Table

5. OK

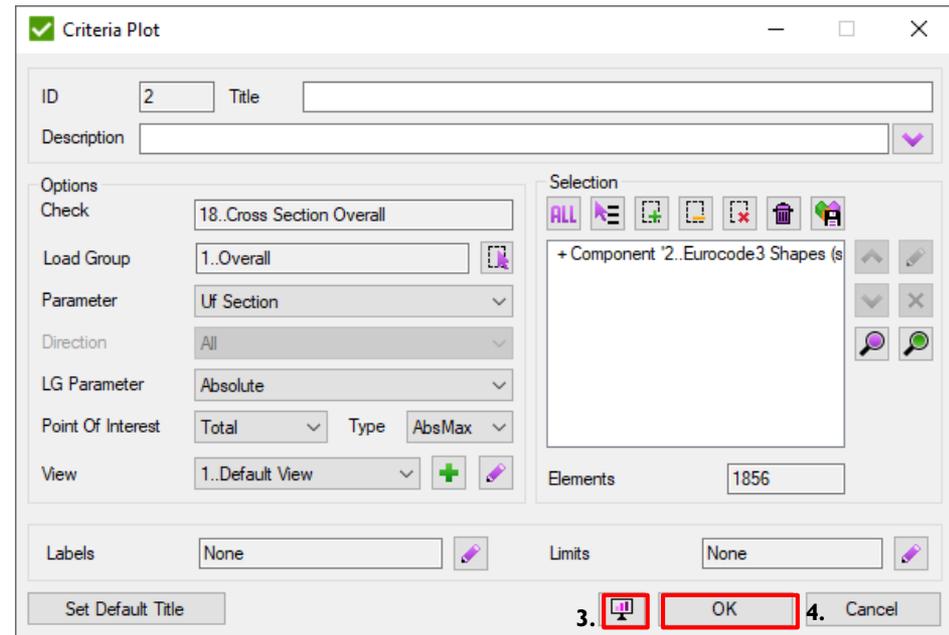
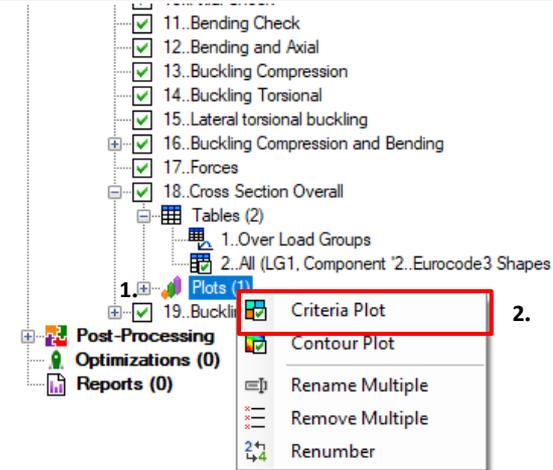
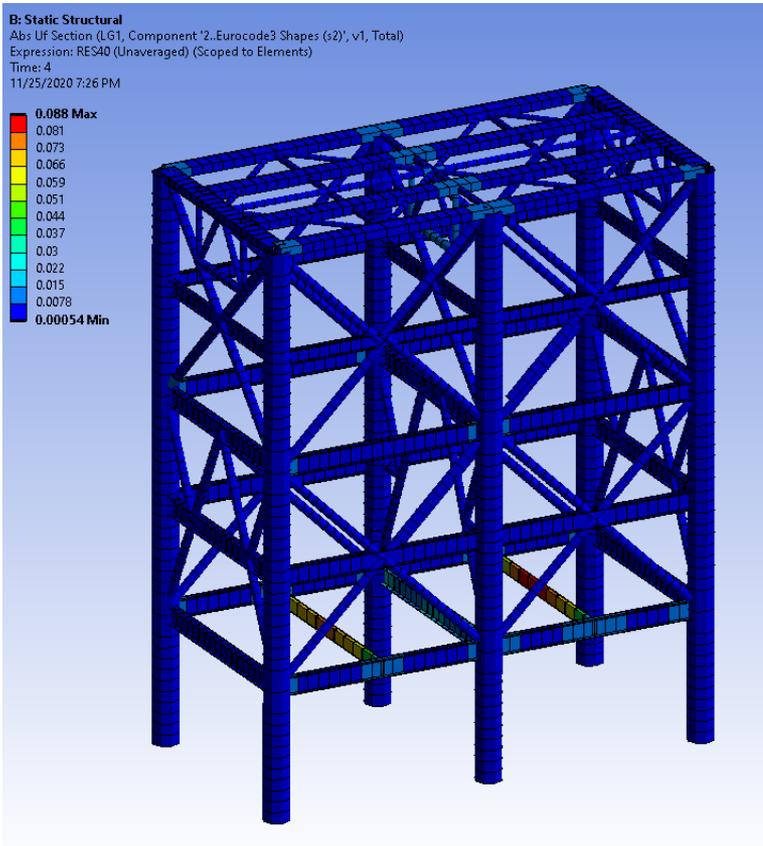
Utilization Factor Plot

1 Select Plots

3 Press  to preview Plot

2 Execute *Criteria Plot* in context menu

4 Press *Ok*



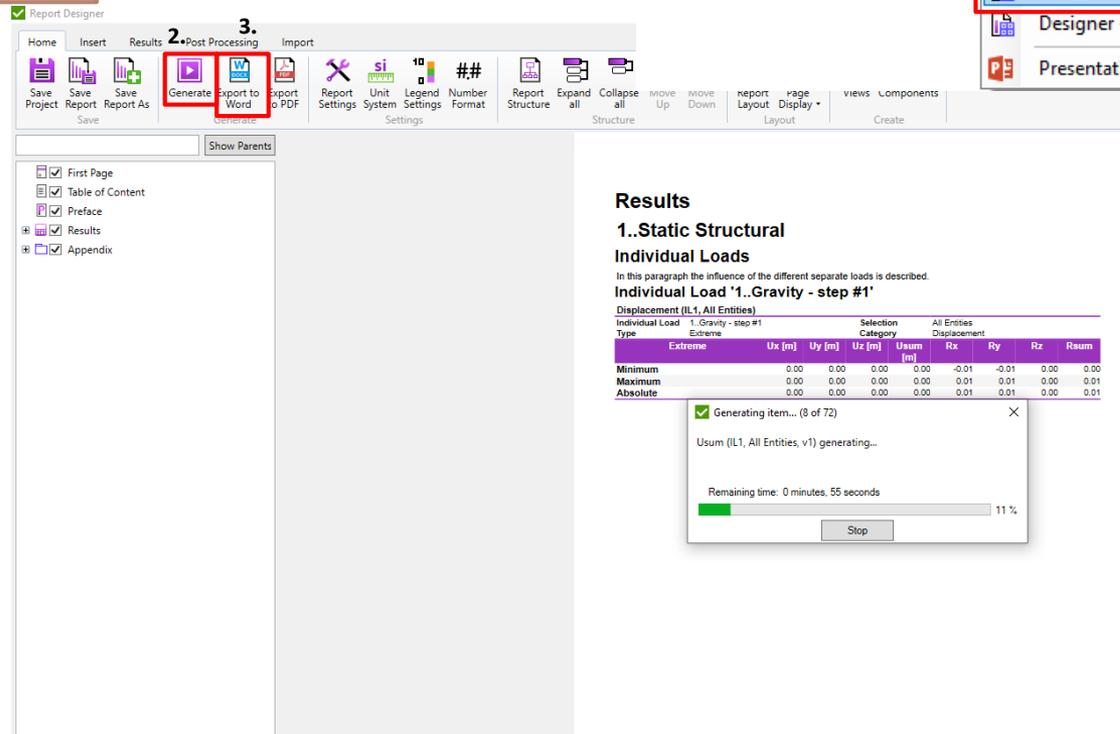
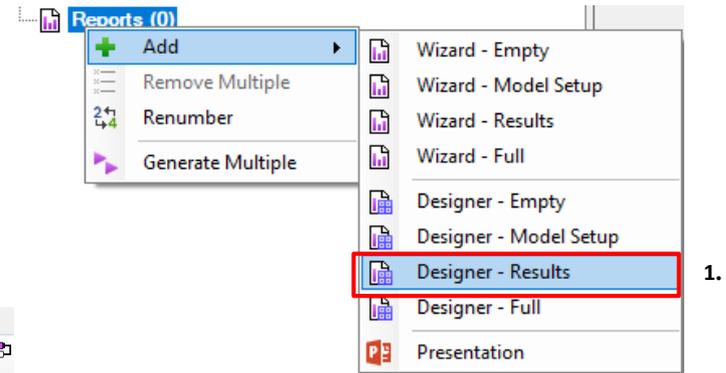
Create Predefined Report

1 Execute Reports - Add - Designer-Results.

2 Press  to generate report

3 When report is generated press 

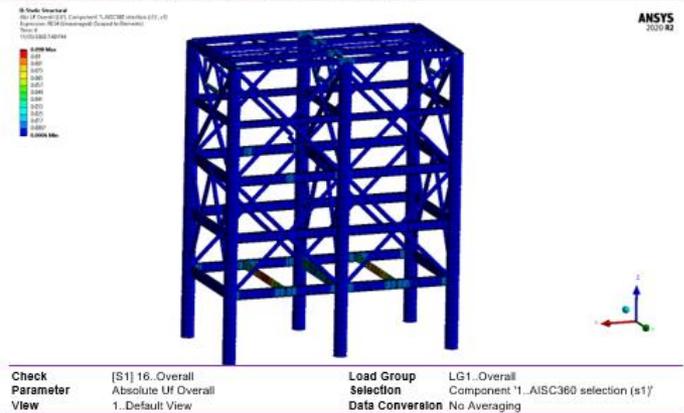
Results report includes an overview of the displacements and stresses for all loads and standards with all predefined tables and plots



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

Standard	1..AISC 360-10 Members (14th, 2010)					
Load Group	LG1..Overall					
Check Selection	[S1] 16..Overall 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)

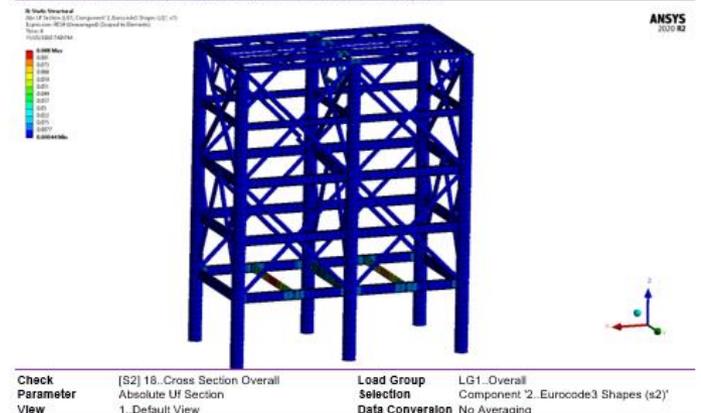


AISC 360 - 10

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

Standard	2..Eurocode3 Members (EN1993-1-1, 2005)						
Load Group	LG1..Overall						
Check Selection	[S2] 18..Cross Section Overall Component '2..Eurocode3 Shapes (s2)'						
Extreme	Uf Axial	Uf ShearY	Uf ShearZ	Uf BendY	Uf BendZ	Uf Comb	Uf Section
Minimum							
Value	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Element ID	2384	406	1781	1577	1605	1212	1177
Load	LS1	LS1	LS1	LS1	LS1	LS1	LS1
Maximum							
Value	0.01	0.00	0.01	0.01	0.09	0.02	0.09
Element ID	952	1957	1571	1957	64	64	64
Load	LS4	LS4	LS4	LS4	LS4	LS4	LS4
Absolute							
Value	0.01	0.00	0.01	0.01	0.09	0.02	0.09
Element ID	952	1957	1571	1957	64	64	64
Load	LS4	LS4	LS4	LS4	LS4	LS4	LS4

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



Eurocode3