



Tutorial

# Structural Checks according to Standards

Updated on: December 13th, 2023

Tested with: SDC Verifier 2023 R2.1

**SDC Verifier** is a powerful all-in-one software solution for structural design, FEA analysis, and verification according to standards.

This step-by-step tutorial is designed to **get** you **started** with the main SDC Verifier features.  
You will learn how to:

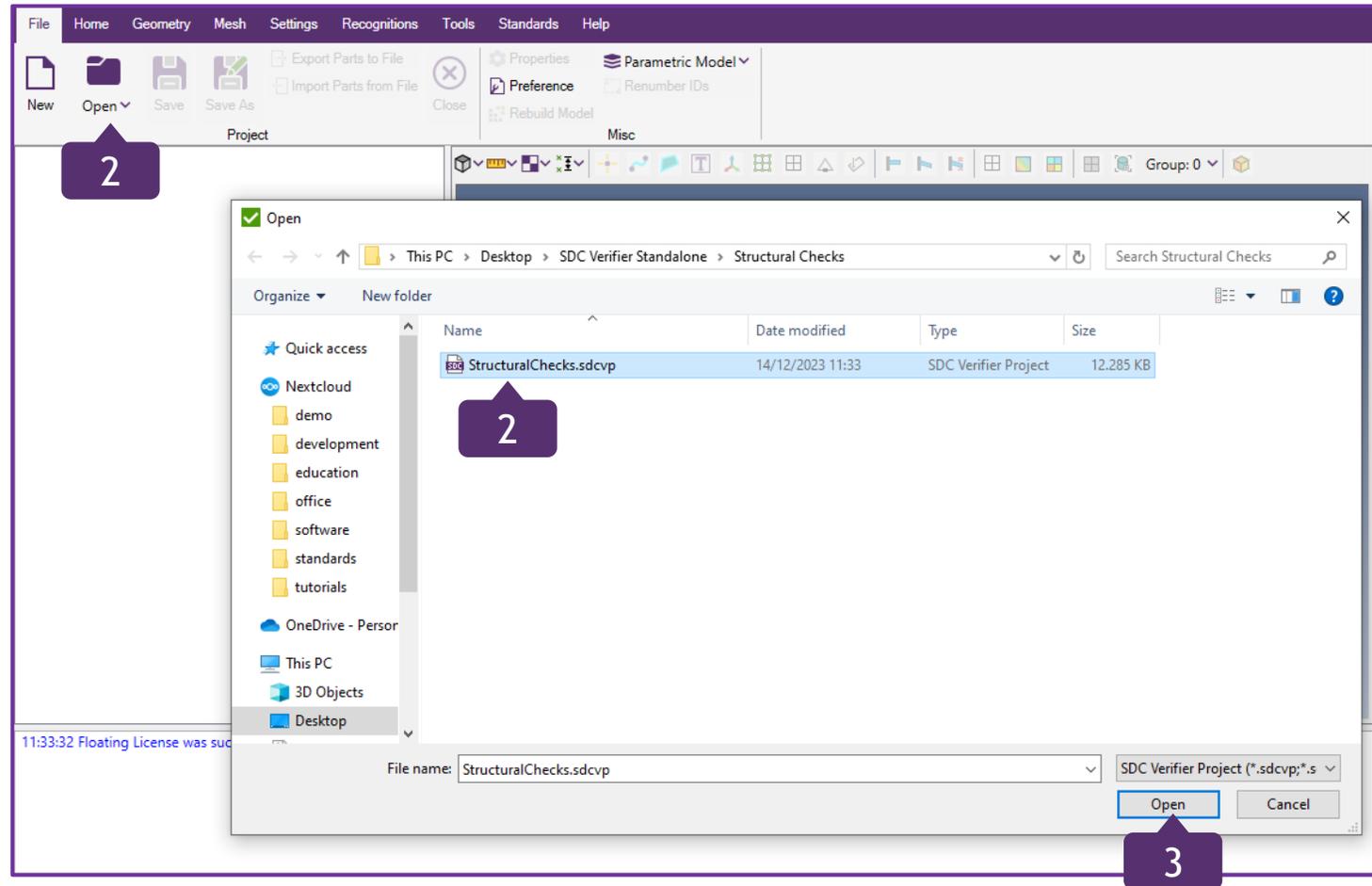
- Launch SDC Verifier;
- Recognize Beam Members;
- Analyse the model with Nastran solver
- Add two Standards: AISC 360-22 Members (2022) and Eurocode3 Fatigue (EN 1993-1-9, 2005);
- Run Beam Member Check;
- Recognise and preview Welds;
- Run Fatigue Check;
- Create Criteria Plot for fatigue Check

# Open the Starter Model

1 Launch SDC Verifier 2023 R2.1

2 Press Open and select project *StructuralChecks*

3 Press *Open*



# Beam Members Recognition

1

In *Recognitions* tab, press on *Beam Member*

2

Press *Find*

3

Press *OK*

The Recognitions tab provides users with a variety of Recognition Tools to define such structural members as Joints, Beam Members, Panels, Welds, Connections and Beam Sections. Recognize All command allows to define all structural members at once and for a short period of time.

The screenshot shows the SDC Verifier software interface. The 'Recognitions' tab is active, and the 'Beam Member' tool is selected in the Finders toolbar. The 'Beam Member Finder' dialog box is open, showing a table of recognized beam members. The 'Find' button is highlighted with a '2' callout. A notification dialog box is also visible, stating '32 Beam Members were recognized' with an 'OK' button highlighted by a '3' callout.

ID	Title	Elements	Length	Length Factor	Cm Type	Modified	Joint - NodeID [Joint Type]
1	bm1 (Y, [3.00; 0.00; 6.00] - 1..Box250x10)	40	12				14[3D] 25[3D] 36[3D]
2	bm2 (Y, [3.00; 3.00; 6.00] - 1..Box250x10)	40	12				58[3D] 69[3D] 80[3D]
3	bm3 (Y, [0.00; 0.00; 6.00] - 1..Box250x10)	40	12				102[3D] 113[3D] 124[3D]
4	bm4 (Y, [0.00; 3.00; 6.00] - 1..Box250x10)	40	12				146[3D] 157[3D] 168[3D]
5	bm5 (Y, [1.50; 0.00; 3.00] - 2..I-beam200)	10	3	1	A		
6	bm6 (Y, [1.50; 3.00; 3.00] - 2..I-beam200)	10	3	1	A		
7	bm7 (Y, [1.50; 0.00; 6.00] - 2..I-beam200)	10	3	1	A		
8	bm8 (Y, [1.50; 3.00; 6.00] - 2..I-beam200)	10	3	1	A		
9	bm9 (Y, [1.50; 0.00; 9.00] - 2..I-beam200)	10	3	1	A		
10	bm10 (Y, [1.50; 3.00; 9.00] - 2..I-beam200)	10	3	1	A		
11	bm11 (Y, [3.00; 1.50; 3.00] - 2..I-beam200)	10	3	1	A		
12	bm12 (Y, [0.00; 1.50; 3.00] - 2..I-beam200)	10	3	1	A		
13	bm13 (Y, [3.00; 1.50; 6.00] - 2..I-beam200)	10	3	1	A		
14	bm14 (Y, [0.00; 1.50; 6.00] - 2..I-beam200)	10	3	1	A		
15	bm15 (Y, [3.00; 1.50; 9.00] - 2..I-beam200)	10	3	1	A		
16	bm16 (Y, [0.00; 1.50; 9.00] - 2..I-beam200)	10	3	1	A		
17	bm17 (Y, [1.50; 3.00; 1.50] - 3..Tube150x6)	14	4.243	1	A		
18	bm18 (Y, [1.50; 0.00; 1.50] - 3..Tube150x6)	14	4.243	1	A		
19	bm19 (Y, [3.00; 1.50; 4.50] - 3..Tube150x6)	14	4.243	1	A		345[2Dz]
20	bm20 (Y, [3.00; 1.50; 4.50] - 3..Tube150x6)	14	4.243	1	A		345[2Dz]
21	bm21 (Y, [0.00; 1.50; 4.50] - 3..Tube150x6)	14	4.243	1	A		377[2Dz]
22	bm22 (Y, [0.00; 1.50; 4.50] - 3..Tube150x6)	14	4.243	1	A		377[2Dz]

The Beam Member Finder Tool detects the beams on the model in all directions: Length Y, Length Z and Length Torsional.

# Plot Beam Members

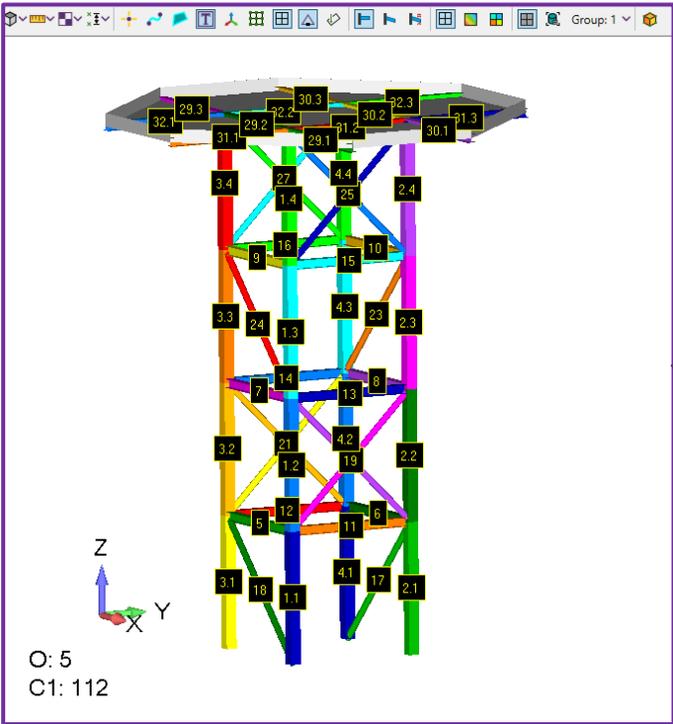
1 In Length Y section, with Ctrl+A combination, select all Beam Members

2 Press and select *Plot Members ID Labels*

3 Press OK

Plotting can be done in Length Z and Length Torsional sections as well.

ID	Title	Elements	Length	Length Factor	CM Type	Modified	Joint - NodeID [Joint Type]
1	bm1 (Y, [3.00; 0.00; 6.00] - 1.Box250x10)	40	12				14[3D] 25[3D] 36[3D]
2	bm2 (Y, [3.00; 3.00; 6.00] - 1.Box250x10)	40	12				58[3D] 69[3D] 80[3D]
3	bm3 (Y, [0.00; 0.00; 6.00] - 1.Box250x10)	40	12				102[3D] 113[3D] 124[3D]
4	bm4 (Y, [0.00; 3.00; 6.00] - 1.Box250x10)	40	12				146[3D] 157[3D] 168[3D]
5	bm5 (Y, [1.50; 0.00; 3.00] - 2.I-beam200)	10	3	1	A		
6	bm6 (Y, [1.50; 3.00; 3.00] - 2.I-beam200)	10	3	1	A		
7	bm7 (Y, [1.50; 0.00; 6.00] - 2.I-beam200)	10	3	1	A		
8	bm8 (Y, [1.50; 3.00; 6.00] - 2.I-beam200)	10	3	1	A		
9	bm9 (Y, [1.50; 0.00; 9.00] - 2.I-beam200)	10	3	1	A		
10	bm10 (Y, [1.50; 3.00; 9.00] - 2.I-beam200)	10	3	1	A		
11	bm11 (Y, [3.00; 1.50; 3.00] - 2.I-beam200)	10	3	1	A		
12	bm12 (Y, [0.00; 1.50; 3.00] - 2.I-beam200)	10	3	1	A		
13	bm13 (Y, [3.00; 1.50; 6.00] - 2.I-beam200)	10	3	1	A		
14	bm14 (Y, [0.00; 1.50; 6.00] - 2.I-beam200)	10	3	1	A		
15	bm15 (Y, [3.00; 1.50; 9.00] - 2.I-beam200)	10	3	1	A		
16	bm16 (Y, [0.00; 1.50; 9.00] - 2.I-beam200)	10	3	1	A		
17	bm17 (Y, [1.50; 3.00; 1.50] - 3..Tube150x6)	14	4.243	1	A		
18	bm18 (Y, [1.50; 0.00; 1.50] - 3..Tube150x6)	14	4.243	1	A		
19	bm19 (Y, [3.00; 1.50; 4.50] - 3..Tube150x6)	14	4.243	1	A		345[2Dz]
20	bm20 (Y, [3.00; 1.50; 4.50] - 3..Tube150x6)	14	4.243	1	A		345[2Dz]
21	bm21 (Y, [0.00; 1.50; 4.50] - 3..Tube150x6)	14	4.243	1	A		377[2Dz]
22	bm22 (Y, [0.00; 1.50; 4.50] - 3..Tube150x6)	14	4.243	1	A		377[2Dz]



The members have been recognized and the forces will be summarized.

In order to make sure that the recognition has been carried out properly, other Plotting options can be selected .

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

1

Press *Edit Member (in all directions)* section to modify the configurations

If necessary, the connections can be added or removed in the relevant points to split them manually.

In this case, the big member is split into four sub-members in Joint Node ID 14, 25 and 36

The specific Members can be edited by nodes.

- 1..bm1 ([3.00; 0.00; 6.00] - 1..Box)
- 1..bm1 ([3.00; 0.00; 6.00] - 1..Box250x10)
- 2..bm2 ([3.00; 3.00; 6.00] - 1..Box250x10)
- 3..bm3 ([0.00; 0.00; 6.00] - 1..Box250x10)
- 4..bm4 ([0.00; 3.00; 6.00] - 1..Box250x10)
- 19..bm19 ([3.00; 1.50; 4.50] - 3..Tube150x6)
- 20..bm20 ([3.00; 1.50; 4.50] - 3..Tube150x6)
- 21..bm21 ([0.00; 1.50; 4.50] - 3..Tube150x6)
- 22..bm22 ([0.00; 1.50; 4.50] - 3..Tube150x6)
- 25..bm25 ([3.00; 1.50; 10.50] - 3..Tube150x6)
- 26..bm26 ([3.00; 1.50; 10.50] - 3..Tube150x6)
- 27..bm27 ([0.00; 1.50; 10.50] - 3..Tube150x6)
- 28..bm28 ([0.00; 1.50; 10.50] - 3..Tube150x6)
- 29..bm29 ([1.50; 0.00; 12.00] - 2..I-beam200)
- 30..bm30 ([1.50; 3.00; 12.00] - 2..I-beam200)
- 31..bm31 ([3.00; 1.50; 12.00] - 2..I-beam200)
- 32..bm32 ([0.00; 1.50; 12.00] - 2..I-beam200)

Filter section allows to single out the groups of beams with the similar parameters.

This slide is devoted to demonstrative purposes of Filter section functionality.

1 Press *Filter* section

2 *By Length [m]* is ON; Select  $\geq$  and 5

3 Press *Filter*

2

3

The filtered members by Length

Current Filter: Beam Member Length Y; By Length  $\geq$  5

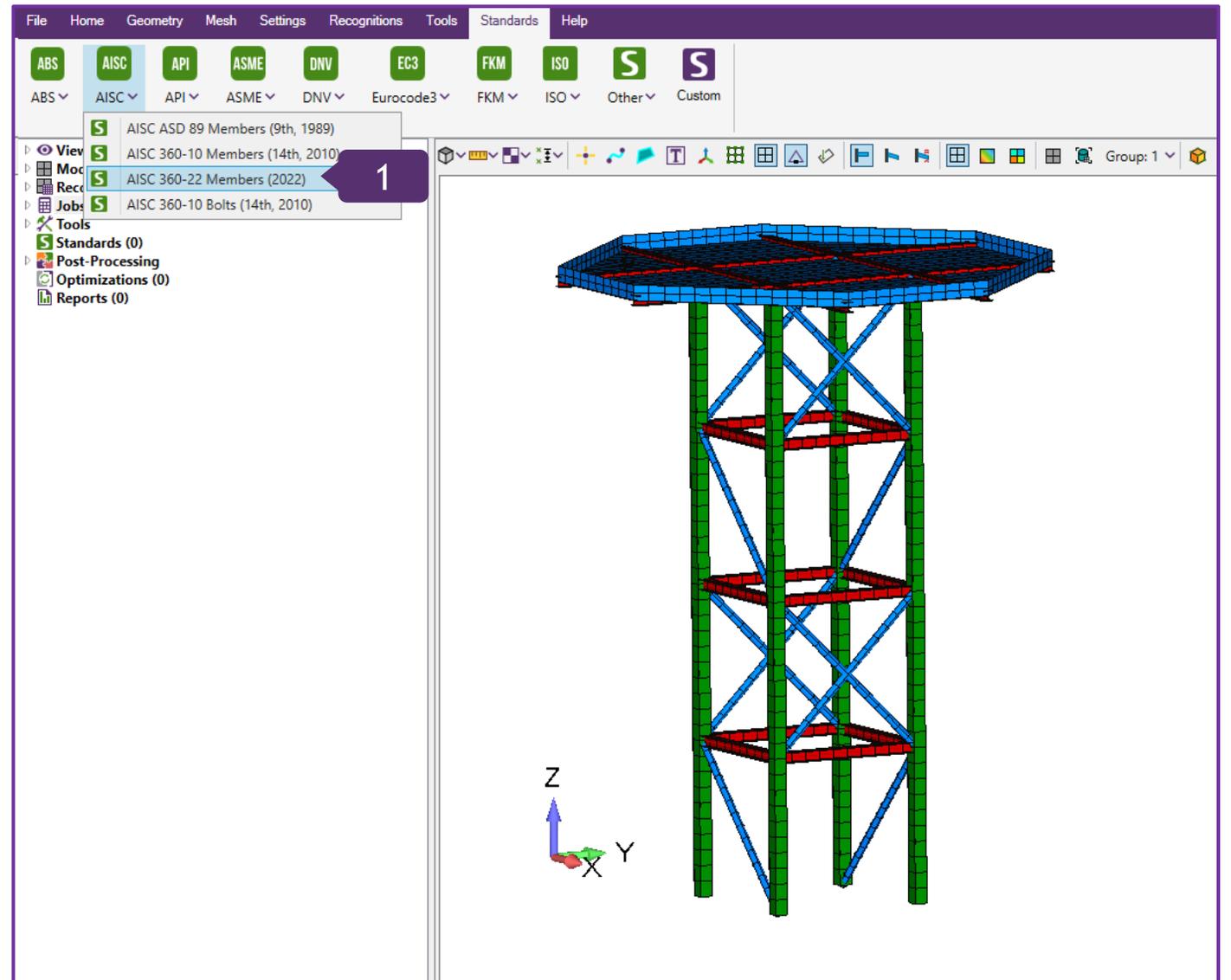
Title	Length [m]	Length Factor (K)	Cm Type
1..bm1 (Y, [3.00; 0.00; 6.00] - 1..Box250x10)	12	1	A
2..bm2 (Y, [3.00; 3.00; 6.00] - 1..Box250x10)	12	1	A
3..bm3 (Y, [0.00; 0.00; 6.00] - 1..Box250x10)	12	1	A
4..bm4 (Y, [0.00; 3.00; 6.00] - 1..Box250x10)	12	1	A
29..bm29 (Y, [1.50; 0.00; 12.00] - 2..I-beam200)	9	1	A
30..bm30 (Y, [1.50; 3.00; 12.00] - 2..I-beam200)	9	1	A
31..bm31 (Y, [3.00; 1.50; 12.00] - 2..I-beam200)	9	1	A
32..bm32 (Y, [0.00; 1.50; 12.00] - 2..I-beam200)	9	1	A

# Add AISC 360-22 Members (2022) Standard

1

In *Standards* section of the *Ribbon*, press on *AISC* and select *AISC 360-22 Members (2022)*

Standards can be added either through the Model Tree, or in the Ribbon - Standards section.



# Define AISC 360-22 Members (2022) Standard

1 Resistance Factors: *LRFD*

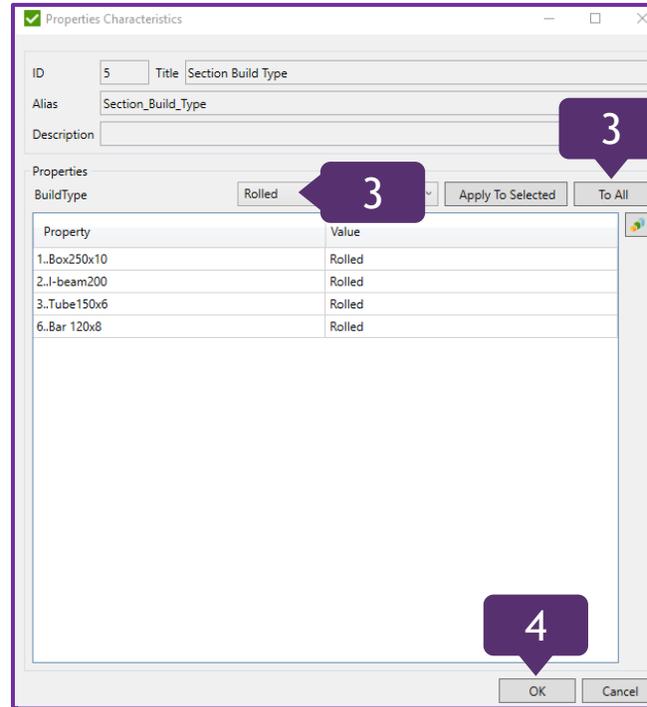
2 In *Section Build Type*, press

3 In *Properties*, *Build Type: Rolled* and press *To All*

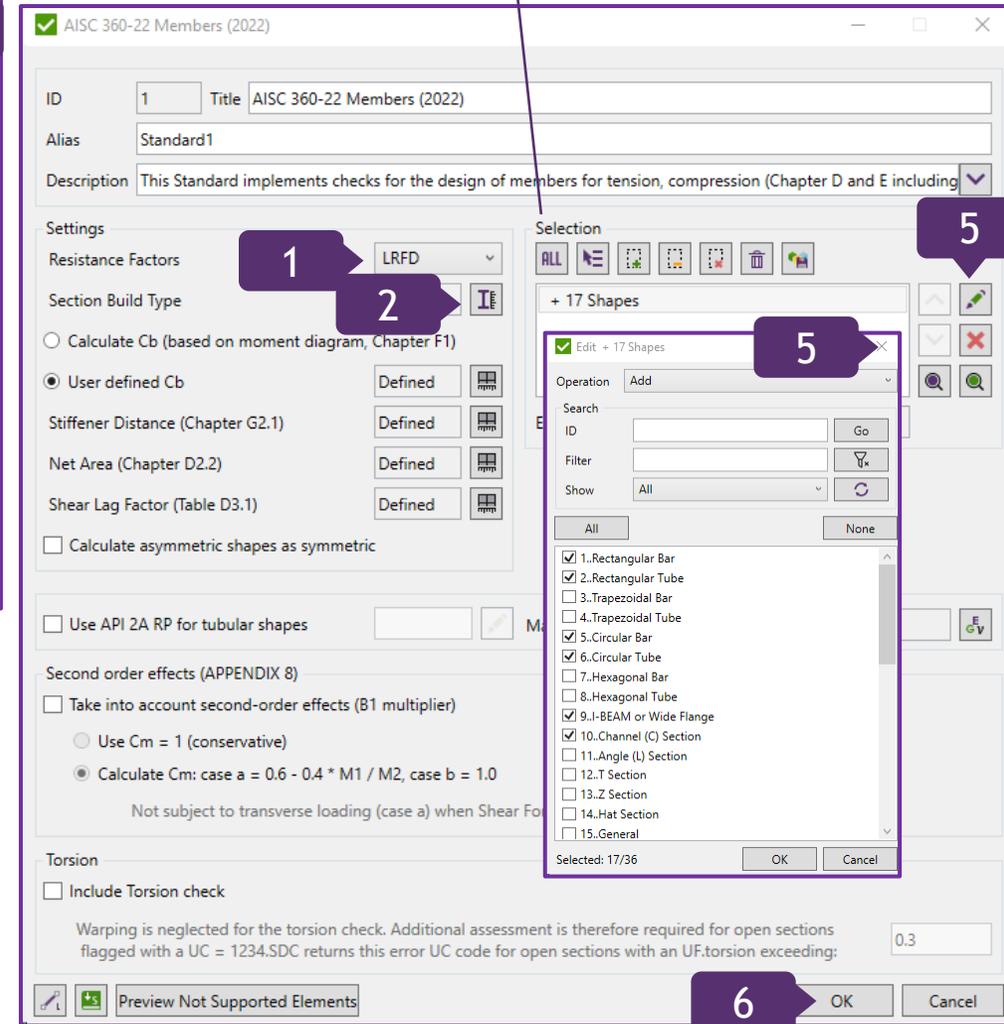
4 Press *OK*

5 Press to check the number of supported shapes; Close the window

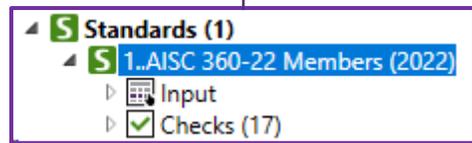
6 Press *OK*



A selection section gives a possibility to define a certain part of the model to be verified.



The Standard has been added.



When defining the Standard, SDC Verifier informative Help page might be helpful. Press F1 to open it.

# The Access to Formulas in Custom Check

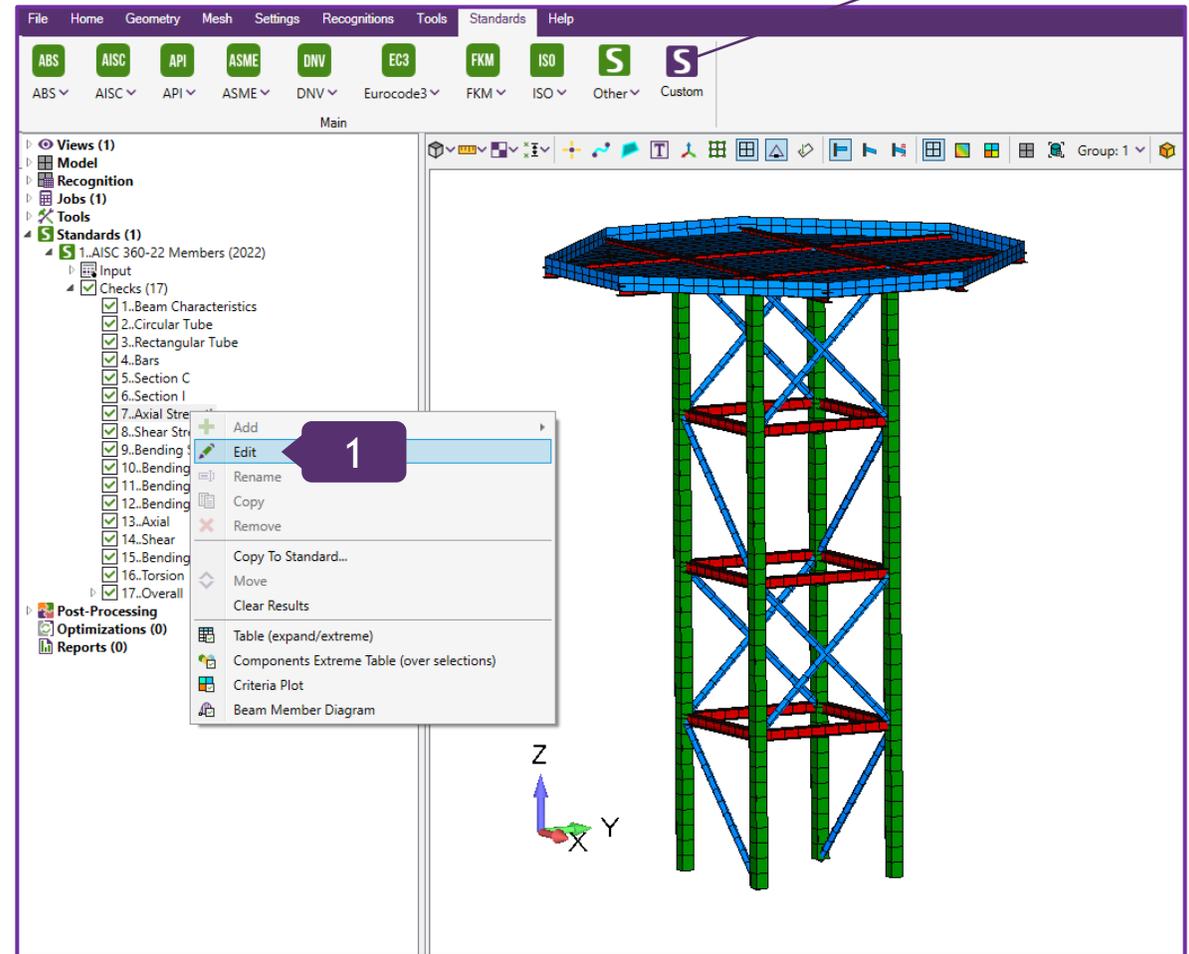
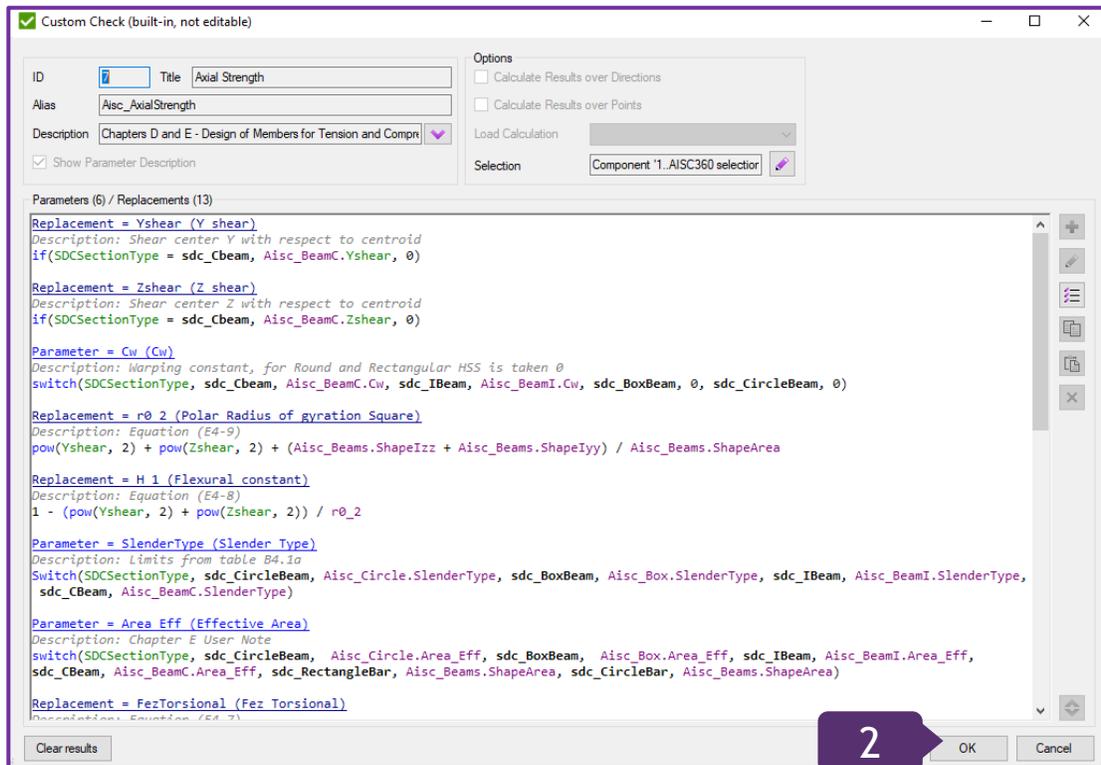
1

Execute right click on 7..Axial Strength and select *Edit*

2

Press *OK*

The formulas and the calculation procedure of the Checks are open. Every Parameter has a description, in which the source Standard the formula has been taken from is listed. Also, the formulas can be edited and modified, but they need to be converted to Custom Check. To conclude, the formulas can be written from scratch by selecting Custom feature.





# Create a Table

1

Expand *Tables*, and execute right click on *1..Over Load Groups*; Select *Edit*

2

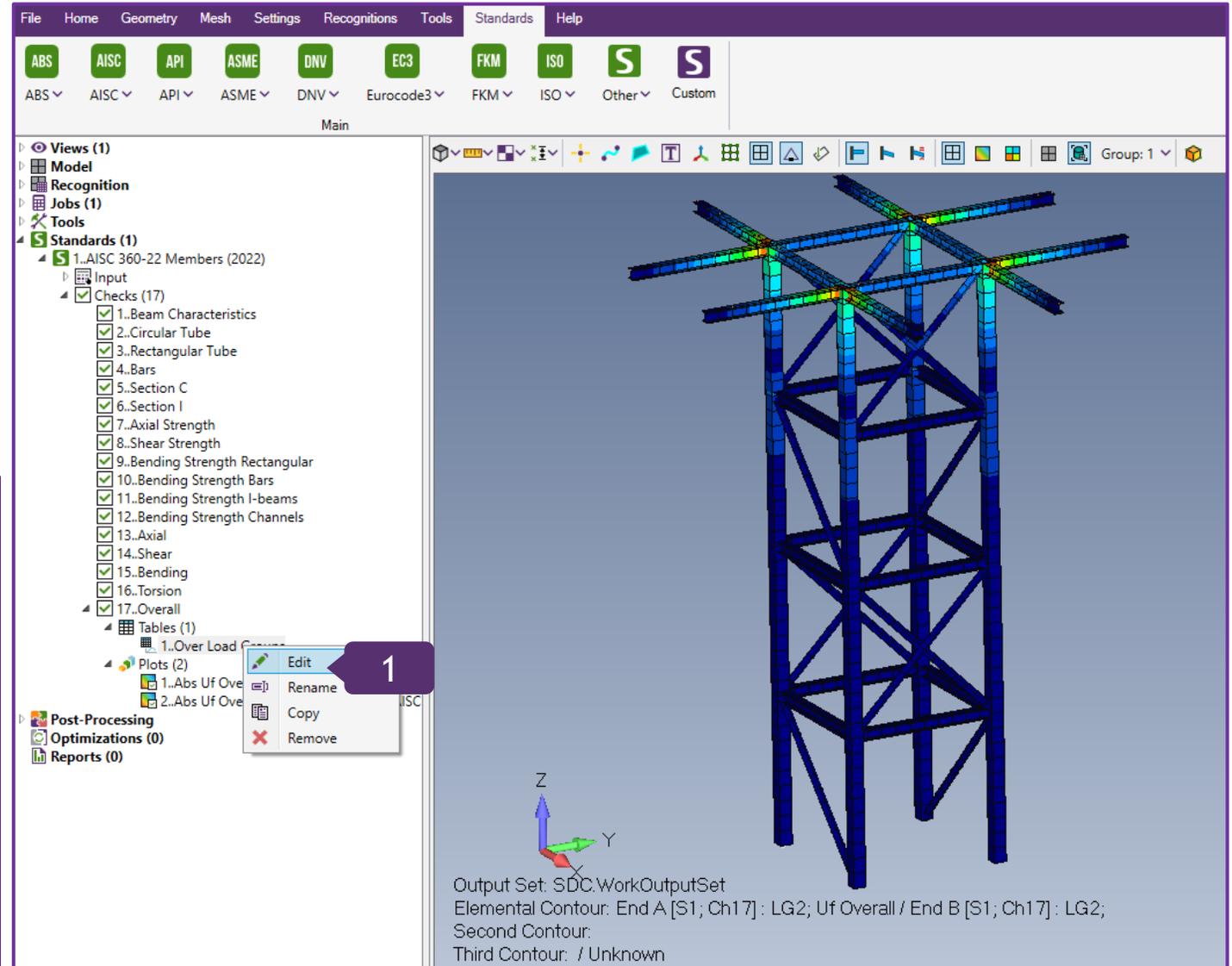
Loads Count: *Selected loads: 2*;  
Direction/Parameter: *All*;  
Extreme Options: *Absolute*

3

Press *Fill Table*

4

Press *OK*



1

To obtain more details, additional Loads can be applied by incorporating this option.

2

2

2

4

3

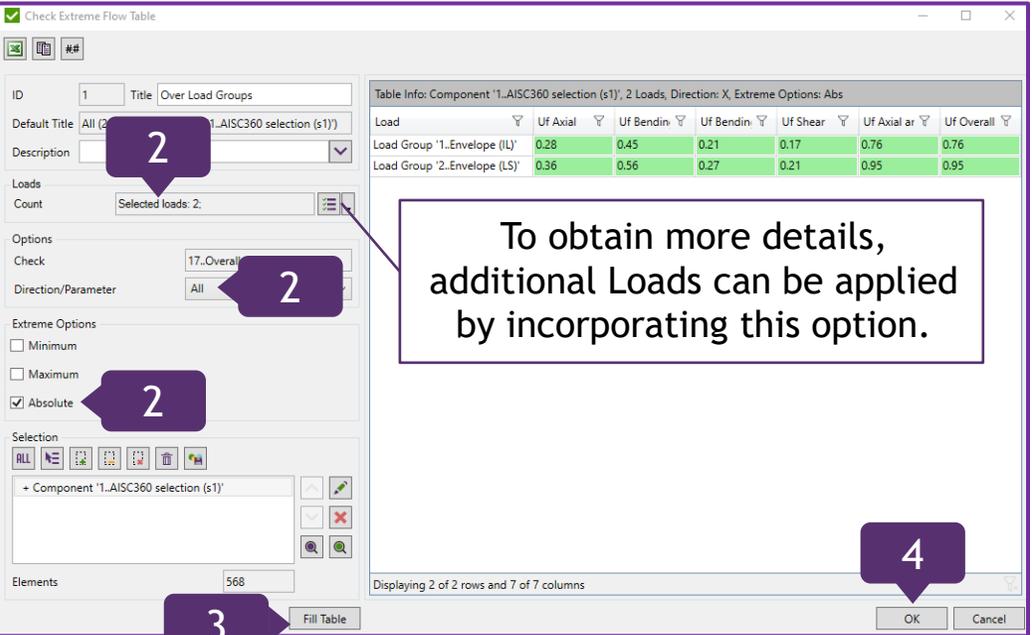


Table Info: Component '1..AISC360 selection (s1)'; 2 Loads; Direction: X; Extreme Options: Abs

Load	Uf Axial	Uf Bendin	Uf Bendin	Uf Shear	Uf Axial ar	Uf Overall
Load Group '1..Envelope (L)	0.28	0.45	0.21	0.17	0.76	0.76
Load Group '2..Envelope (LS)	0.36	0.56	0.27	0.21	0.95	0.95

Load	Uf Axial	Uf Bendin	Uf Bendin	Uf Shear	Uf Axial ar	Uf Overall
Load Group '1..Envelope (L)	0.28	0.45	0.21	0.17	0.76	0.76
Load Group '2..Envelope (LS)	0.36	0.56	0.27	0.21	0.95	0.95

Load	Uf Axial	Uf Bendin	Uf Bendin	Uf Shear	Uf Axial ar	Uf Overall
Load Group '1..Envelope (L)	0.28	0.45	0.21	0.17	0.76	0.76
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Load	Uf Axial	Uf Bendin	Uf Bendin	Uf Shear	Uf Axial ar	Uf Overall
Load Group '1..Envelope (L)	0.28	0.45	0.21	0.17	0.76	0.76
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Load	Uf Axial	Uf Bendin	Uf Bendin	Uf Shear	Uf Axial ar	Uf Overall
Load Group '1..Envelope (L)	0.28	0.45	0.21	0.17	0.76	0.76
Load Group '2..Envelope (LS)	0.36	0.56	0.27	0.21	0.95	0.95

Load	Uf Axial	Uf Bendin	Uf Bendin	Uf Shear	Uf Axial ar	Uf Overall
Load Group '1..Envelope (L)	0.28	0.45	0.21	0.17	0.76	0.76
Load Group '2..Envelope (LS)	0.36	0.56	0.27	0.21	0.95	0.95

Load	Uf Axial	Uf Bendin	Uf Bendin	Uf Shear	Uf Axial ar	Uf Overall
Load Group '1..Envelope (L)	0.28	0.45	0.21	0.17	0.76	0.76
Load Group '2..Envelope (LS)	0.36	0.56	0.27	0.21	0.95	0.95

Load	Uf Axial	Uf Bendin	Uf Bendin	Uf Shear	Uf Axial ar	Uf Overall
Load Group '1..Envelope (L)	0.28	0.45	0.21	0.17	0.76	0.76
Load Group '2..Envelope (LS)	0.36	0.56	0.27	0.21	0.95	0.95

Load	Uf Axial	Uf Bendin	Uf Bendin	Uf Shear	Uf Axial ar	Uf Overall
Load Group '1..Envelope (L)	0.28	0.45	0.21	0.17	0.76	0.76
Load Group '2..Envelope (LS)	0.36	0.56	0.27	0.21	0.95	0.95

Displaying 2 of 2 rows and 7 of 7 columns

# Create Additional Load Groups

Vertical Only and Side Only loading cycles will be included in the Fatigue Analysis.

1 Select *Load Groups*;  
Execute right click and select *Add*

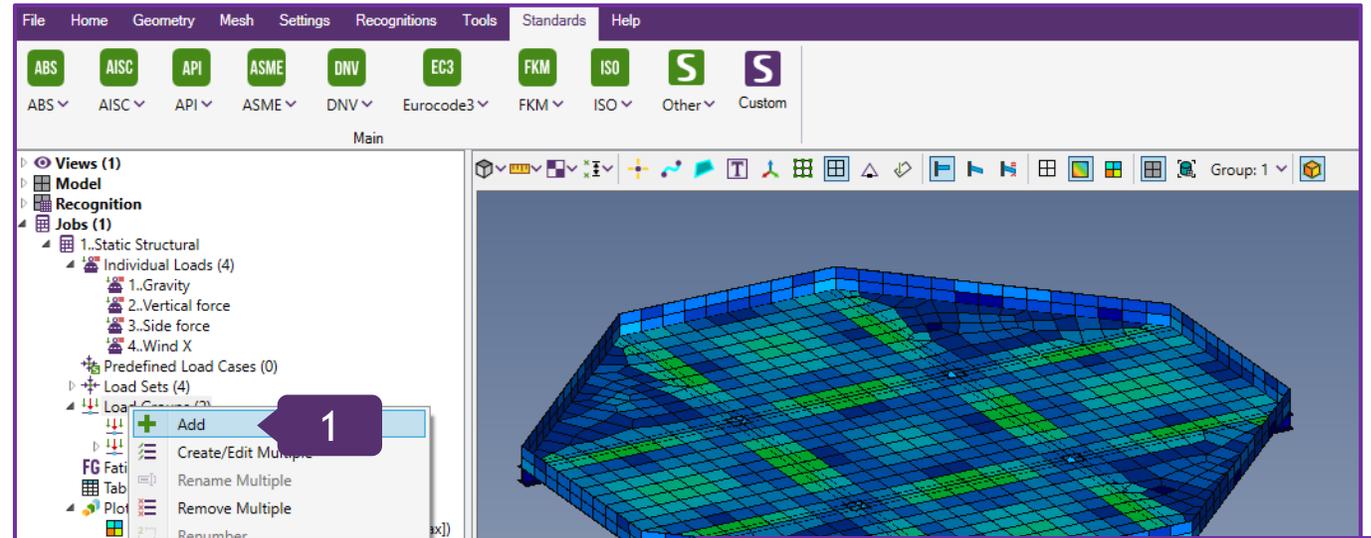
2 Title: *Vertical Only*

3 Select *1..Gravity* and *2..Vertical force*;  
Press   
Press *OK*

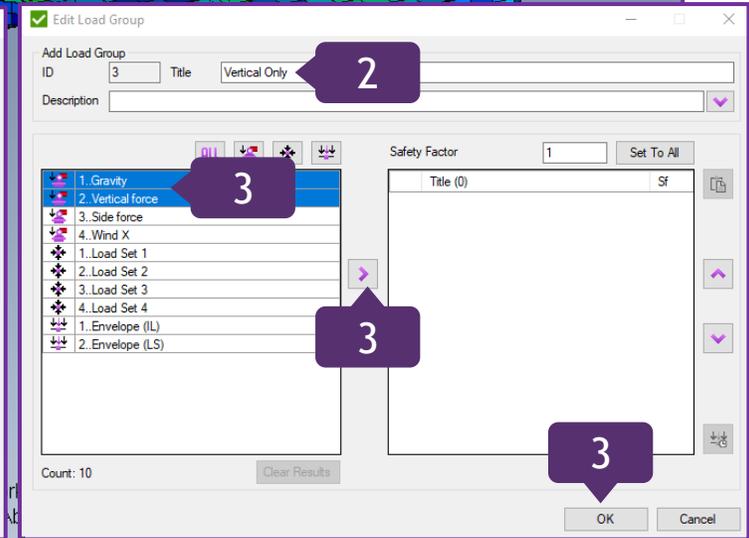
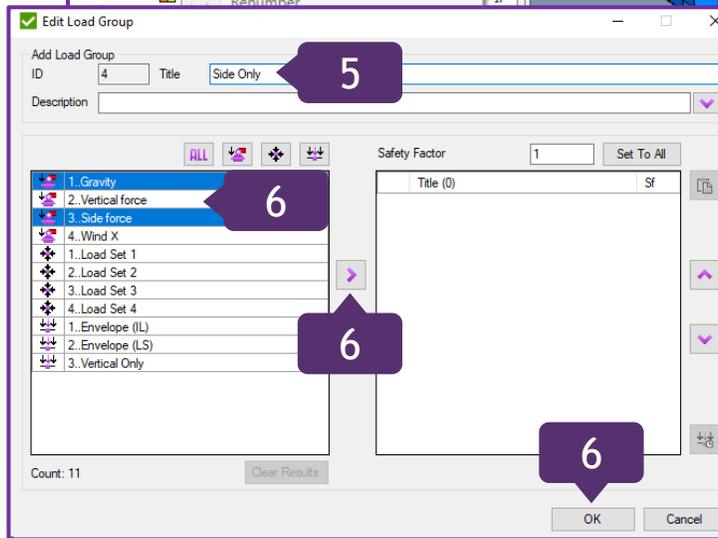
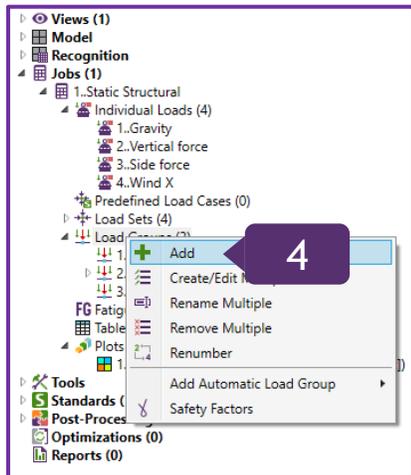
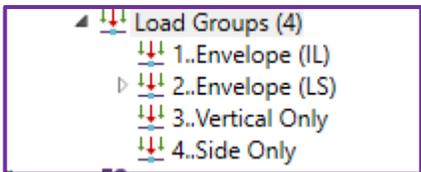
4 Select *Load Groups* one more time;  
Execute right click and select *Add*

5 Title: *Side Only*

6 Select *1..Gravity* and *3..Side force*;  
Press   
Press *OK*



## Created Load Groups



# Create Fatigue Group

1 Select *Fatigue Groups*;  
Execute right click and select *Add*

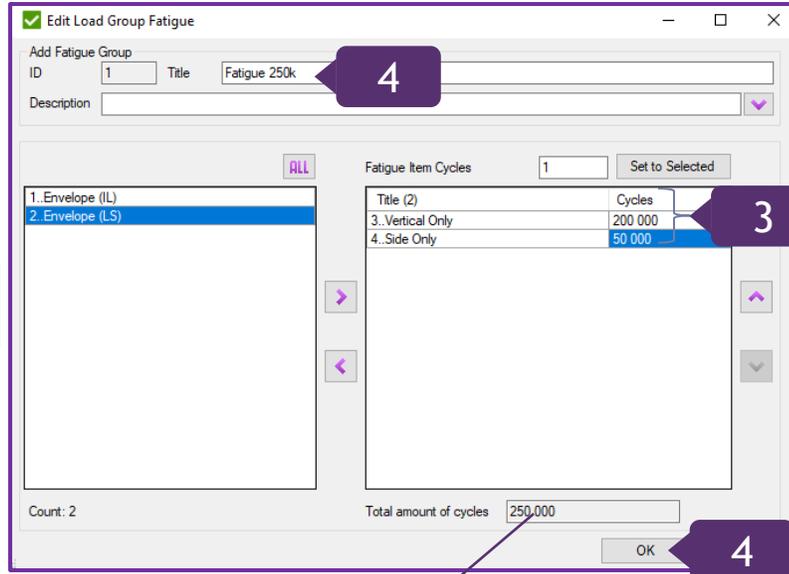
2 Select *3..Vertical Only* and *4..Side Only*;  
Press

3 *3..Vertical Only*: 200 000 cycles;  
*4..Side Only*: 50 000 cycles

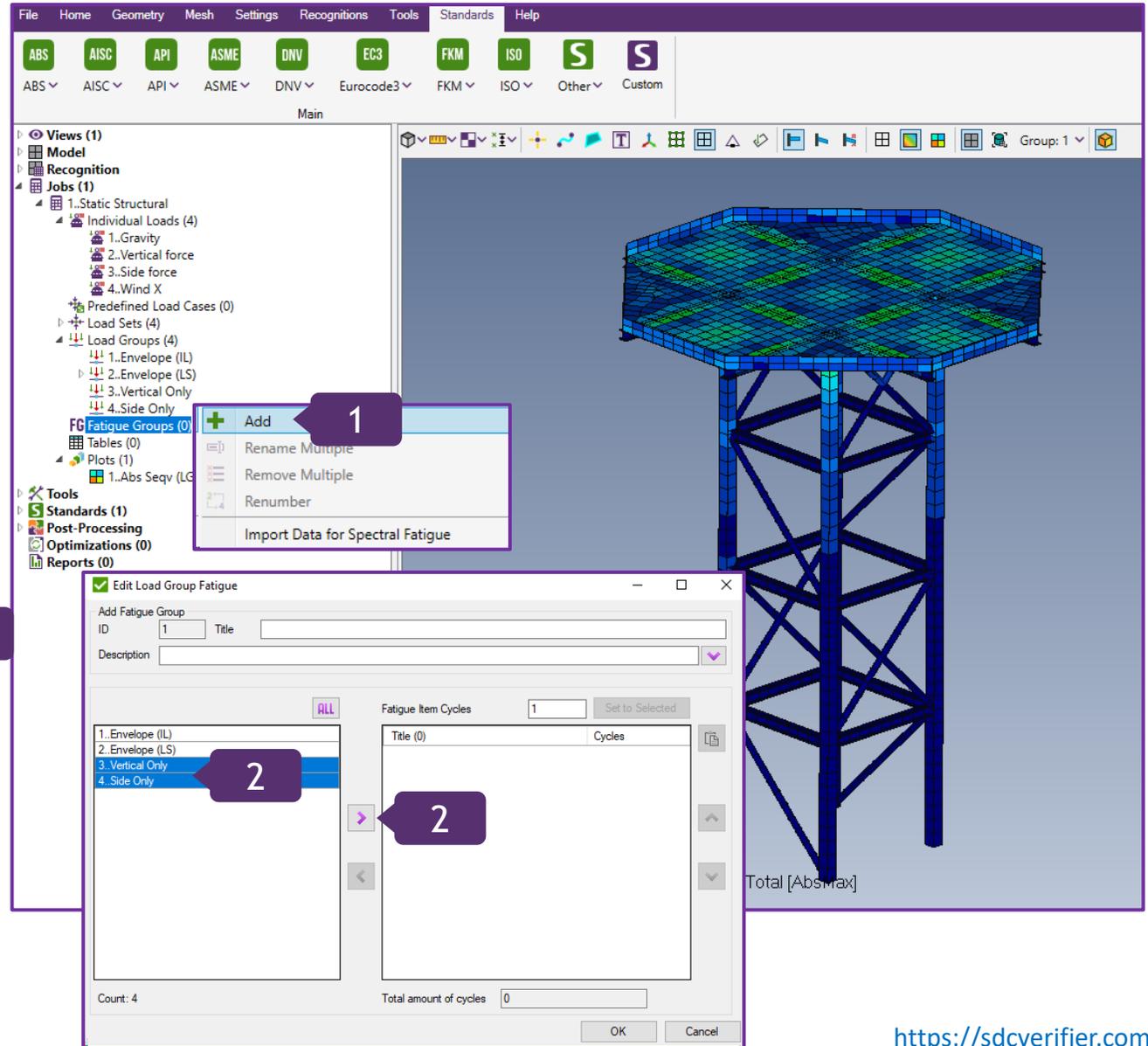
4 Title: *Fatigue 250k*;  
Press *OK*

Created Fatigue Group

FG Fatigue Groups (1)  
FG 1..Fatigue 250k



Total amount of cycles has been calculated automatically.

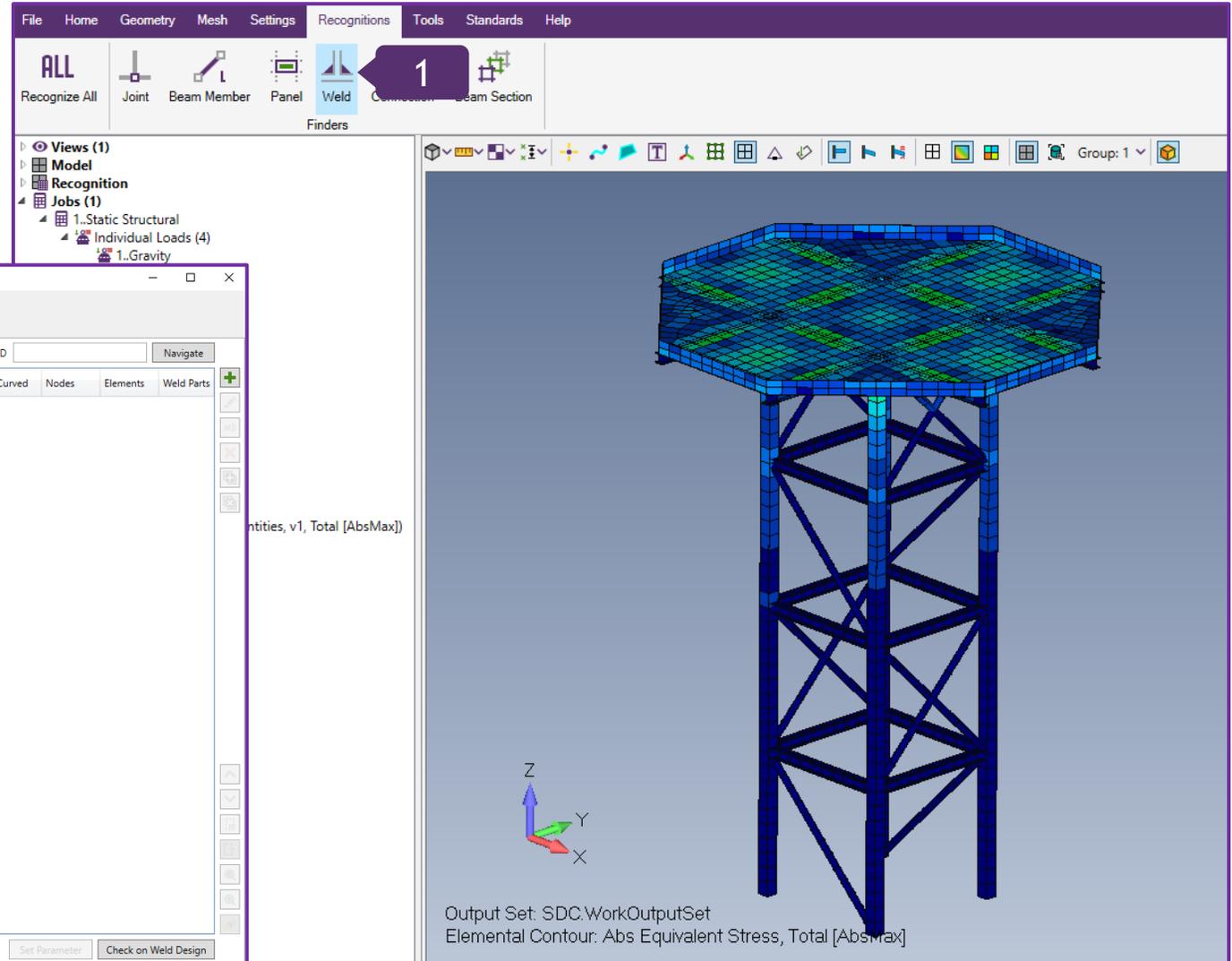


1

In *Recognitions* section of the *Ribbon*, press on *Weld*

2

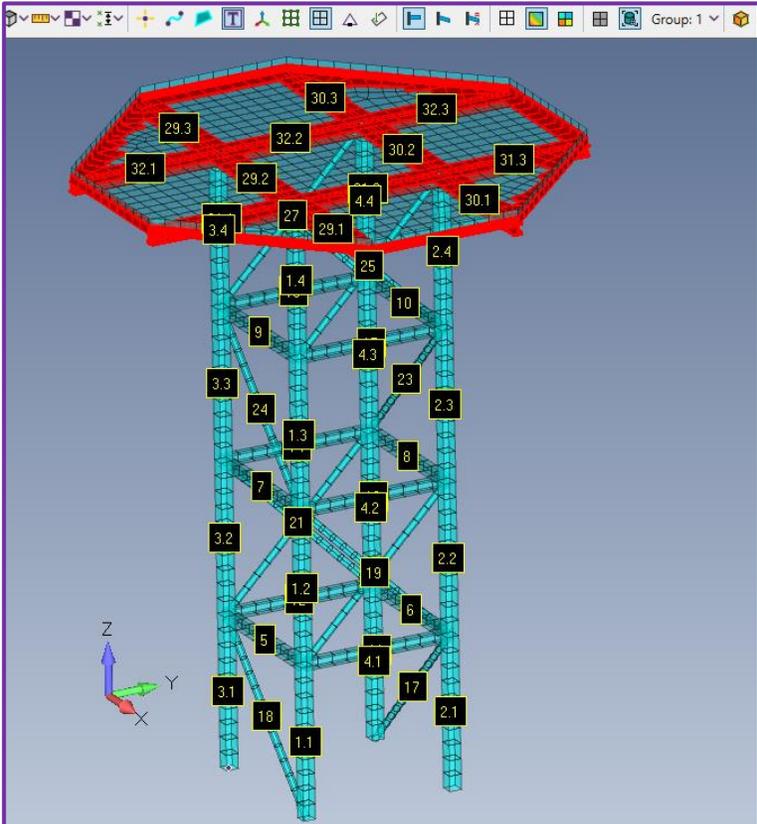
Press *Find*



1 In *Welds* section, select all *Welds*

2 To preview Welds, click on

3 Press *OK*



Welds Finder

Welds Weld Strength Settings Hot Spot Stress

Filter: None = Apply Filter Find Weld by ID: Navigate

ID	Title	Tensile Strength (Min) [Pa]	Yield Stress (Min) [Pa]	Is Symmetric	Is Curved	Nodes	Elements	Weld Parts
1	Weld 1 [-1.5; -1.5; 12]	355000000	240000000	Yes	No	15	31	2
2	Weld 2 [-3; 1.5; 12]	355000000	240000000	Yes	No	11	20	2
3	Weld 3 [-1.5; 4.5; 12]	355000000	240000000	Yes	No	15	31	2
4	Weld 4 [1.5; 6; 12]	355000000	240000000	Yes	No	11	20	2
5	Weld 5 [4.5; 4.5; 12]	355000000	240000000	Yes	No	15	31	2
6	Weld 6 [6; 1.5; 12]	355000000	240000000	Yes	No	11	20	2
7	Weld 7 [1.5; -3; 12]	355000000	240000000	Yes	No	11	20	2
8	Weld 8 [4.5; -1.5; 12]	355000000	240000000	Yes	No	15	31	2
9	Weld 9 [4.5; 0; 12]	355000000	240000000	Yes	No	11	31	3
10	Weld 10 [1.5; 0; 12]	355000000	240000000	Yes	No	11	30	3
11	Weld 11 [-1.5; 0; 12]	355000000	240000000	Yes	No	11	31	3
12	Weld 12 [4.5; 3; 12]	355000000	240000000	Yes	No	11	31	3
13	Weld 13 [1.5; 3; 12]	355000000	240000000	Yes	No	11	30	3
14	Weld 14 [-1.5; 3; 12]	355000000	240000000	Yes	No	11	31	3
15	Weld 15 [3; -1.5; 12]	355000000	240000000	Yes	No	11	30	3
16	Weld 16 [3; 1.5; 12]	355000000	240000000	Yes	No	11	30	3
17	Weld 17 [3; 4.5; 12]	355000000	240000000	Yes	No	11	31	3
18	Weld 18 [0; -1.5; 12]	355000000	240000000	Yes	No	11	30	3
19	Weld 19 [0; 1.5; 12]	355000000	240000000	Yes	No	11	30	3
20	Weld 20 [0; 4.5; 12]	355000000	240000000	Yes	No	11	31	3

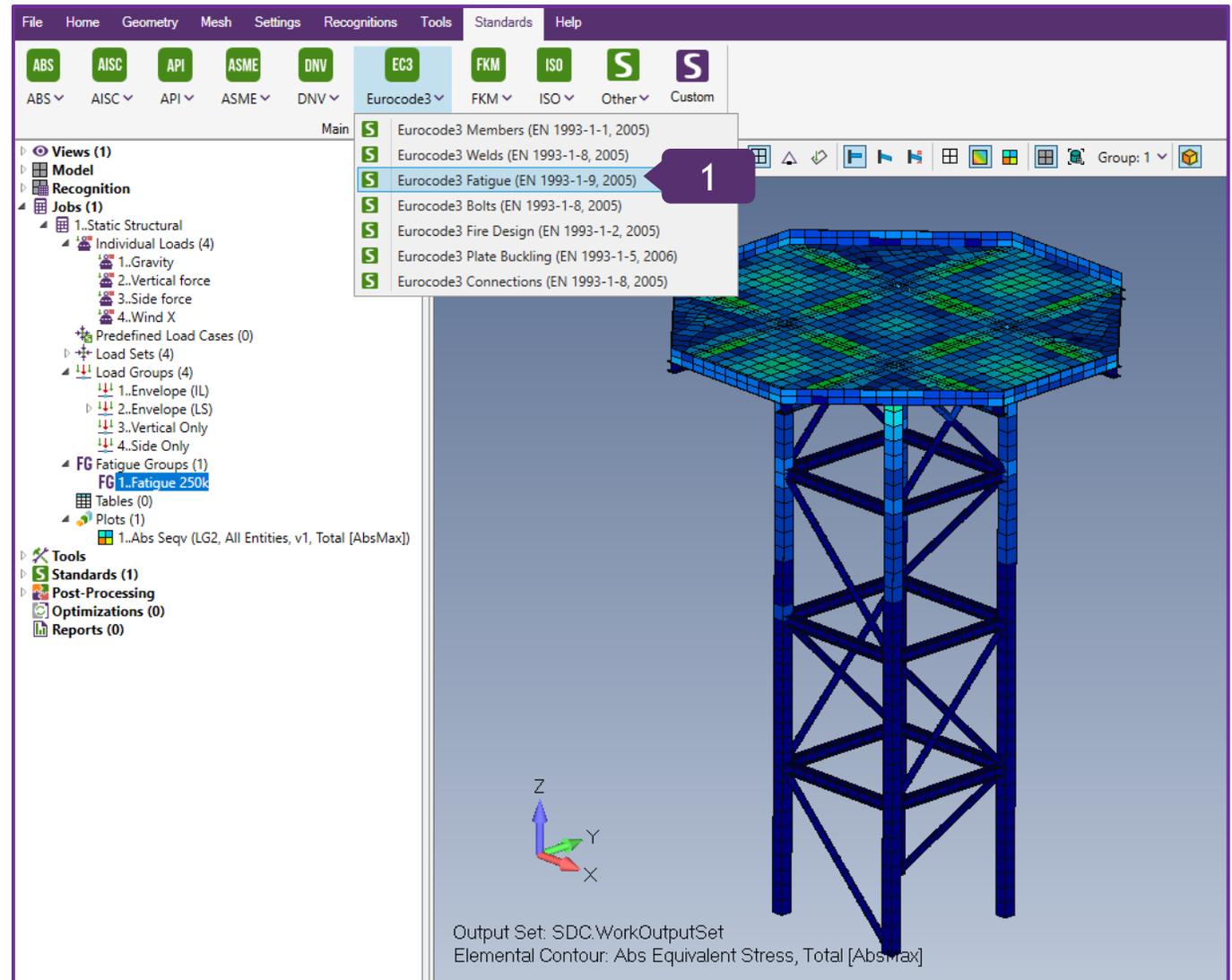
Settings Find Set Parameter Check on Weld Design OK Cancel

All Property, Material and Thickness changes have been recognized, along with the connection of a certain angle as welded elements.

# Add Eurocode3 Fatigue (EN 1993-1-9, 2005) Standard

1

In *Standards* section of the *Ribbon*, press on *Eurocode3* and select *Eurocode3 Fatigue (EN 1993-1-9, 2005)*



1

In *FAT Class*, press



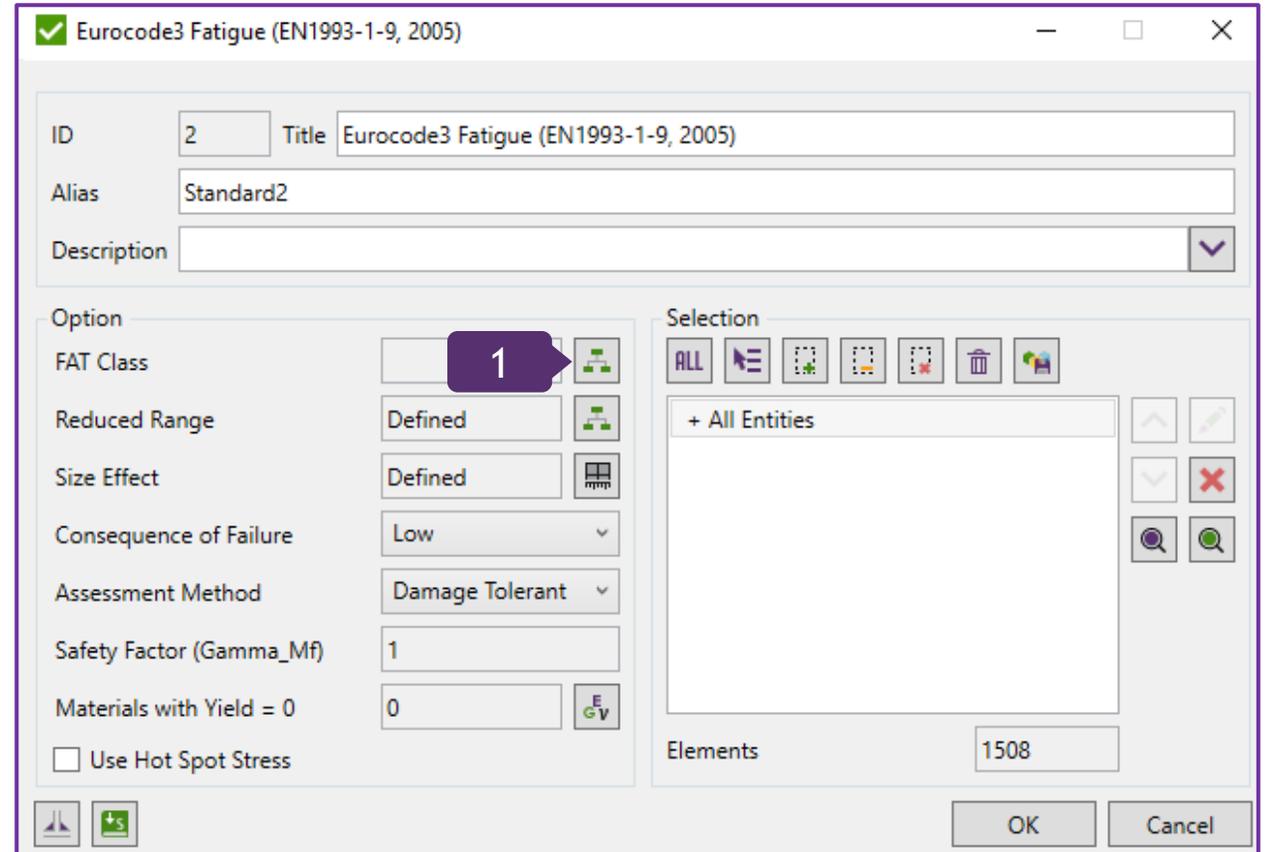
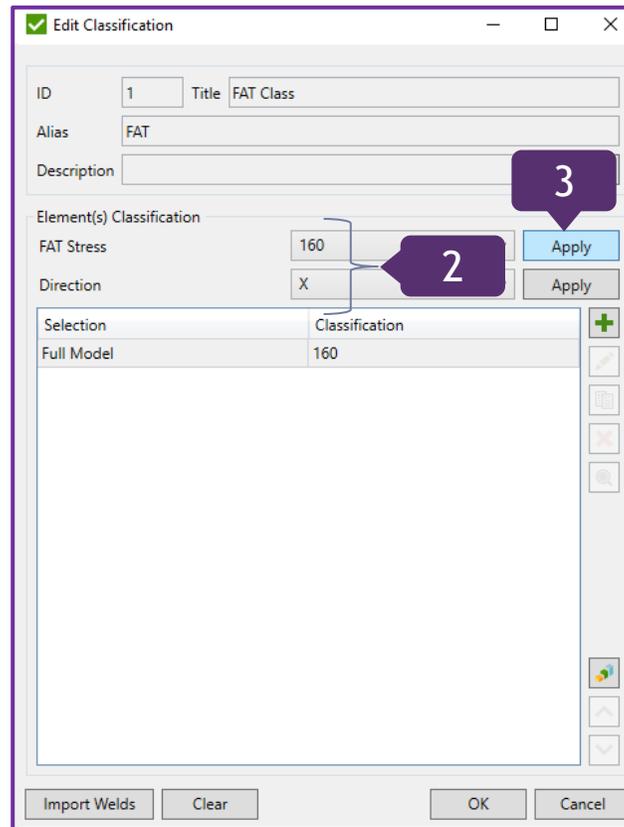
2

FAT Stress: 160;  
Direction: X

3

Press *Apply*

FAT Class is the fatigue strength for nominal stress ranges. It is represented by a series of  $(\log \Delta \sigma_R) - (\log N)$  curves and  $(\log \Delta \tau_R) - (\log N)$  curves (S-N-curves), which correspond to typical detail categories. Each detail category is designated by a number, which represents in N/mm<sup>2</sup> the reference value  $\Delta \sigma_c$  and  $\Delta \tau_c$  for the fatigue strength at 2 million cycles.



# Define Welds for X Direction

1

Press  to define new condition

2

Press *Add all Welds*

3

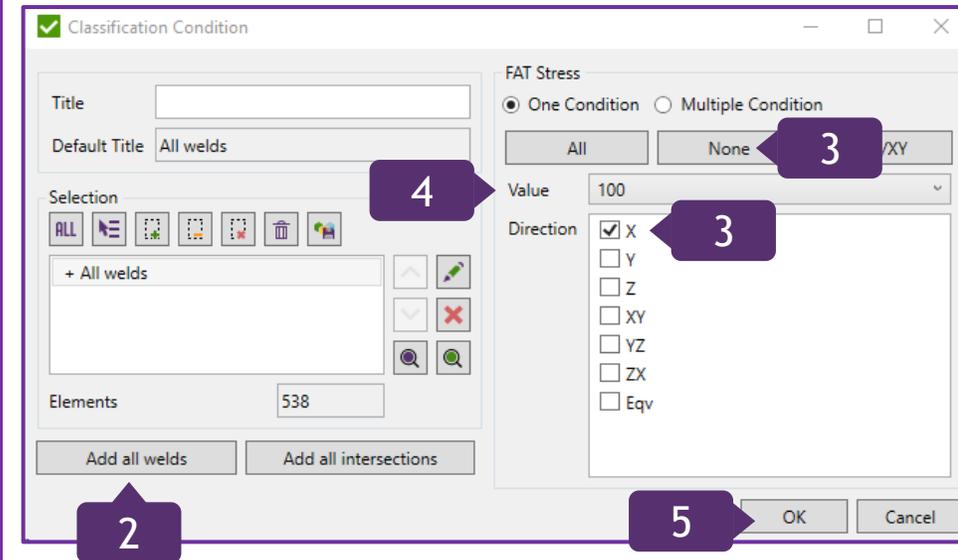
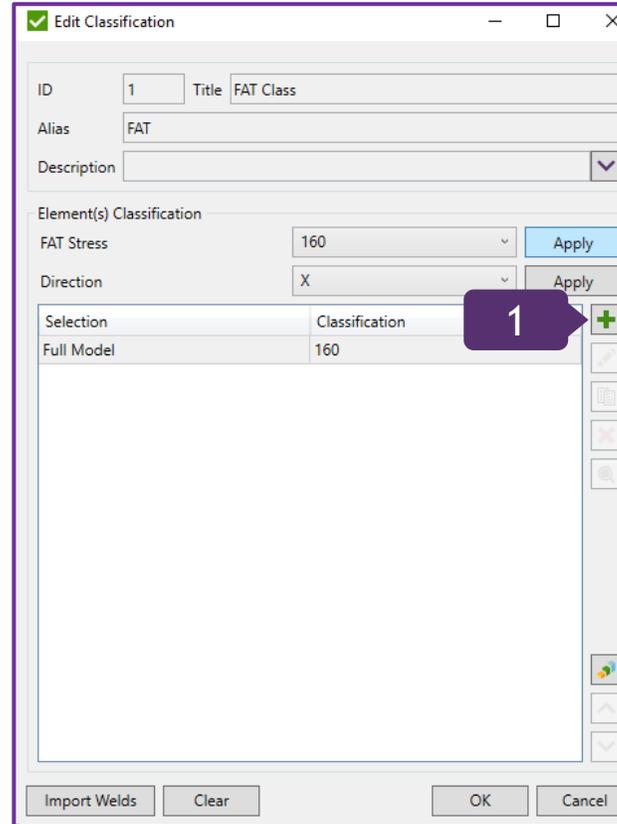
Press *None*, and then select *Direction: X*

4

*Value: 100*

5

Press *OK*



# Define Welds for Y Direction

1

Press  to define new condition

2

Press *Add all Welds*

3

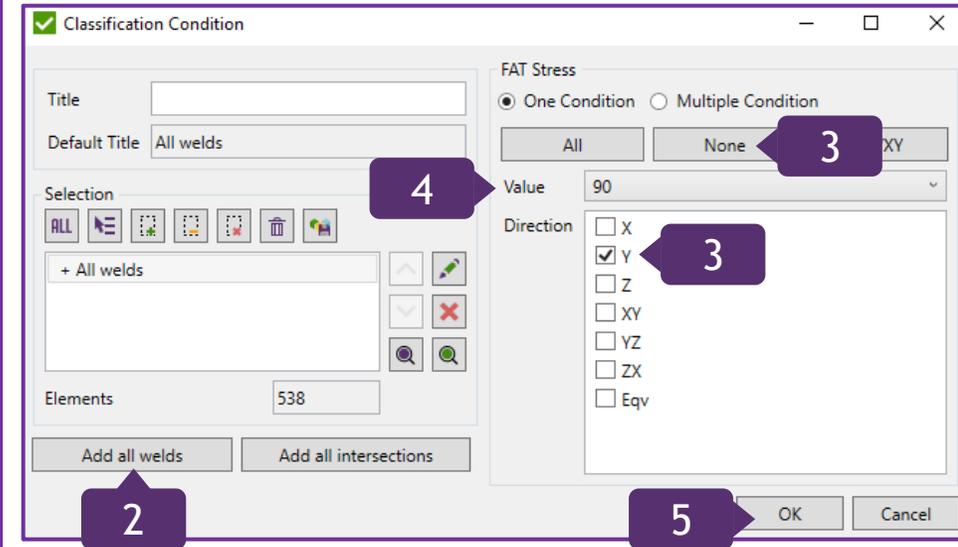
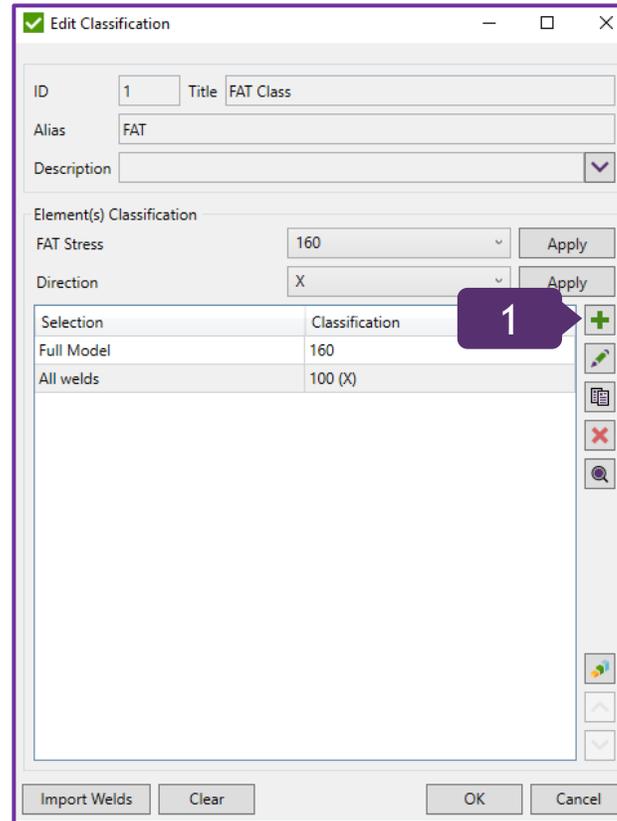
Press *None*, and then select *Direction: Y*

4

*Value: 90*

5

Press *OK*



# Define Welds for XY Shear Direction

1

Press  to define new condition

2

Press *Add all Welds*

3

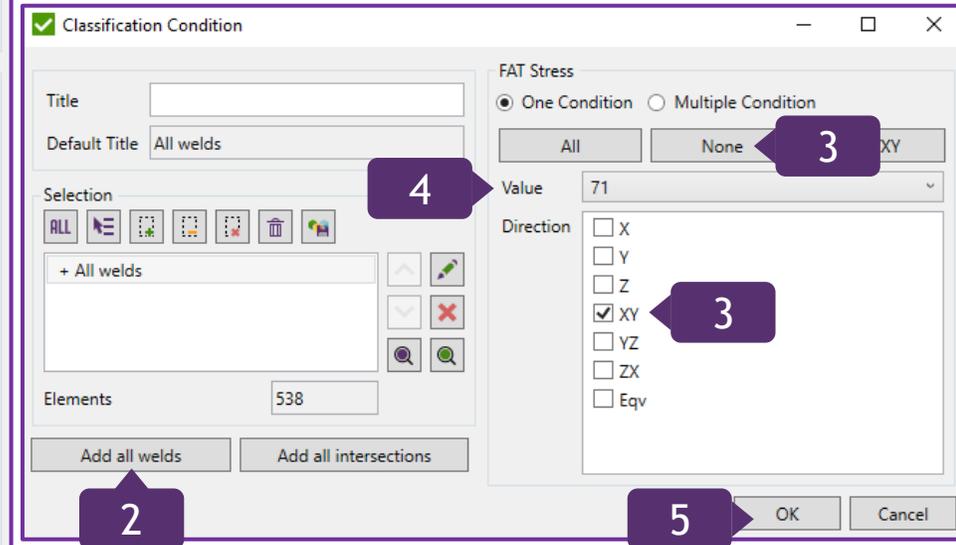
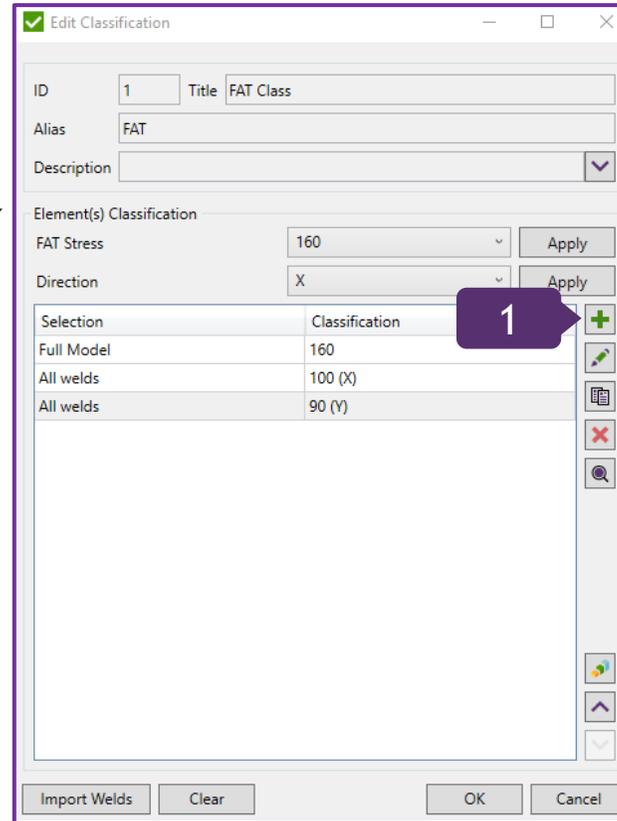
Press *None*, and then select *Direction: XY*

4

Value: 71

5

Press *OK*



# Define All Welds Intersections

1 Press to define new condition

2 Press *Add all intersections*

3 Direction: *All*

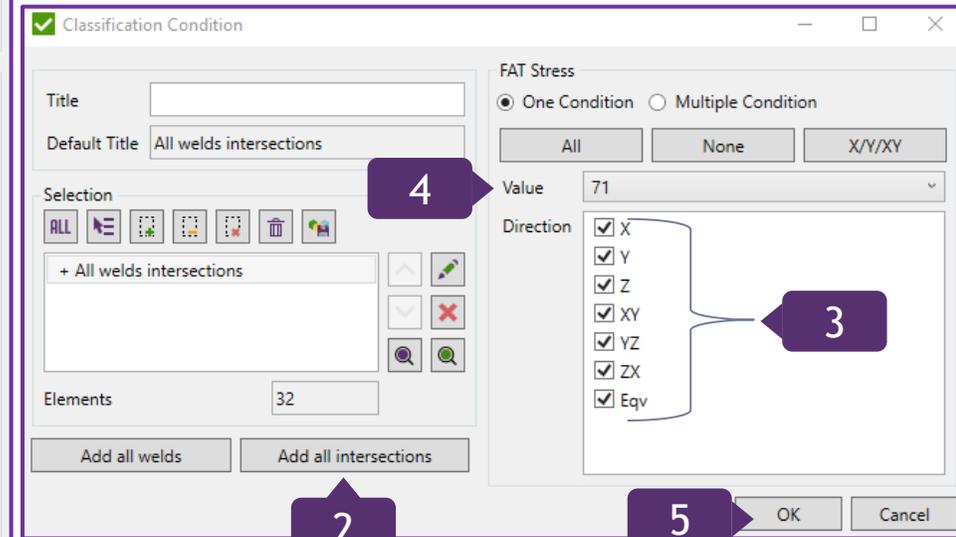
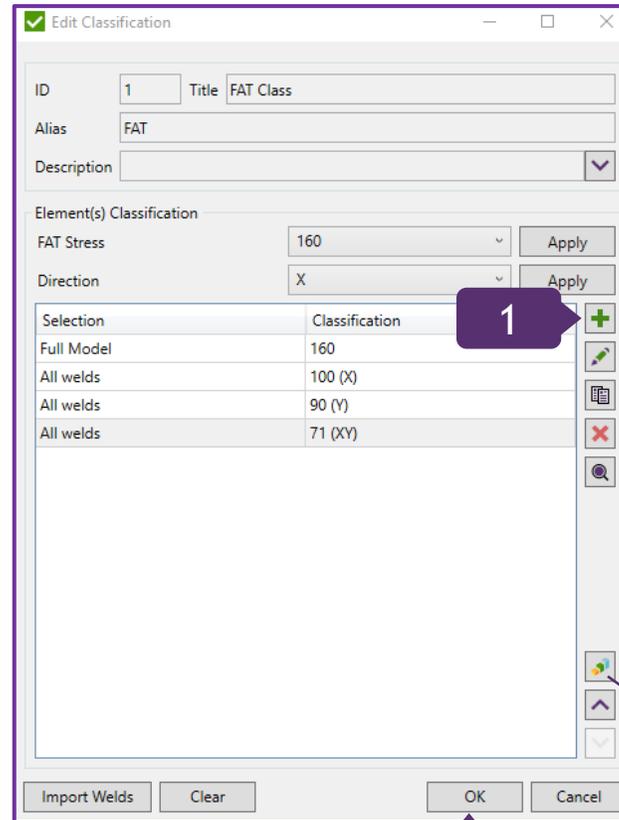
4 Value: *71*

5 Press *OK*

Classification has been defined.

Note: Every successive rule overwrites the previous one.

Selection	Classification
Full Model	160
All welds	100 (X)
All welds	90 (Y)
All welds	71 (XY)
All welds intersections	71 (All Directions)



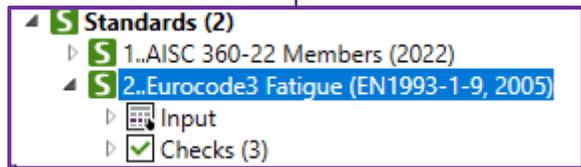
Full Model and All Welds can be previewed and plotted by pressing

1 Consequence of Failure: *High*

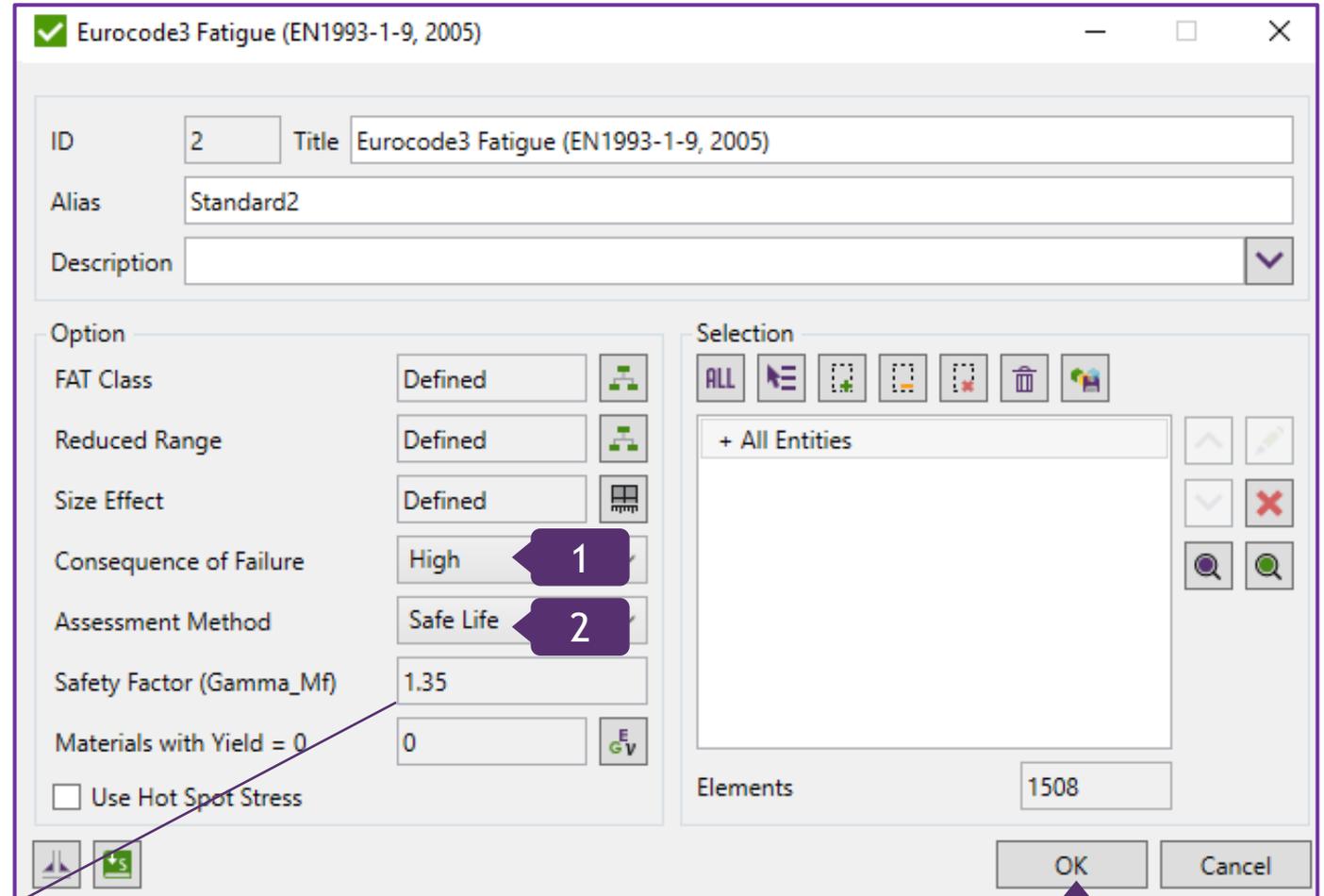
2 Assessment Method: *Safe Life*

3 Press *OK*

The Standard has been added.



Note: The value of Safety Factor (Gamma\_Mf) shifts in accordance to the configurations of Consequence of Failure and Assessment Method.



# Criteria Plot for Fatigue Check

1 Expand *Checks*, and execute right click on *2..Fatigue Check*

2 Select *Criteria Plot*

3 Press  to select *Fatigue Group*

4 Select *1.. Fatigue 250k* and press *OK*

5 Parameter: *Damage root 5*

6 Direction: *Overall*

7 Point of Interest: *Total*;  
Type: *AbsMax*

8 Press *OK*

The Criteria Plot has been created

1

2

3

4

5

6

7

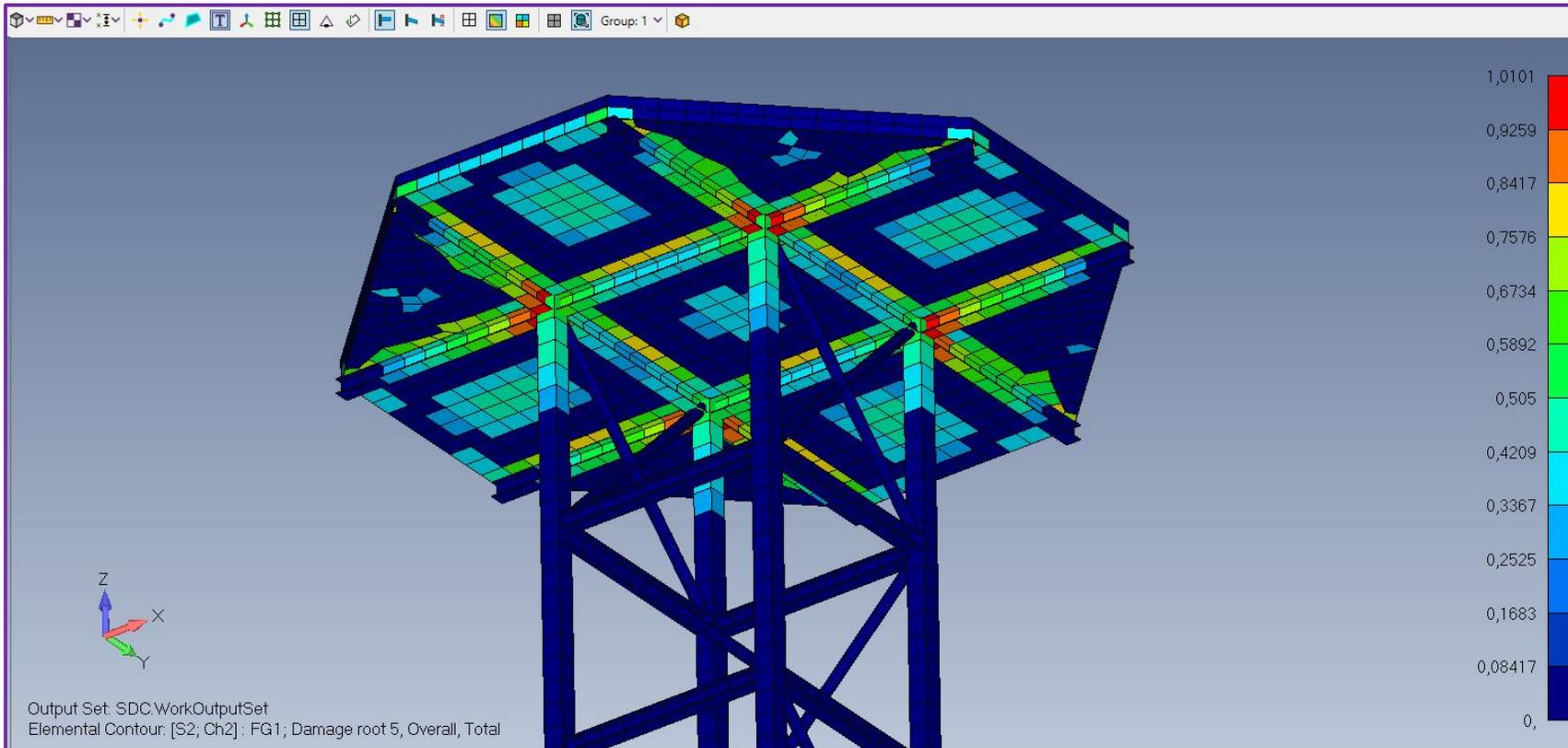
8

4

# Preview the Plot

1 Expand *Plots*, and execute right click on *1..Overall Damage root 5 (FG1, All Entities, v1, Total)*

2 Select *Preview*



Views (1)  
Model  
Recognition  
Jobs (1)  
1..Static Structural  
Tools  
Standards (2)  
1..AISC 360-22 Members (2022)  
2..Eurocode3 Fatigue (EN1993-1-9, 2005)  
Input  
Checks (3)  
1..Nominal Check  
2..Fatigue Check  
Plots (1)  
1..Overall Damage root 5 (FG1, All Entities, v1, Total)  
3..Fatigue Stress Overshoots  
Post-Processing  
Optimizations (0)  
Reports (0)

Edit  
Rename  
Copy  
Remove  
Preview  
Preview with current view  
Preview with current View And Selection

As it might be seen on the plot, the structure is above the safe value for fatigue damage in its specific parts. Therefore, the modifications are required, and they can be carried out with incorporation of Optimizations Tool or manually.

1

In *Model* section, expand *Properties* and select *2..I-beam200*

2

Execute right click and select *Edit*

3

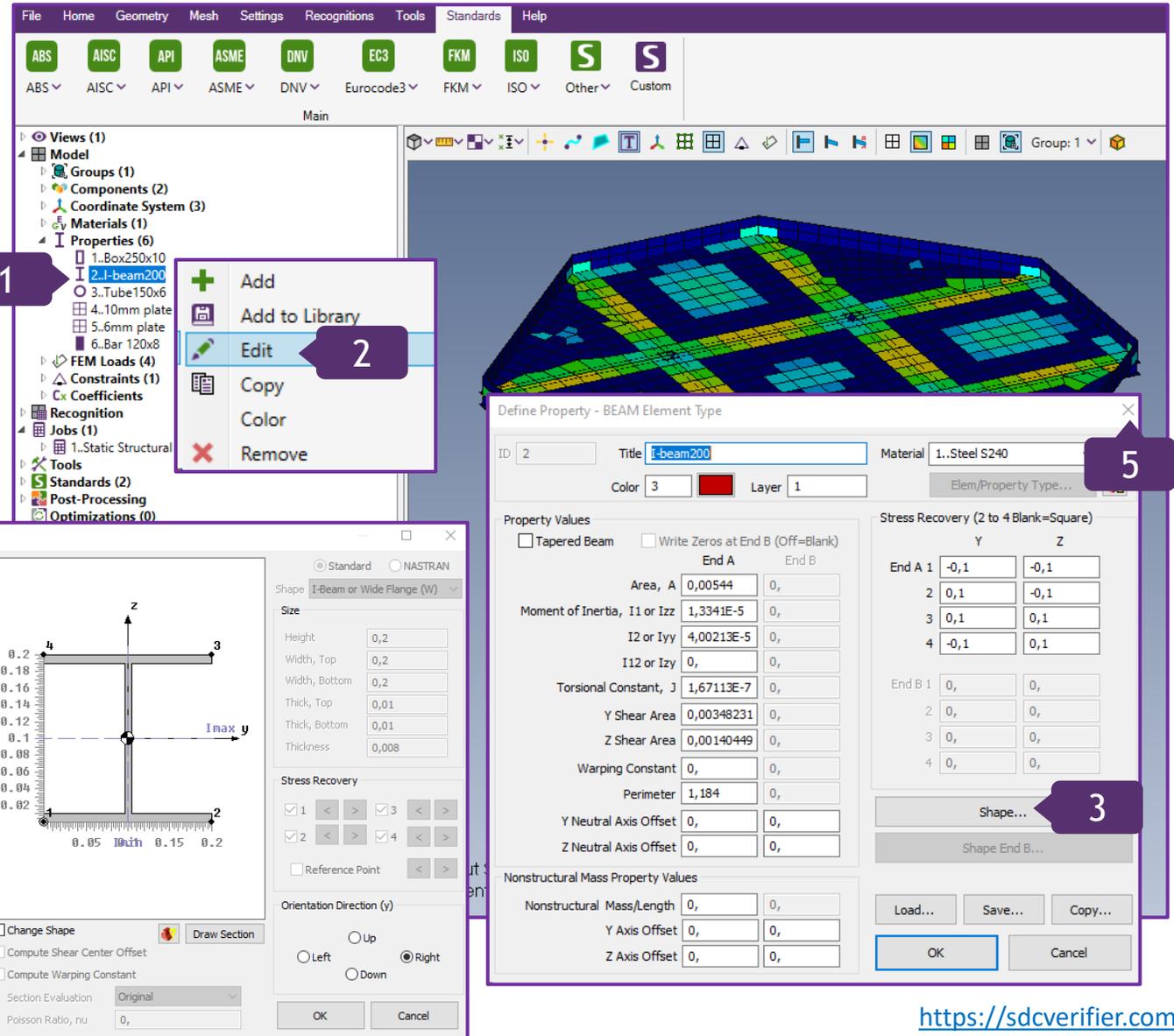
Press on *Shape*

4

Make the required modifications in *Cross Section Definition* window

5

Close the window



There is a separate tutorial “Modelling with SDC Verifier”, in which the creation and modification of Properties are described in details (slides 24-25; 29-31)