



Tutorial

**Weld Strength Eurocode3, DNV OS-C101 and C201**

29 Jan 2020  
version 5.3

This step-by-step tutorial demonstrates how to perform the weld strength check according to Eurocode 3, DNV OS-C101-LRFD, DNV OS-C201-WSD standards in SDC Verifier.

The following steps are covered:

- ▶ Weld Finder Tool detailed review;
- ▶ Weld Stress calculations;
- ▶ Standards creation;
- ▶ Report preparation and results.

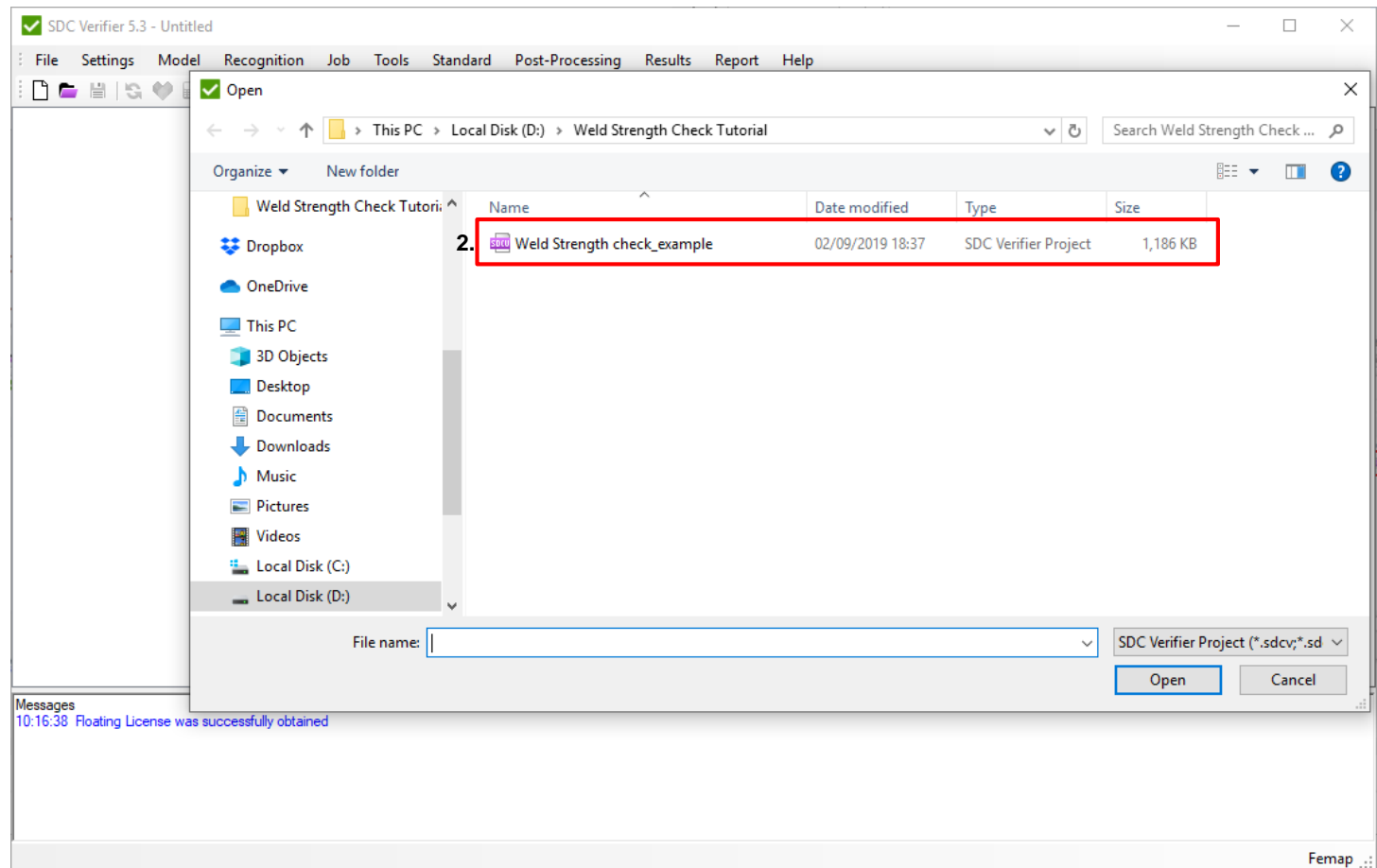
# Open Project

1

Launch **SDC Verifier** 

2

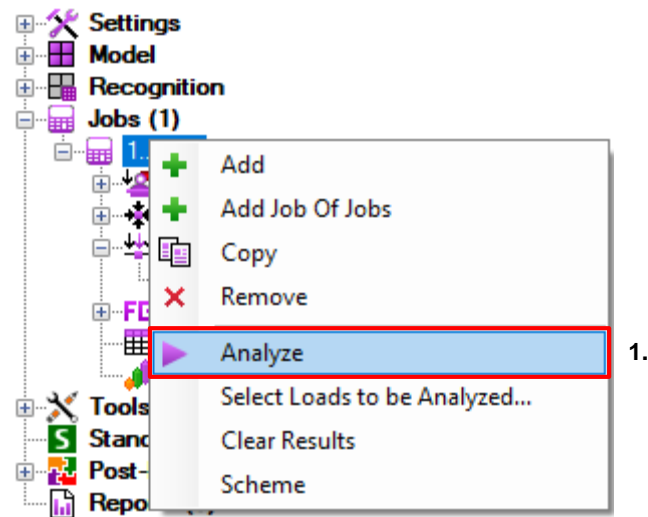
Open the project **Weld Strength  
check\_example**



# Run Analysis

1

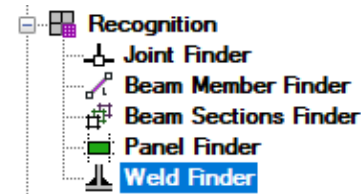
Execute ► **Analyze** from *Job1*  
context menu



# Weld Finder – General overview

1

Execute **Recognition** => **Weld Finder** => **Edit**.



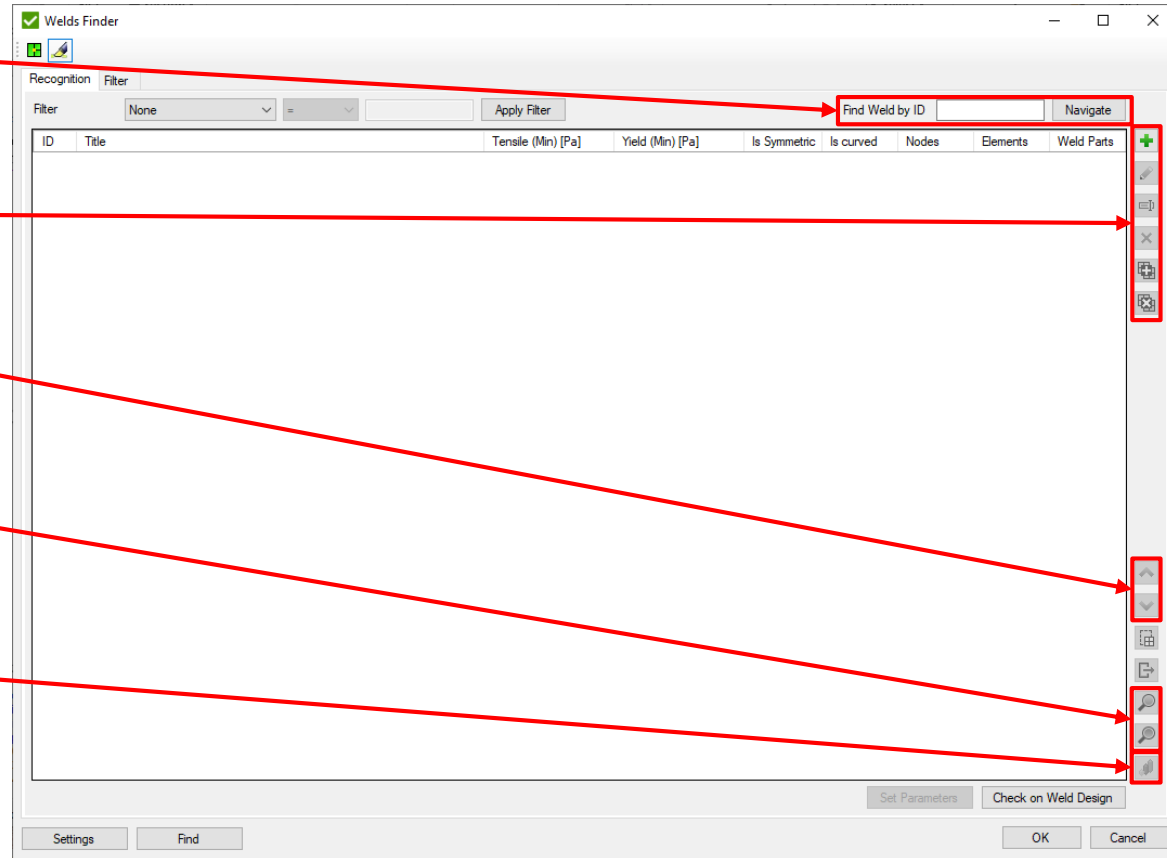
**Navigate** option in order to find weld by ID.

**Add, Edit, Combine, Split and Remove** Weld(s).

**Move Welds.** Order is important when the same element belongs to 2 welds.

**Preview** selected weld(s).

**Plot** of selected weld(s) in colors and with labels of IDs (drop-down menu).



# Add exception rule for recognition

1 Press *Settings*

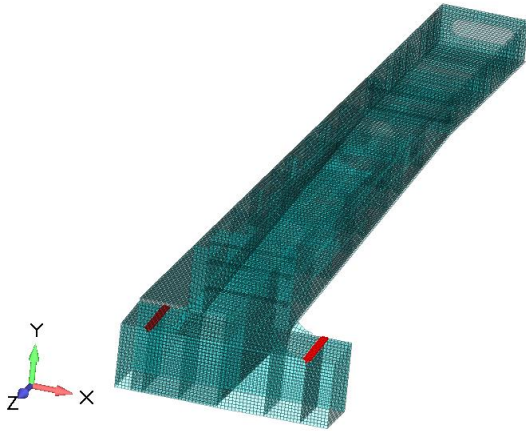
2 Press *Edit* for **Not weld properties**.

3 Select **property ID4**.

4 Select **property ID5**.

5 Press *Add*.

6 Press 




Connections with properties 4 and 5 are not treated as welds

**Not Welded Properties**

3. Property 1: 4.stl plt 20 mm thks

4. 5.stl plt 25 mm thks

5. Add

6. 

**Welds Finder**

Recognition Filter


Filter No

ID Title

**Weld Finder Settings**

General

Selection All Entities

Not welded properties 0 2. 

Default Weld Title Weld

Weld Parts Recognition Settings

☒ Set All Weld Parts Welded if Different Property IDs

Prop 1 Prop 2 Prop 3

Welds Recognition Settings

☒ Treat as Weld if Different Property IDs

Treat Neighbor Weld Elements as One Weld if Angle < 3

Angle < 20 Angle < 70

6 welds 1 weld

Angle 63.44

Treat Elements of Same Property as Weld if Angle > 45

Prop 1 Angle Normals Prop 1

1. Settings Find

OK Cancel

# Not welded properties. Option2

The image shows a 3D finite element model of a mechanical part, likely a bracket or flange, with a blue mesh. Several elements are highlighted with orange squares and labeled with numbers 4 and 5. Overlaid on the model is a software dialog box titled 'Not Welded Properties'. The dialog has a green checkmark icon and a title bar. It contains two main sections: 'Add multiple' and 'Not welded combinations'. In the 'Add multiple' section, 'Property 1' is set to '1.stl plt 10 mm thks'. 'Property 2' is a list with 8 items: '1.stl plt 10 mm thks', '2.stl plt 8 mm thks', '3.stl plt 15 mm thks', '4.stl plt 20 mm thks', '5.stl plt 25 mm thks', '6.stl plt 35 mm thks', '7.stl plt 4 mm thks', and '8.stl plt 12 mm thks'. Below this list is an 'Add' button. Further down, there is a section 'Add by IDs' with input fields for 'Property 1 ID:' (containing '4') and 'Property 2 ID:' (containing '5'). Each input field has a small icon to its right, and there is an 'Add' button below these fields. The 'Not welded combinations' section on the right is a table with two columns: 'Property 1' and 'Property 2'. It contains two rows: '4.stl plt 20 mm thks' under 'Property 1' and '5.stl plt 25 mm thks' under 'Property 2'. The dialog box has 'OK' and 'Cancel' buttons at the bottom right.

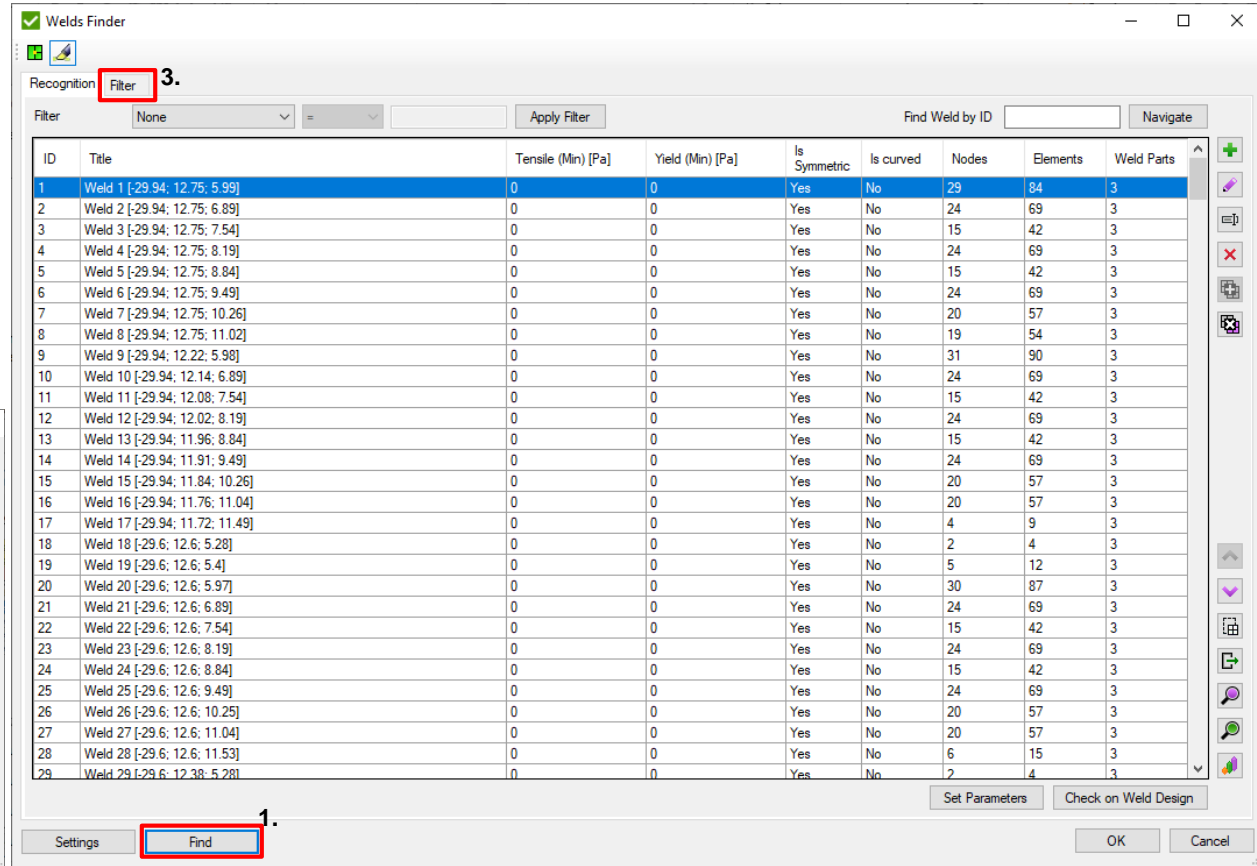
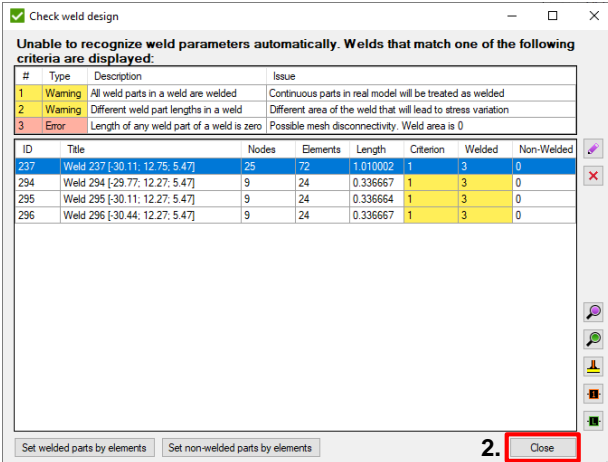
It is possible to select properties manually in Femap by elements to add a not welded combination

# Recognize welds

1 Press *Find*.

2 Press *Close*.

3 Press *Filter*.





# Weld Finder – Details

**Selection** gives a possibility to select a part of the model (group, component) for making changes.

This filter can be used to search the weld(s) due to different parameters (length, thickness, area, weld only, non weld only etc.).

**Edit, Combine, Split, Export and Remove** Weld(s).

**Navigate** option in order to find a weld by ID.

**Preview** selected weld(s).

**Plot** of selected weld(s) in colors and with labels of IDs (drop-down menu).

The screenshot shows the 'Welds Finder' application window. It features a 'Recognition' tab with a 'Filter' sub-tab. The 'Selection' section has a dropdown menu set to 'All Entities'. Below it, the 'Display Weld Parts' section has radio buttons for 'All', 'Welded' (selected), and 'Non-Welded'. A 'Filter Rule' section shows 'Show all' and an 'Apply Filter' button. The main area is a table with columns: Weld ID, Title, Length [m], Weld Type, Welded, Csys, t [m], r [m], s [m], h [m], Alpha, and Throat Thickness (a) [m]. The table lists 12 weld parts. To the right of the table is a vertical toolbar with icons for selection, edit, combine, split, export, and remove. Below the table, there is a 'Find Weld by ID' section with a text input and a 'Navigate' button. At the bottom, there are sections for 'Apply to selected weld parts' and 'Apply to selected weld parts (only for welded parts)', each with input fields for Length, Thickness, Csys, Origin, Weld type, Weld leg horizontal, Weld leg vertical, and Penetration depth, along with 'Apply' buttons. A 'Settings' button is at the bottom left, and 'Find', 'OK', and 'Cancel' buttons are at the bottom right. A red box highlights the 'Find Weld by ID' section and the 'Apply' button. A red box highlights the vertical toolbar. A red box highlights the 'Apply to selected weld parts (only for welded parts)' section. A red box highlights the 'Plot' section, which is a dropdown menu with options: 'Welded/non-welded parts', 'Weld parts', 'Welds in colors', 'Welds in colors + Labels of IDs', 'Weld parts lengths + Labels of values', 'Weld parts throat thicknesses + Labels of values', 'Weld types + Labels of values', 'Coordinate systems', 'Weld part throat', and 'Welded/non-welded parts + throat'.

Weld ID	Title	Length [m]	Weld Type	Welded	Csys	t [m]	r [m]	s [m]	h [m]	Alpha	Throat Thickness (a) [m]
1	Weld Part 1.3 [-29.94; 12.7...	0.994	None	Yes	Rotation [90; 0; 90]	0.008					
2	Weld Part 2.3 [-29.94; 12.7...	0.774	None	Yes	Rotation [90; 0; 90]	0.008					
3	Weld Part 3.3 [-29.94; 12.7...	0.525	None	Yes	Rotation [90; 0; 90]	0.008					
4	Weld Part 4.3 [-29.94; 12.7...	0.774	None	Yes	Rotation [90; 0; 90]	0.008					
5	Weld Part 5.3 [-29.94; 12.7...	0.525	None	Yes	Rotation [90; 0; 90]	0.008					
6	Weld Part 6.3 [-29.94; 12.7...	0.774	None	Yes	Rotation [90; 0; 90]	0.008					
7	Weld Part 7.3 [-29.94; 12.7...	0.773	None	Yes	Rotation [90; 0; 90]	0.008					
8	Weld Part 8.3 [-29.94; 12.7...	0.742	None	Yes	Rotation [90; 0; 90]	0.008					
9	Weld Part 9.3 [-29.94; 12.2...	1.031	None	Yes	Rotation [-85.04; ...]	0.008					
10	Weld Part 10.3 [-29.94; 12....	0.778	None	Yes	Rotation [-84.82; ...]	0.008					
11	Weld Part 11.3 [-29.94; 12....	0.527	None	Yes	Rotation [-84.82; ...]	0.008					
12	Weld Part 12.3 [-29.94; 12....	0.778	None	Yes	Rotation [-84.82; ...]	0.008					

# Weld Finder – Set weld parameters

**Set Non-welded only** - change selected **welded** parts by selecting elements on the model.

**Set Welded only** - change selected **non-welded** parts by selecting elements on the model.

**Restore default** data if some of them were assigned incorrectly.

Possibility to apply weld type and dimensions of weld to all selected weld(s) parts.

Possibility to modify or change length, thickness, coordinate system and origin to all selected weld(s) parts.

The screenshot shows the 'Weld Finder' application window. It features a 'Recognition' tab with a 'Filter' sub-tab. The 'Information' section includes a 'Selection' dropdown set to 'All Entities', a 'Display Weld Parts' section with radio buttons for 'All', 'Welded' (selected), and 'Non-Welded', and a 'Filter Rule' section with a 'Show all' dropdown and an 'Apply Filter' button. A table lists 15 weld parts with columns for Weld ID, Title, Length [m], Weld Type, Welded status, Csys, t [m], r [m], s [m], h [m], Alpha, and Throat Thickness (a) [m]. Below the table are buttons for 'Find Weld by ID', 'Navigate', 'Restore Default', 'Set Welded Parts by Elements', and 'Set Non-Welded Parts by Elements'. At the bottom, there are two sections for applying parameters to selected weld parts. The left section, 'Apply to selected weld parts', includes input fields for Length [m], Weld part thickness (t) [m], Csys [0; 0; 0], and Origin [0; 0; 0], each with an 'Apply' button. The right section, 'Apply to selected weld parts (only for welded parts)', includes a 'Weld type' dropdown, radio buttons for 'Apply by sizes' (selected) and 'Apply by throat thickness (a)', and input fields for Weld leg horizontal (r) [m], Weld leg vertical (h) [m], Penetration depth (s) [m], and Throat thickness (a) [m]. It also has an 'Override type' dropdown and an 'Apply' button. A diagram of a weld cross-section is shown on the right, with labels for t, h, s, r, a, and Alpha.

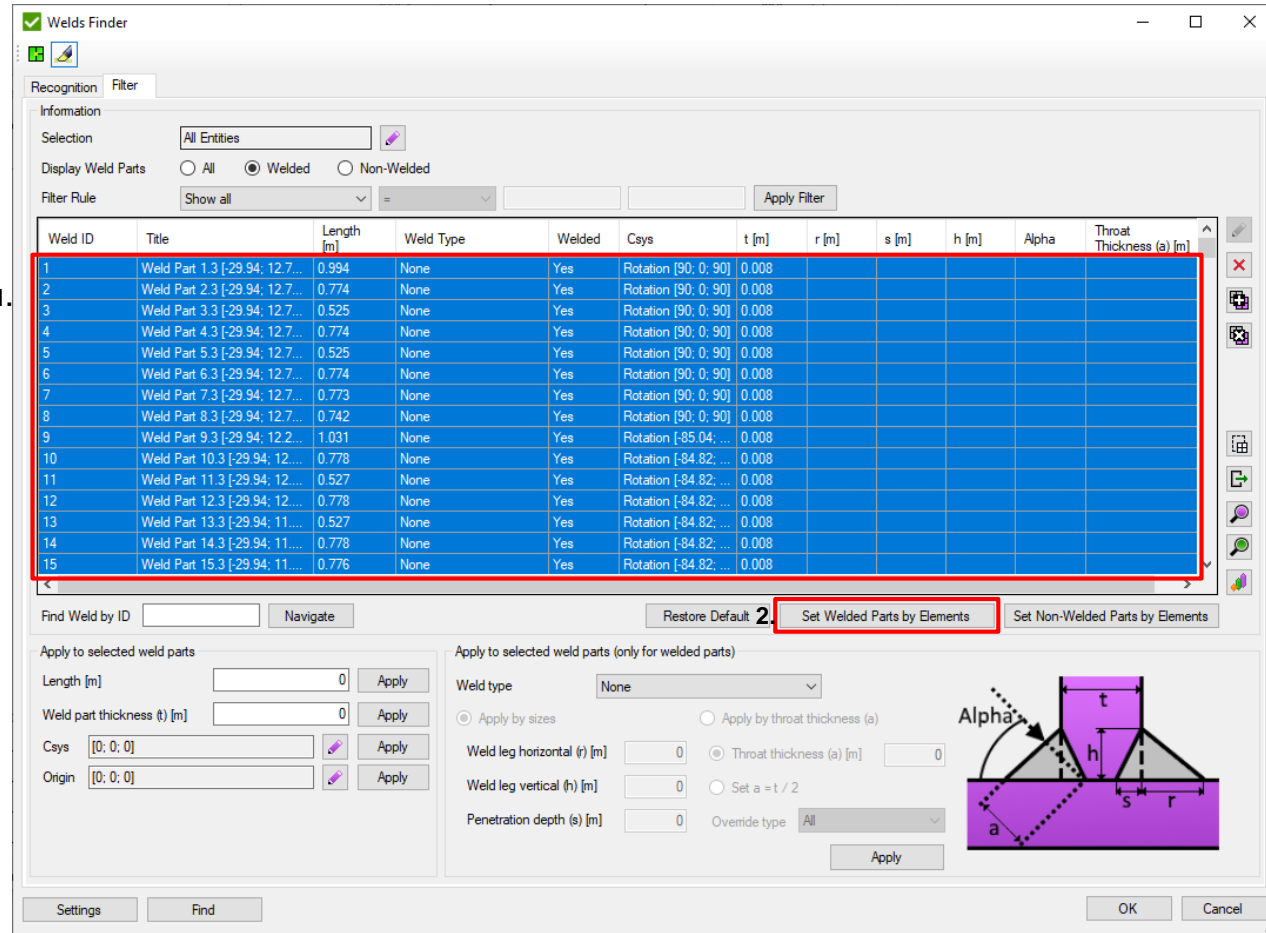
Weld ID	Title	Length [m]	Weld Type	Welded	Csys	t [m]	r [m]	s [m]	h [m]	Alpha	Throat Thickness (a) [m]
1	Weld Part 1.3 [-29.94; 12.7...	0.994	None	Yes	Rotation [90; 0; 90]	0.008					
2	Weld Part 2.3 [-29.94; 12.7...	0.774	None	Yes	Rotation [90; 0; 90]	0.008					
3	Weld Part 3.3 [-29.94; 12.7...	0.525	None	Yes	Rotation [90; 0; 90]	0.008					
4	Weld Part 4.3 [-29.94; 12.7...	0.774	None	Yes	Rotation [90; 0; 90]	0.008					
5	Weld Part 5.3 [-29.94; 12.7...	0.525	None	Yes	Rotation [90; 0; 90]	0.008					
6	Weld Part 6.3 [-29.94; 12.7...	0.774	None	Yes	Rotation [90; 0; 90]	0.008					
7	Weld Part 7.3 [-29.94; 12.7...	0.773	None	Yes	Rotation [90; 0; 90]	0.008					
8	Weld Part 8.3 [-29.94; 12.7...	0.742	None	Yes	Rotation [90; 0; 90]	0.008					
9	Weld Part 9.3 [-29.94; 12.2...	1.091	None	Yes	Rotation [-85.04; ...]	0.008					
10	Weld Part 10.3 [-29.94; 12...	0.778	None	Yes	Rotation [-84.82; ...]	0.008					
11	Weld Part 11.3 [-29.94; 12...	0.527	None	Yes	Rotation [-84.82; ...]	0.008					
12	Weld Part 12.3 [-29.94; 12...	0.778	None	Yes	Rotation [-84.82; ...]	0.008					
13	Weld Part 13.3 [-29.94; 11...	0.527	None	Yes	Rotation [-84.82; ...]	0.008					
14	Weld Part 14.3 [-29.94; 11...	0.778	None	Yes	Rotation [-84.82; ...]	0.008					
15	Weld Part 15.3 [-29.94; 11...	0.776	None	Yes	Rotation [-84.82; ...]	0.008					

# Set welded parts by elements

1 Select all welds part by pressing **Ctrl+A** keys combination.

2 Press **Set welded parts by elements** to find weld parts by elements and include them in weld strength calculations (also this command could be performed for few or single weld part).

1.



# Set weld part type welded (manually)

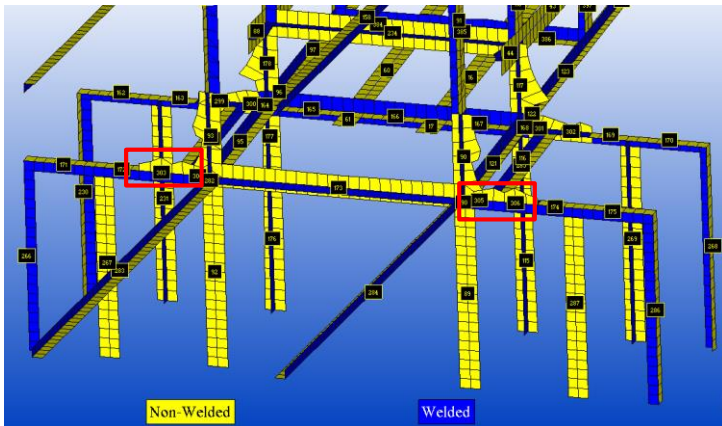
1 Select **Non-Welded** element(s) which should be changed to **Welded** element(s).

It is sufficient to select only one element from a weld part to pick full part automatically.

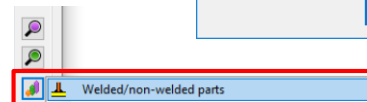
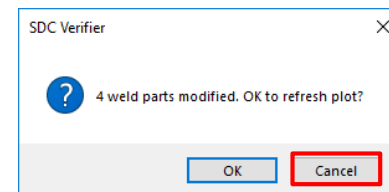
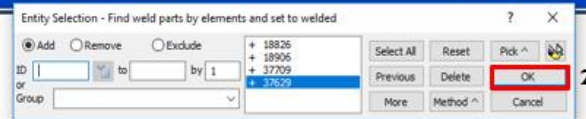
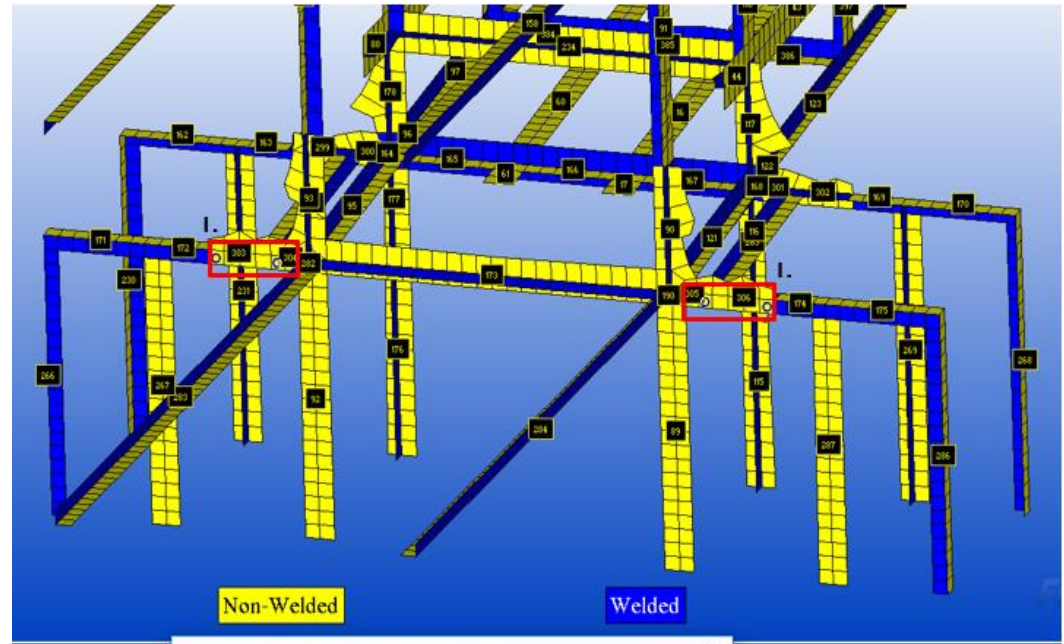
2 Press **OK**.

3 Press **Cancel**.

Updated plot shown below



In order to get refreshed plot of the weld(s), select all weld parts by using **Ctrl+A** keys combination and choose command **Welded/non-welded parts**



# Set weld parameters

1 Select all weld parts by pressing **Ctrl+A** keys combination.

2 Select the type of weld **Double fillet**.

3 Choose the method: **Apply by throat thickness**.

4 Select **Set  $a = t / 2$**  type (half of thickness welded plate).

5 Press **Apply**.

6 Press **OK**.

For beams elements  $t$  is the minimum thickness of shape. For bars element  $t$  is the minimum of height/width. For plates element  $t$  is a plate thickness.

Welds Finder

Recognition Filter

Information

Selection All Entities

Display Weld Parts ☐ All ☒ Welded ☐ Non-Welded

Filter Rule Show all = Apply Filter

Weld ID	Title	Length [m]	Weld Type	Welded	Csys	t [m]	r [m]	s [m]	h [m]	Alpha	Throat Thickness (a) [m]
1	Weld Part 1.3 [-29.94; 12.7...	0.994	None	Yes	Rotation [90; 0; 90]	0.008					
2	Weld Part 2.3 [-29.94; 12.7...	0.774	None	Yes	Rotation [90; 0; 90]	0.008					
3	Weld Part 3.3 [-29.94; 12.7...	0.525	None	Yes	Rotation [90; 0; 90]	0.008					
4	Weld Part 4.3 [-29.94; 12.7...	0.774	None	Yes	Rotation [90; 0; 90]	0.008					
5	Weld Part 5.3 [-29.94; 12.7...	0.525	None	Yes	Rotation [90; 0; 90]	0.008					
6	Weld Part 6.3 [-29.94; 12.7...	0.774	None	Yes	Rotation [90; 0; 90]	0.008					
7	Weld Part 7.3 [-29.94; 12.7...	0.773	None	Yes	Rotation [90; 0; 90]	0.008					
8	Weld Part 8.3 [-29.94; 12.7...	0.742	None	Yes	Rotation [90; 0; 90]	0.008					
9	Weld Part 9.3 [-29.94; 12.2...	1.031	None	Yes	Rotation [90; 0; 90]	0.008					
10	Weld Part 10.3 [-29.94; 12...	0.778	None	Yes	Rotation [90; 0; 90]	0.008					
11	Weld Part 11.3 [-29.94; 12...	0.527	None	Yes	Rotation [90; 0; 90]	0.008					
12	Weld Part 12.3 [-29.94; 12...	0.778	None	Yes	Rotation [90; 0; 90]	0.008					
13	Weld Part 13.3 [-29.94; 11...	0.527	None	Yes	Rotation [90; 0; 90]	0.008					
14	Weld Part 14.3 [-29.94; 11...	0.778	None	Yes	Rotation [90; 0; 90]	0.008					
15	Weld Part 15.3 [-29.94; 11...	0.776	None	Yes	Rotation [90; 0; 90]	0.008					

SDC Verifier

Weld type will be changed in 458 welded parts. OK to continue?

6. OK Cancel

Find Weld by ID Navigate Restore Default Set Welded Parts by Elements Set Non-Welded Parts by Elements

Apply to selected weld parts

Length [m] 0 Apply

Weld part thickness (t) [m] 0 Apply

Csys [0; 0; 0] Apply

Origin [0; 0; 0] Apply

Apply to selected weld parts (only for welded parts)

Weld type 2. Double fillet

☐ Apply by sizes 3. ☒ Apply by throat thickness (a)

Weld leg horizontal (r) [m] 0 ☐ Throat thickness (a) [m] 0

Weld leg vertical (h) [m] 4. ☒ Set a = t / 2

Penetration depth (s) [m] 0 Override type All

5. Apply

Settings Find OK Cancel

Alpha = 45°

t

h

s=0

r

a

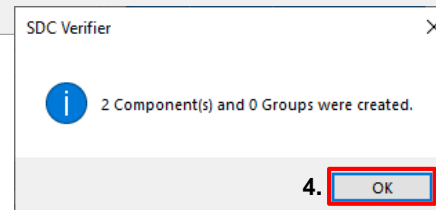
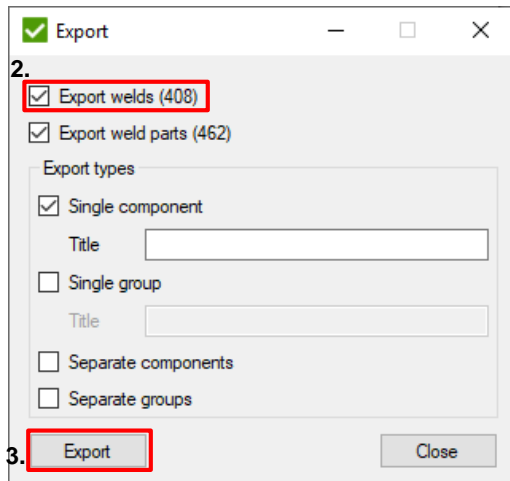
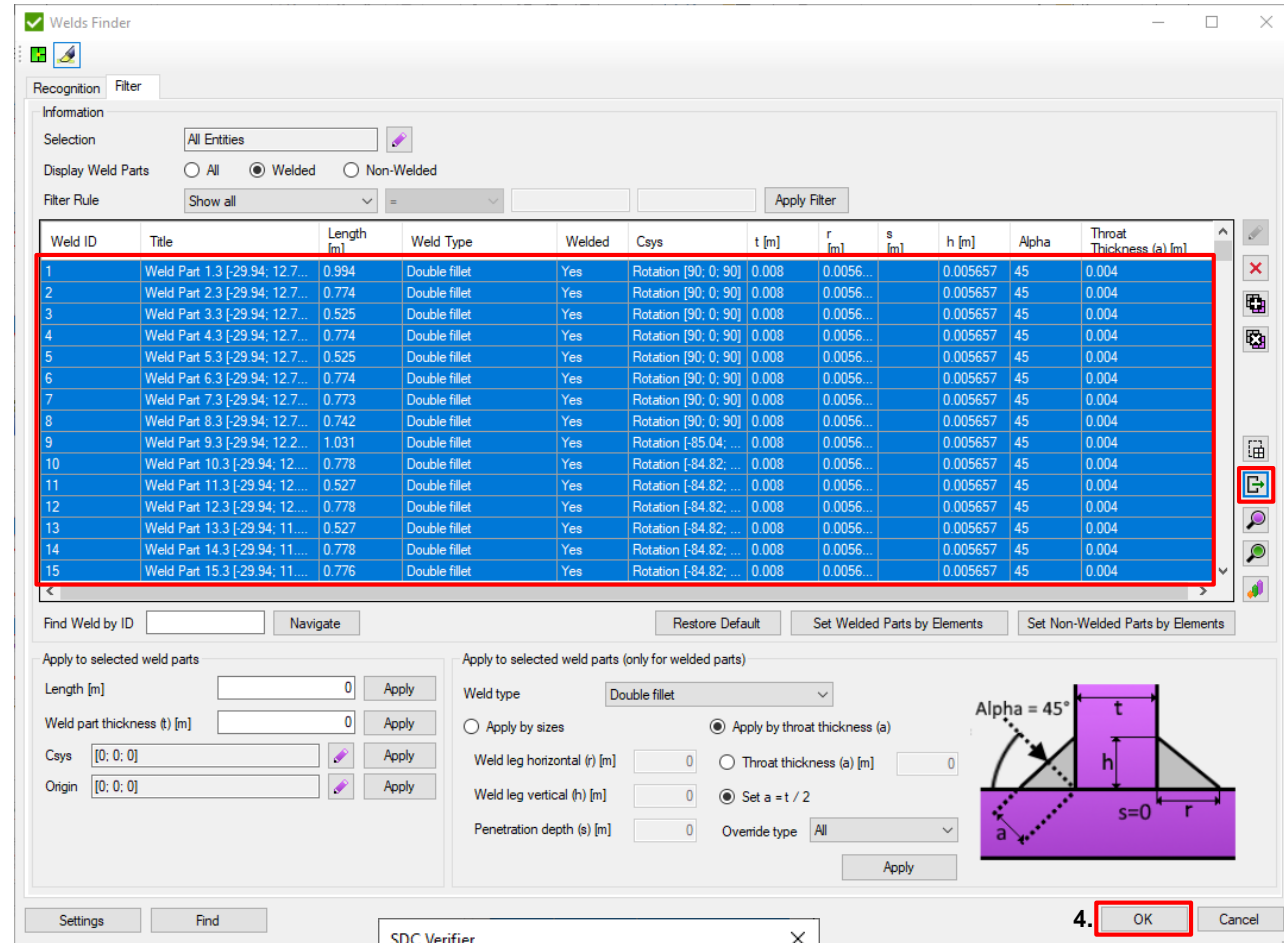
# Export Welds

1 Press *Export weld*.

2 Select **Export welds**.

3 Press *Export*.

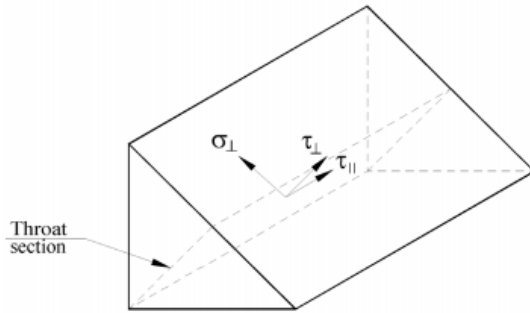
4 Press *OK* twice.



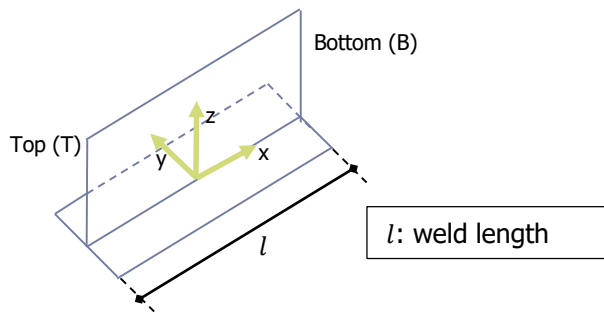
4. OK Cancel



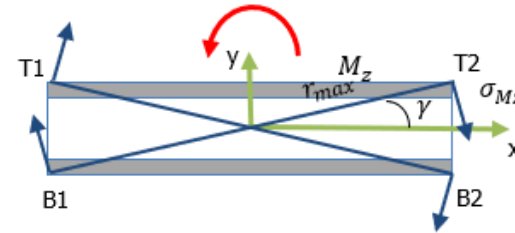
# Weld Stresses Calculation



$\tau_{||}$  = shear design stress (in plane of the throat) parallel to the axis of the weld (equal to X direction in the check);  
 $\sigma_{\perp}$  = normal design stress perpendicular to the throat (equal to Y direction of the check);  
 $\tau_{\perp}$  = shear design stress (in plane of the throat) perpendicular to the axis of the weld (equal to XY direction of the check)



Moments depend on the axis in a weld plane and are also included in the weld strength calculations



The stresses  $\tau_{||}$ ,  $\sigma_{\beta}$  and  $\tau_{\beta}$  are evaluated at the points T1, T2, B1 and B2 as follows:

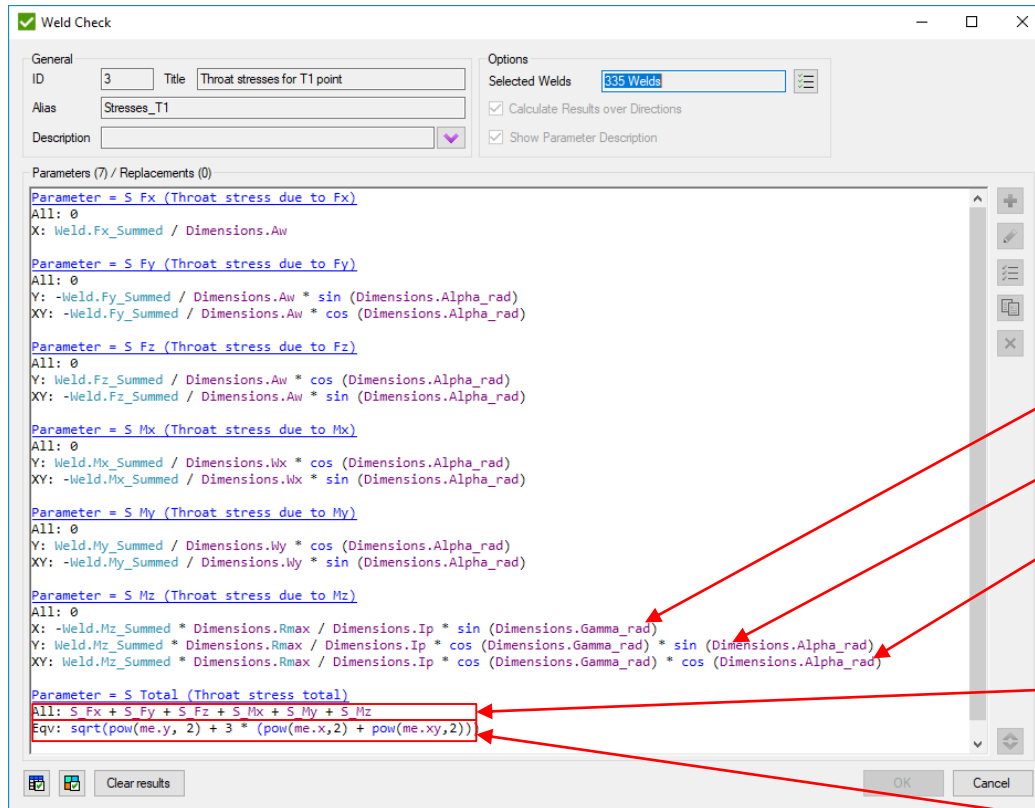
Angles matrix of rotations due to weld throat plane.

Stress calculations

$\tau_{  ,T1}$	1	0	0	0	0	$-\sin \gamma$
$\sigma_{\perp,T1}$	0	$-\sin \alpha$	$\cos \alpha$	$\cos \alpha$	$\cos \alpha$	$\cos \gamma * \sin \alpha$
$\tau_{\perp,T1}$	0	$-\cos \alpha$	$-\sin \alpha$	$-\sin \alpha$	$-\sin \alpha$	$\cos \gamma * \cos \alpha$
$\tau_{  ,T2}$	1	0	0	0	0	$-\sin \gamma$
$\sigma_{\perp,T2}$	0	$-\sin \alpha$	$\cos \alpha$	$\cos \alpha$	$-\cos \alpha$	$-\cos \gamma * \sin \alpha$
$\tau_{\perp,T2}$	0	$-\cos \alpha$	$-\sin \alpha$	$-\sin \alpha$	$\sin \alpha$	$-\cos \gamma * \cos \alpha$
$\tau_{  ,B1}$	1	0	0	0	0	$\sin \gamma$
$\sigma_{\perp,B1}$	0	$\sin \alpha$	$\cos \alpha$	$-\cos \alpha$	$\cos \alpha$	$-\cos \gamma * \sin \alpha$
$\tau_{\perp,B1}$	0	$\cos \alpha$	$-\sin \alpha$	$\sin \alpha$	$-\sin \alpha$	$-\cos \gamma * \cos \alpha$
$\tau_{  ,B2}$	1	0	0	0	0	$\sin \gamma$
$\sigma_{\perp,B2}$	0	$\sin \alpha$	$\cos \alpha$	$-\cos \alpha$	$-\cos \alpha$	$\cos \gamma * \sin \alpha$
$\tau_{\perp,B2}$	0	$\cos \alpha$	$-\sin \alpha$	$\sin \alpha$	$\sin \alpha$	$\cos \gamma * \cos \alpha$

$$= \begin{bmatrix} \frac{F_x}{A_w} \\ \frac{F_y}{A_w} \\ \frac{F_z}{A_w} \\ \frac{M_x}{I_x} d_y \\ \frac{M_y}{I_y} d_x \\ \frac{M_z * r_{max}}{I_p} \end{bmatrix} *$$

# Implementation of weld stresses



$\tau_{||,Mz}$

$\sigma_{\beta,Mz}$

$\tau_{\beta,Mz}$

$$\begin{aligned}\tau_{||} &= \tau_{||,Fx} + \tau_{||,Fy} + \tau_{||,Fz} + \tau_{||,Mx} + \tau_{||,My} + \tau_{||,Mz} \\ \sigma_{\beta} &= \sigma_{\beta,Fx} + \sigma_{\beta,Fy} + \sigma_{\beta,Fz} + \sigma_{\beta,Mx} + \sigma_{\beta,My} + \sigma_{\beta,Mz} \\ \tau_{\beta} &= \tau_{\beta,Fx} + \tau_{\beta,Fy} + \tau_{\beta,Fz} + \tau_{\beta,Mx} + \tau_{\beta,My} + \tau_{\beta,Mz}\end{aligned}$$

$$\sigma_{VM} = \sqrt{\sigma_{\perp}^2 + 3 * (\tau_{\perp}^2 + \tau_{||}^2)}$$

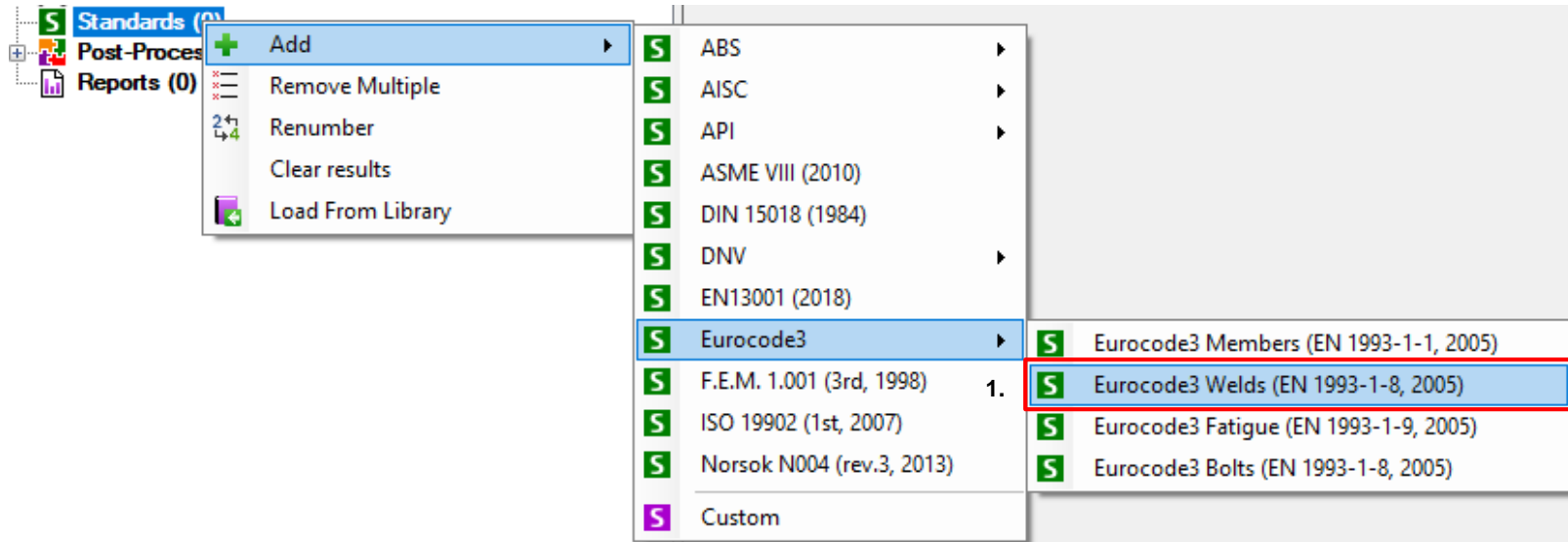
Von Mises stress at certain point.



# Add Eurocode3 (EN1993-1-8)

1

Execute **Add => Eurocode3 Weld (EN 1993-1-8. 2005)** in the Standards context menu.



**Eurocode3 Weld (EN 1993-1-8. 2005)** Design of joints is implemented to verify the structure stability of each structural member (weld).

# Eurocode3 Correction Factor

**Weld Selection** gives a possibility to include or exclude weld(s), preview chosen weld(s) or go to weld finder.

1

Press the button  to select the **Correction factor**.

2

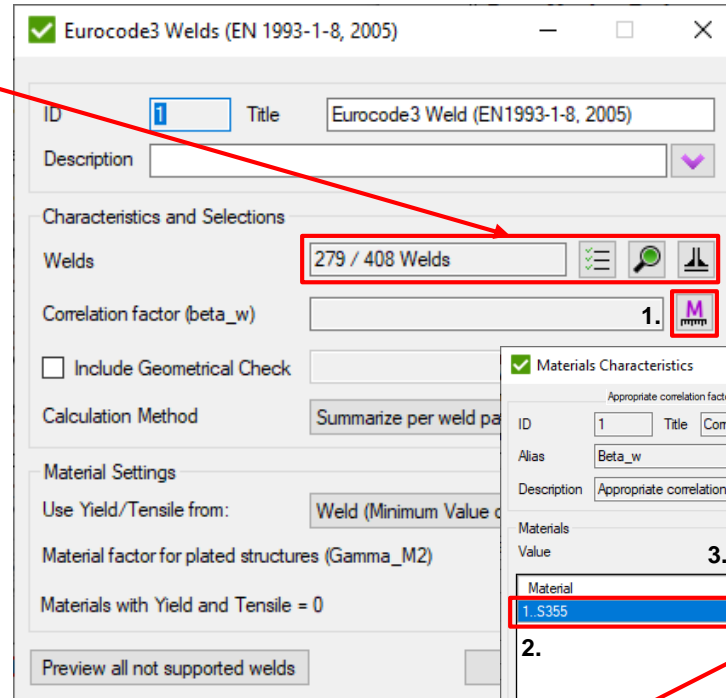
Select the material for which the **Correction factor** will be applied.

3

Input value of the **Correction factor** according to the table 4.1, and press **Apply to selected**.

4

Press **OK**.



✓ Eurocode3 Welds (EN 1993-1-8, 2005)

ID: 1 Title: Eurocode3 Weld (EN1993-1-8, 2005)

Description:

Characteristics and Selections

Welds: 279 / 408 Welds

Correlation factor (beta\_w): 1.

☐ Include Geometrical Check

Calculation Method: Summarize per weld pair

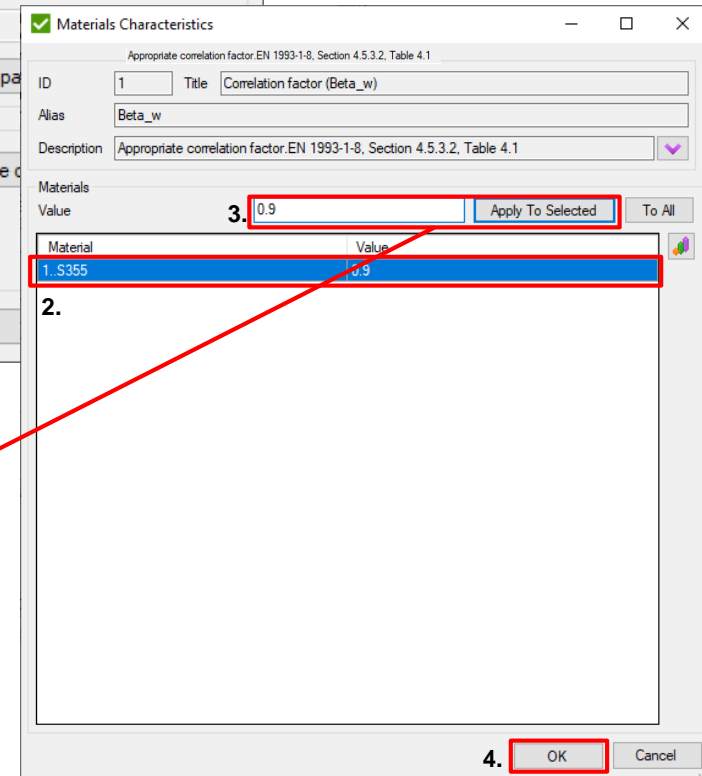
Material Settings

Use Yield/Tensile from: Weld (Minimum Value of...)

Material factor for plated structures (Gamma\_M2):

Materials with Yield and Tensile = 0

Preview all not supported welds



✓ Materials Characteristics

Appropriate correlation factor: EN 1993-1-8, Section 4.5.3.2, Table 4.1

ID: 1 Title: Correlation factor (Beta\_w)

Alias: Beta\_w

Description: Appropriate correlation factor: EN 1993-1-8, Section 4.5.3.2, Table 4.1

Materials

Value: 0.9

Apply To Selected To All

Material Value

1. S355 0.9

2.

OK Cancel

Table 4.1: Correlation factor  $\beta_w$  for fillet welds

Standard and steel grade			Correlation factor $\beta_w$
EN 10025	EN 10210	EN 10219	
S 235 S 235 W	S 235 H	S 235 H	0,8
S 275 S 275 N/NL S 275 M/ML	S 275 H S 275 NH/NLH	S 275 H S 275 NH/NLH S 275 MH/MLH	0,85
S 355 S 355 N/NL S 355 M/ML S 355 W	S 355 H S 355 NH/NLH	S 355 H S 355 NH/NLH S 355 MH/MLH	0,9
S 420 N/NL S 420 M/ML		S 420 MH/MLH	1,0
S 460 N/NL S 460 M/ML S 460 Q/QL/QL1	S 460 NH/NLH	S 460 NH/NLH S 460 MH/MLH	1,0

# Eurocode3 Weld Strength

1 Press the button  to apply **Material Yield and Tensile** parameters.

2 Select the material for which the **Properties** will be applied.

3 Input value of the **Material Yield and Tensile** parameters, and press **Set**.

4 Press **OK**.

5 Press **OK**.

**Material Fatigue Parameters**

Materials	Tensile Strength [Pa]	Yield Stress [Pa]
1..S355	470000000	355000000

2.

3.

Properties

Tensile Strength [Pa]  
470e6

Yield Stress [Pa]  
355e6

Set

4.

OK Cancel

**Eurocode3 Welds (EN 1993-1-8, 2005)**

ID 1 Title Eurocode3 Weld (EN1993-1-8, 2005)

Description

Characteristics and Selections

Welds 279 / 408 Welds

Correlation factor (beta\_w) Defined

☐ Include Geometrical Check

Calculation Method Summarize per weld part

Material Settings

Use Yield/Tensile from: Weld (Minimum Value or User Defined)

Material factor for plated structures (Gamma\_M2) 1.25

Materials with Yield and Tensile = 0 1

Preview all not supported welds

5. OK Cancel

**Gamma\_M2** - material resistance factor for plated structures is a constant value (=1.25) and used in calculations to check a base material strength.

# Create extreme table

1 Execute **Extreme Table** in the **Weld Check Total** context menu.

2 Press the  button and select **Load Group 1**

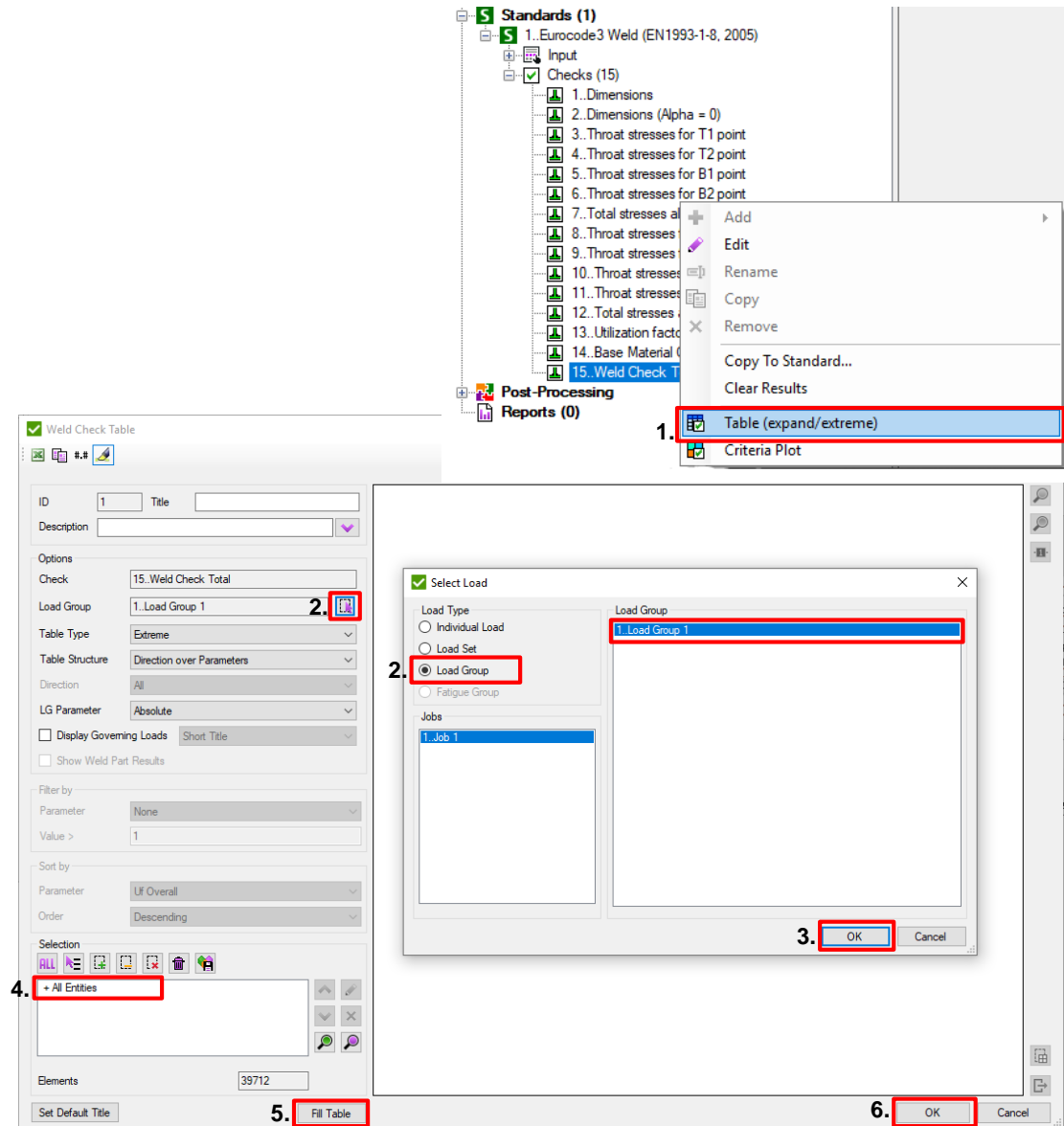
3 Press **OK**.

4 Selection: **All Entities**.

5 Press **Fill Table**.

6 Press **OK**.

Extreme table for '1..Load Group 1' can be added to DNV OS-C101 and DNV OS-C201 standards respectively.



The screenshot illustrates the steps to create an extreme table in SDC Verifier. It shows the 'Standards (1)' tree with '1. Eurocode3 Weld (EN1993-1-8, 2005)' selected. The 'Weld Check Total' context menu is open, and 'Table (expand/extreme)' is highlighted. The 'Weld Check Table' dialog is shown with 'Load Group 1' selected. The 'Select Load' dialog is open, showing 'Load Group 1' selected. The 'Weld Check Table' dialog is shown with 'All Entities' selected. The 'Fill Table' button is highlighted. The 'OK' button is highlighted.

1. Table (expand/extreme)

2. Load Group 1

3. OK

4. + All Entities


5. Fill Table

6. OK

# Create criteria plot

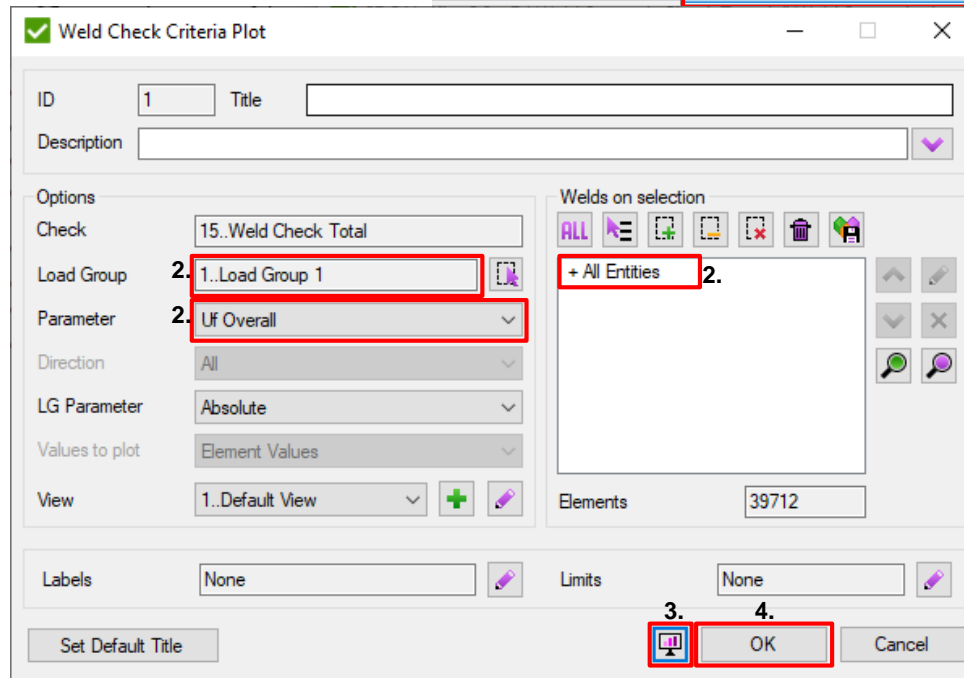
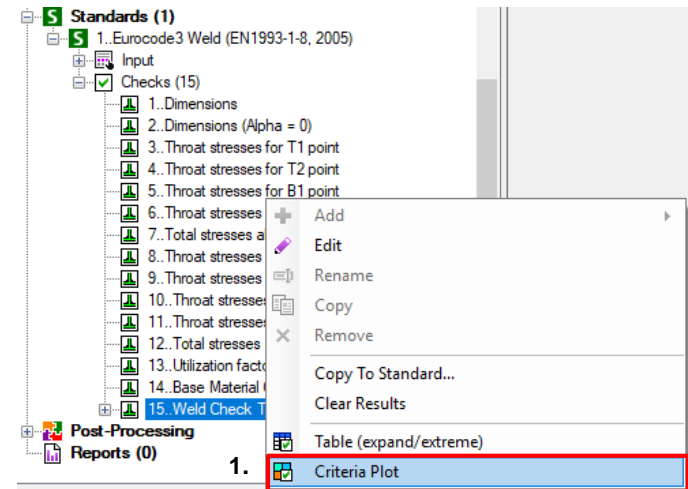
1 Execute **Criteria Plot** in the **Weld Strength Check** context menu

2 Load: **Load Group 1**;  
Parameter: **UF Overall**;  
Selection: **All Entities**.

3 Press the  to preview Plot in Femap

4 Press **OK**.

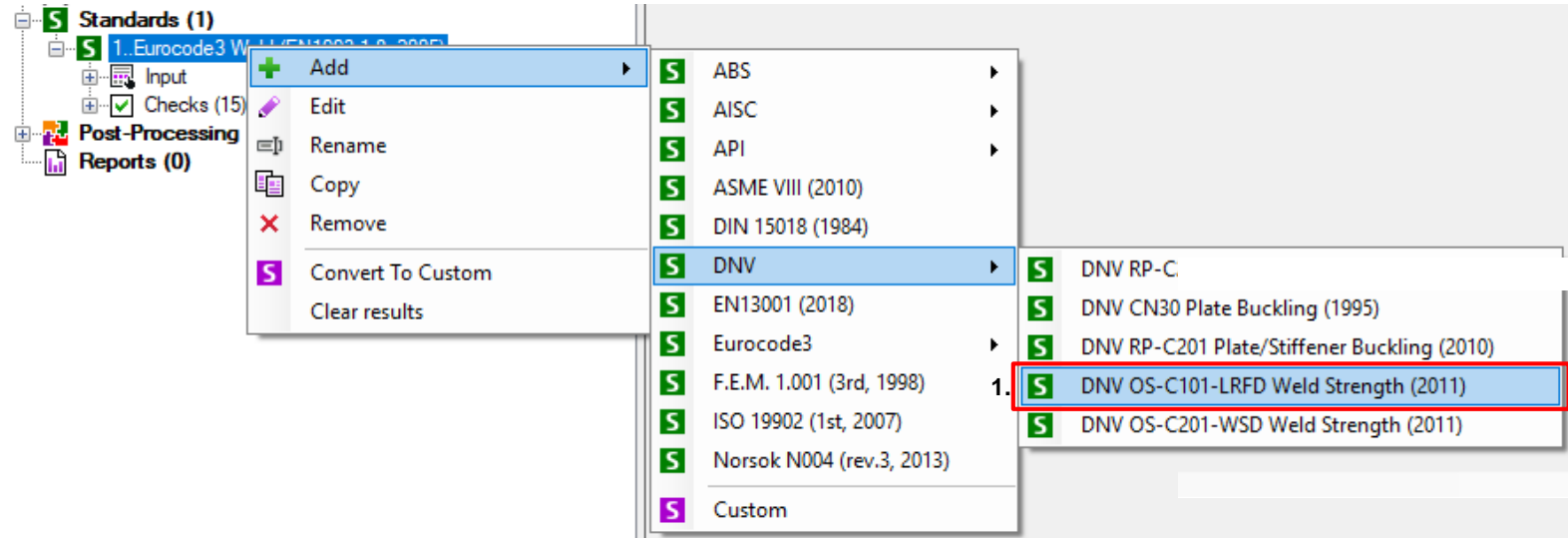
Criteria plot for '1..Load Group 1' can be added to DNV OS-C101 and DNV OS-C201 standards respectively.



# Add DNV OS-C101-LRFD

1


Execute **Criteria Plot** in the **Weld Strength Check** context menu



The offshore standard **DNV OS-C101 (released in April, 2011)** verifies structural stability for each structural member (weld).

# DNV OS-C101. Correction Factor

**Weld Selection** gives a possibility to include or exclude weld(s), preview chosen weld(s) or go to weld finder.

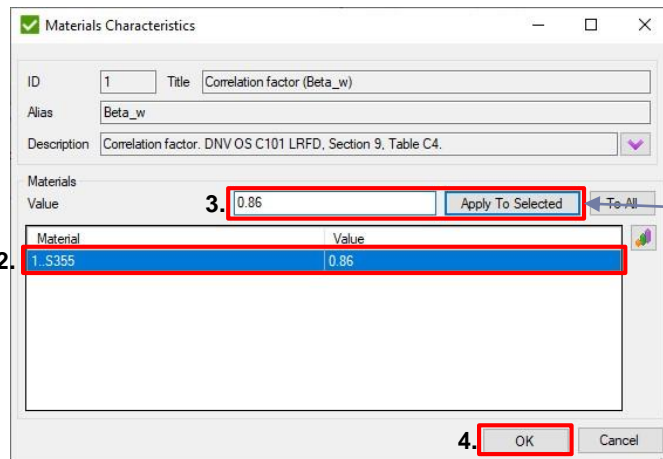
1 Press the button  select **Correction factor**.

2 Select the material for which the **Correction factor** will be applied.

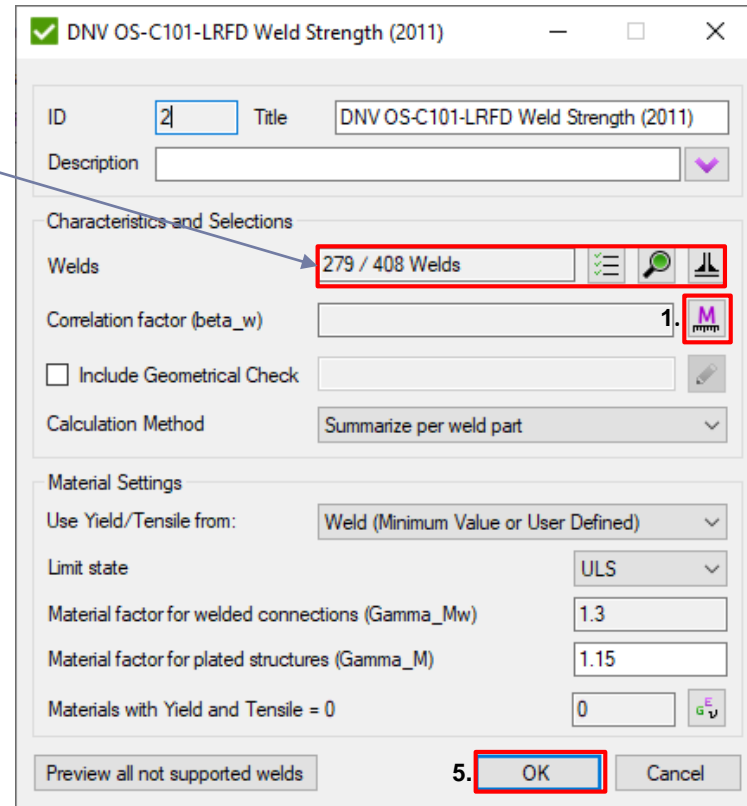
3 Input value of the **Correction factor** according to the table, and press *Apply to selected*.

4 Press *OK*.

5 Press *OK*.



The dialog box shows the 'Materials Characteristics' settings. The 'Materials' section has a 'Value' field with '0.86' entered, which is highlighted with a red box and labeled '3.'. The 'Apply To Selected' button is also highlighted with a red box and labeled '4.'. The 'Material' list shows '1.S355' selected, highlighted with a blue box and labeled '2.'. The 'OK' button is highlighted with a red box and labeled '4.'.



The dialog box shows the 'DNV OS-C101-LRFD Weld Strength (2011)' settings. The 'Welds' field shows '279 / 408 Welds', highlighted with a red box and labeled '279 / 408 Welds'. The 'Correlation factor (beta\_w)' field has '1.' entered, highlighted with a red box and labeled '1.'. The 'OK' button is highlighted with a red box and labeled '5.'.

Steel grade	Lowest ultimate tensile strength $f_u$	Correlation factor $\beta_w$
NV NS	400	0.83
NV 27	400	0.83
NV 32	440	0.86
NV 36	490	0.89
NV 40	510	0.9
NV 420	530	1.0
NV 460	570	1.0

# DNV OS-C101. Safety Factors

✓ DNV OS-C101-LRFD Weld Strength (2011)

ID: 2 Title: DNV OS-C101-LRFD Weld Strength (2011)

Description:

Characteristics and Selections

Welds: 279 / 408 Welds

Correlation factor (beta\_w): Defined

☐ Include Geometrical Check

Calculation Method: Summarize per weld part

Material Settings

Use Yield/Tensile from: Weld (Minimum Value or User Defined)

Limit state: ULS

Material factor for welded connections (Gamma\_Mw): 1.3

Material factor for plated structures (Gamma\_M): 1.15

Materials with Yield and Tensile = 0

Preview all not supported welds OK Cancel

**Gamma\_Mw** - material factor that is used for DNV OS C 101 calculation can be found in Table C1, section 9 of the standard.

**101** The material factors  $\gamma_{Mw}$  for welded connections are given in Table C1.

Table C1 Material factors $\gamma_{Mw}$ for welded connections	
Limit states	Material factor
ULS	1.3
ALS	1.0

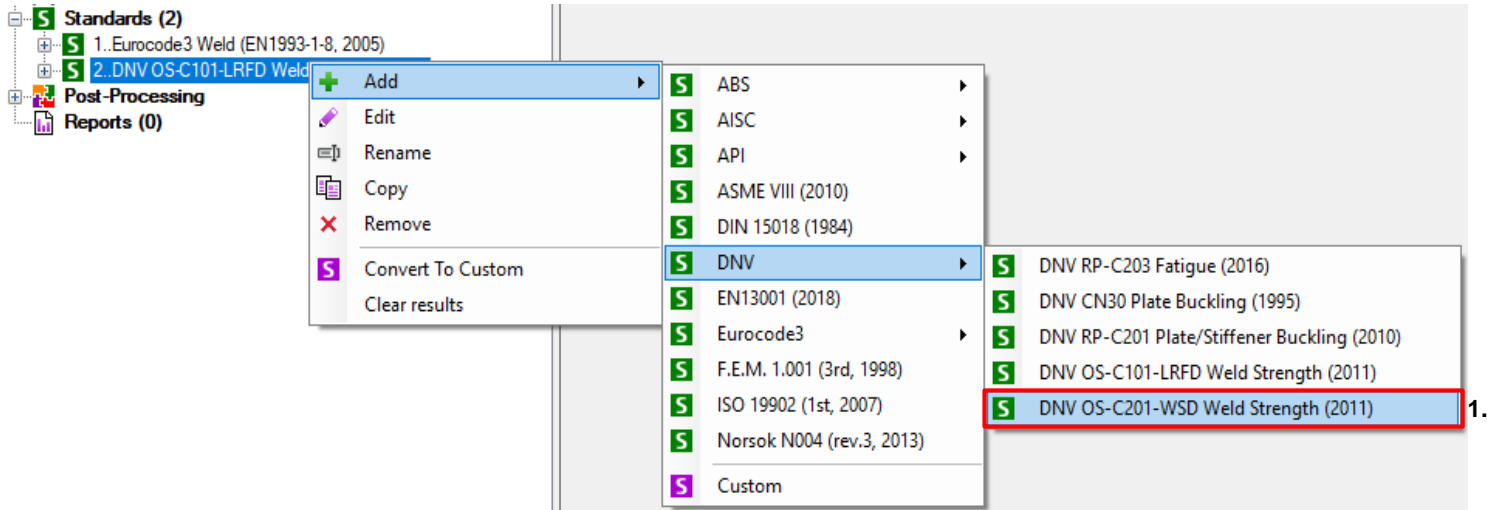
**Gamma\_M** - material resistance factor for plated structures is a constant value (=1.15) and used in calculations to check base material strength.



# Add DNV OS-C201 WSD

1

Execute Add => DNV OS-C201 WSD  
Weld Strength (2011) in the Standards  
context menu.



The offshore standard **DNV OS-C201**  
(released in April, 2011) verifies  
structural stability for each structural  
member (weld)

# DNV OS C201. Correction Factor

**Weld Selection** gives a possibility to include or exclude weld(s), preview chosen weld(s) or go to weld finder.

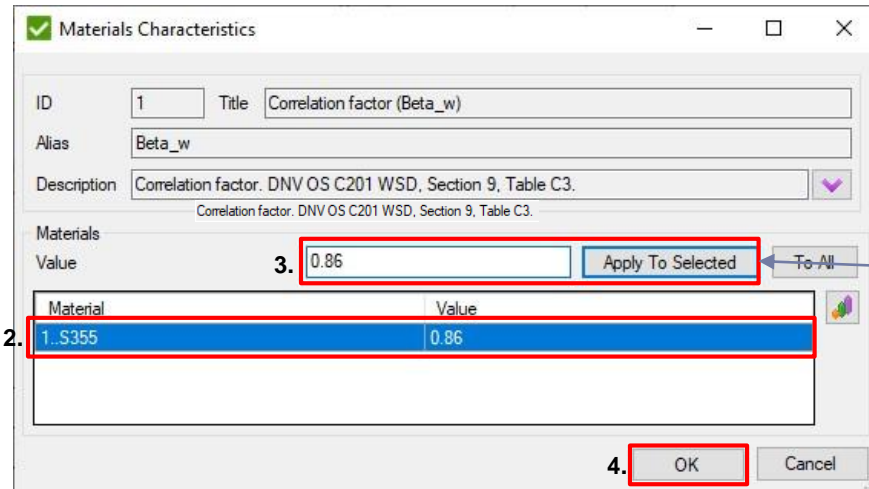
1 Press the button  to select **Correction factor**.

2 Select the material for which the **Correction factor** will be applied.

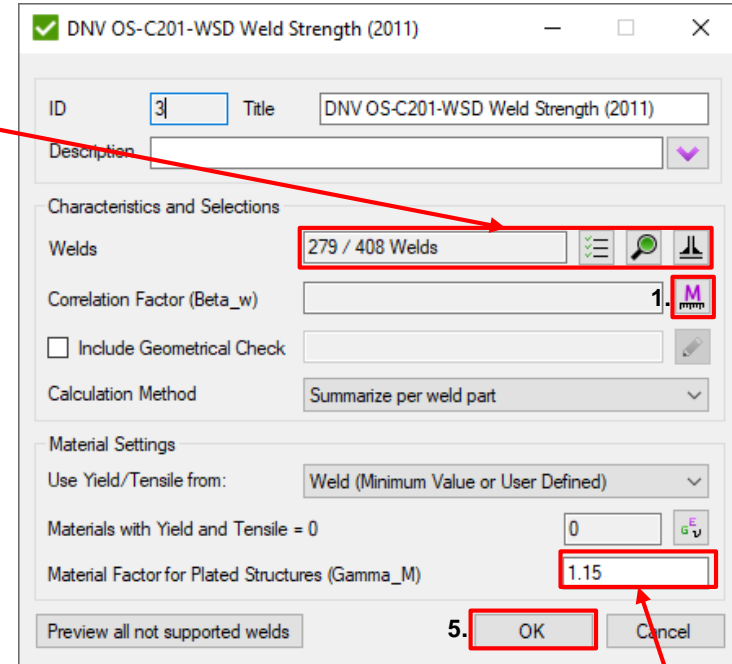
3 Input value of the **Correction factor** according to the table, and press *Apply to selected*.

4 Press *OK*.

5 Press *OK*.



The dialog box shows the 'Materials Characteristics' section. The 'Value' field is set to 0.86, which is highlighted with a red box and labeled '3.'. The 'Apply To Selected' button is highlighted with a red box and labeled '4.'. The 'OK' button is highlighted with a red box and labeled '5.'. The material list shows '1\_S355' selected, highlighted with a red box and labeled '2.'.



The dialog box shows the 'DNV OS-C201-WSD Weld Strength (2011)' section. The 'Welds' field shows '279 / 408 Welds', highlighted with a red box. The 'Correlation Factor (Beta\_w)' field is set to 1, highlighted with a red box. The 'Material Factor for Plated Structures (Gamma\_M)' field is set to 1.15, highlighted with a red box. The 'OK' button is highlighted with a red box and labeled '5.'.

**Gamma<sub>M</sub>** - material resistance factor for plated structures is a constant value (=1.15) and used in calculations to check base material strength.

Steel grade	Lowest ultimate tensile strength $f_u$	Correlation factor $\beta_w$
NV NS	400	0.83
NV 27	400	0.83
NV 32	440	0.86
NV 36	490	0.89
NV 40	510	0.9
NV 420	530	1.0
NV 460	570	1.0

# Add Report

1

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

2

Exclude all checks except the **Weld Check Total** in each standard (also for DNV OS-C101 and DNV OS-C201).

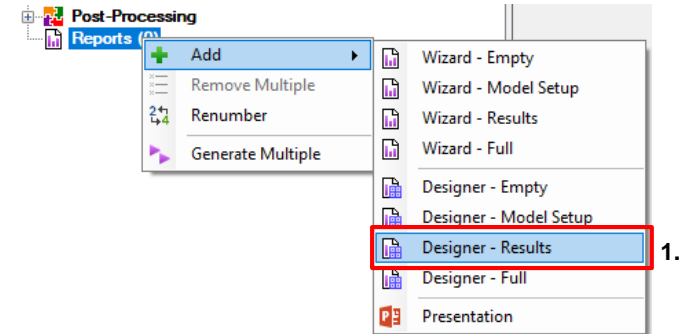
There are 4 templates of the reports:

**Empty** – only first page and preface items are included;

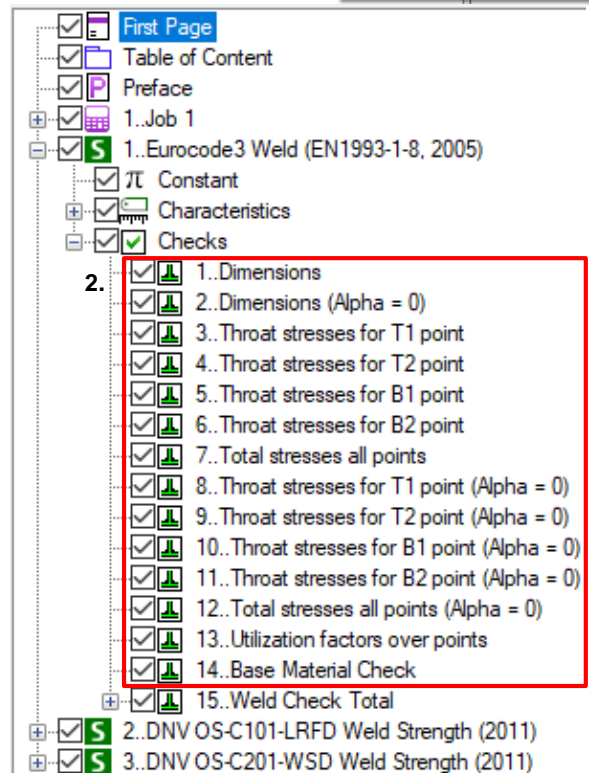
**Model Setup** – description of the model data (materials, properties, components, boundary conditions) is included;

**Results** – for each load extreme displacement tables, stress and displacement plots are included. Predefined tables: sum of reaction forces, stresses/displacements summary tables. In addition all standards are included with a set of tables/plots created in the project;

**Full** – Model Setup + Results + all tables/plots created in jobs.



1.



# Report - Governing Load

1

Click **Governing Loads** in **Weld Check Total** context menu

2

Result: **from Check**;

3

Standard: **Eurocode 3 Weld**.

4

Check: **Weld Check Total**.

5

Parameter: **Uf Overall**.

6

Load Group: **Load Group 1**.

7

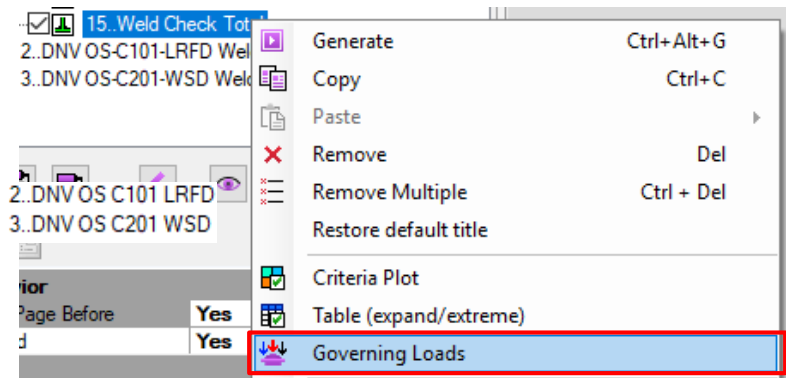
Selection: **All Entities**.

8

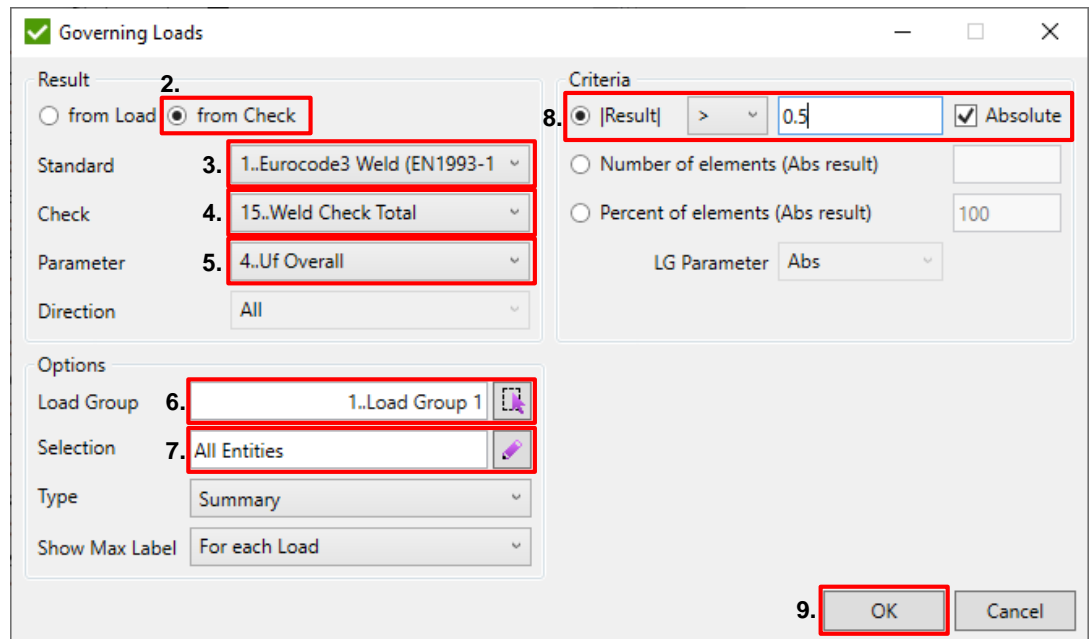
Criteria: **Result >0.5**.

9

Press **OK**.



1.



# Report - Governing Load

1 Select **Governing Load** at the report tree (click once on this chapter).

2 Include plot: **Yes**

3 Show only welds: **Yes**.

Add Governing Load for '1..Load Group 1' also possible for DNV OS-C101 and DNV OS-C201 standards.

<b>Behavior</b>	
Break Page Before	No
Enabled	Yes
<b>Data</b>	
Title (Default)	Governing Loads (LG1; All Entities)
Title (User)	
<b>Options</b>	
Include Description Table	Yes
<b>Plot</b>	
Include Plot	Yes
Selection	All Entities
Show Max Label	For each Load
Show only welds	Yes
Views	1 selected...

# Report - Copy/Paste Structure

1

Execute **Copy Structure** in **Weld Strength Check** context menu for Eurocode 3 standard.

2

Execute **Paste Structure** in **Weld Check Total** context menu for DNV OS-C101 standard.

Repeat **Paste structure** for '1..Load Group 1' for DNV OS-C201 standard.

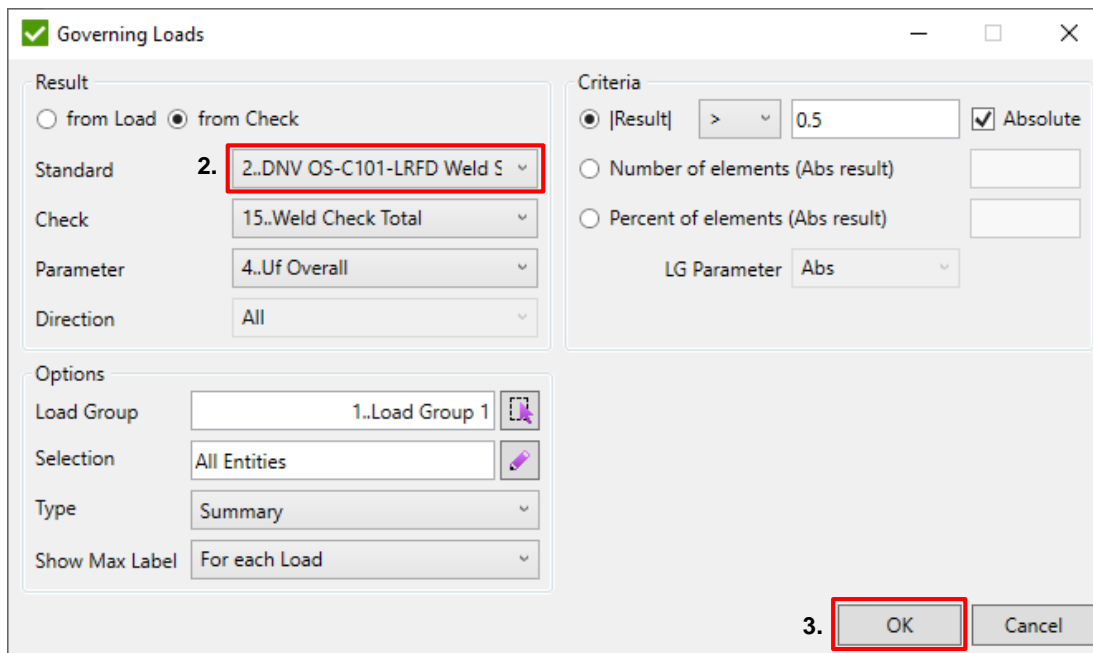
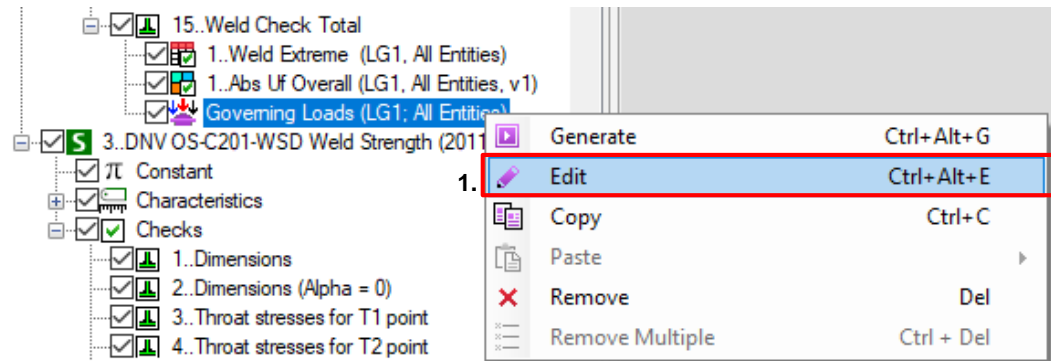
The screenshot displays the SDC Verifier interface with two context menus open. The top menu is for '15..Weld Check Total' and the bottom menu is for '2..DNV OS-C101-LRFD'. Both menus show options like 'Generate', 'Copy', 'Paste', 'Remove', 'Criteria Plot', 'Table (expand/extreme)', 'Governing Loads', 'Apply To All', 'Replace', 'Sort Tables/Plots', 'Add User Chapter', 'Add Load Containers', and 'Add Selection Containers'. The 'Copy structure' option in the top menu is highlighted with a red box and labeled '1.'. The 'Paste structure' option in the bottom menu is highlighted with a red box and labeled '2.'. The 'Weld Check Total' menu also shows 'Copy structure' and 'Paste structure' options at the bottom, with 'Copy structure' highlighted by a red box and labeled '1.' and 'Paste structure' highlighted by a red box and labeled '2.'.

# Report – Governing Load

1 Press **Edit** in governing load context menu in **DNV OS-C101** standard.


2 Select standard: **2..DNV OS-C101-LRFD**

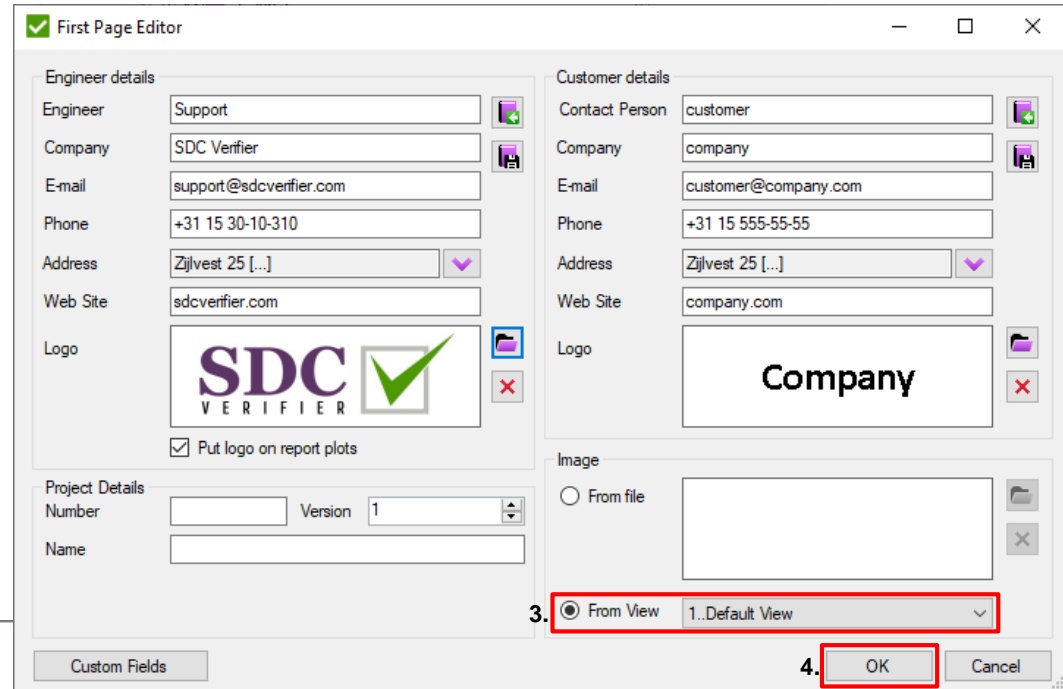
3 Press **OK**.



Repeat editing operation in DNV OS-C201 by selecting a proper standard

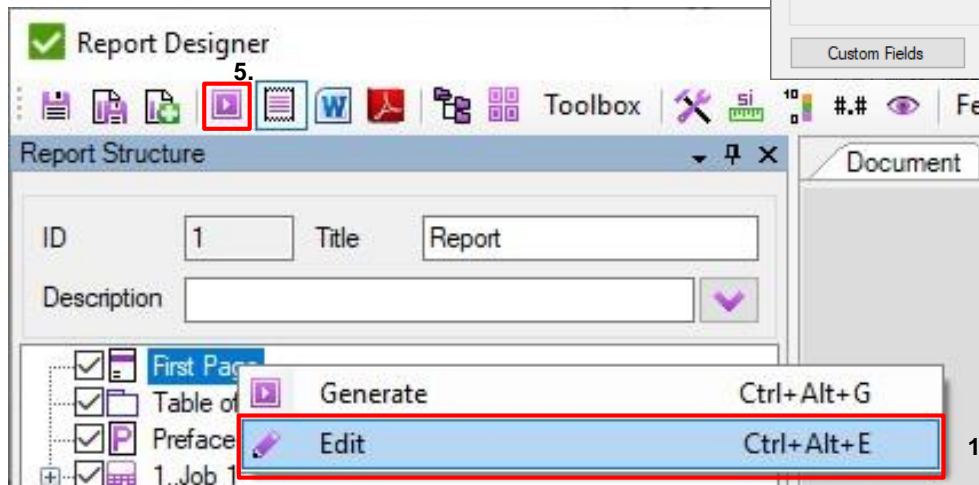
# Report - First Page

- 1 Right click on *First Page* => **Edit**.
- 2 Fill in information about project.
- 3 Select Image **From View** and pick.
- 4 Press **OK**.
- 5 Press button  to generate report.



The 'First Page Editor' dialog box is shown with the following fields and options:

- Engineer details:** Engineer (Support), Company (SDC Verifier), E-mail (support@sdccverifier.com), Phone (+31 15 30-10-310), Address (Zijlvest 25 [...]), Web Site (sdccverifier.com), Logo (SDC Verifier logo).
- Customer details:** Contact Person (customer), Company (company), E-mail (customer@company.com), Phone (+31 15 555-55-55), Address (Zijlvest 25 [...]), Web Site (company.com), Logo (Company logo).
- Image:** ☒ From file, ☐ From View (selected), 1..Default View.
- Project Details:** Number, Version (1), Name.
- Buttons:** Custom Fields, OK, Cancel.





# Report - Results

## Eurocode3

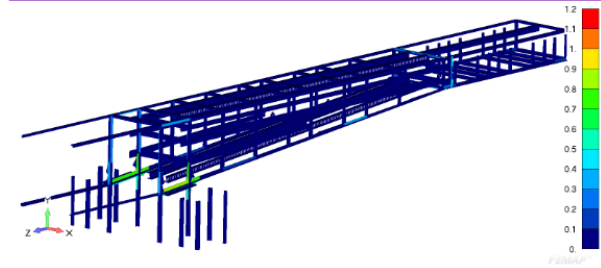
### 15..Weld Check Total

Property	Value
Category	Weld Check
Parameter Count	4

#### 1..Weld Extreme (LG1, 335 Welds)

Standard	1..Eurocode3 Weld (EN1993-1-8, 2005)		Check	[S1] 15..Weld Check Total
Load Group	LG1..Load Group 1		Welds	335
Extreme	UF VM total	UF N total	UF material total	UF Overall
Minimum	0.00	0.00	0.00	0.00
Maximum	0.81	0.47	0.70	0.81
Absolute	0.81	0.47	0.70	0.81

#### 1..Absolute UF Overall (LG1, 335 Welds, v1)

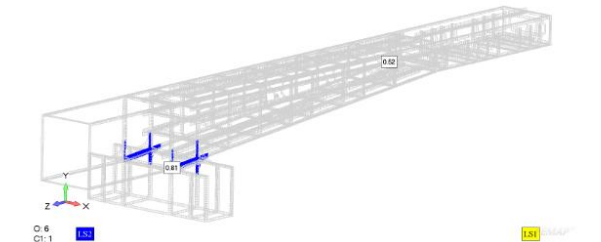


Check	[S1] 15..Weld Check Total	Load Group	LG1..Load Group 1
Parameter	Absolute UF Overall	Welds	335
View	1..Default View		

#### Governing Loads (LG1; All Entities)

Standard	1..Eurocode3 Weld (EN1993-1-8, 2005)	Direction	All
Check	15..Weld Check Total	Parameter	4..UF Overall
Criteria	Abs(value) > Abs(0.5)		

Load	Element Count	Peak Element Id	Peak Value
LS2..Load Set 2	144	36318	0.81
LS1..Load Set 1	2	1318	0.52



## DNV OS-C101

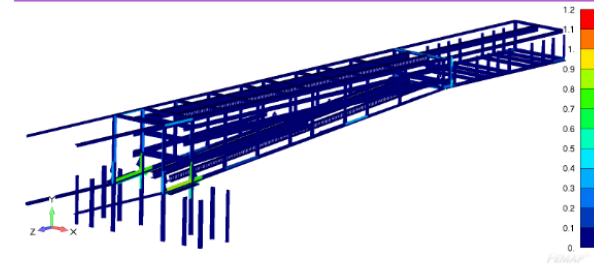
### 15..Weld Check Total

Property	Value
Category	Weld Check
Parameter Count	4

#### 1..Weld Extreme (LG1, 335 Welds)

Standard	2..DNV OS C101 LRFD	Check	[S2] 15..Weld Check Total	
Load Group	LG1..Load Group 1	Welds	335	
Extreme	UF VM total	UF N total	UF material total	UF Overall
Minimum	0.00	0.00	0.00	0.00
Maximum	0.81	0.44	0.65	0.81
Absolute	0.81	0.44	0.65	0.81

#### 1..Absolute UF Overall (LG1, 335 Welds, v1)

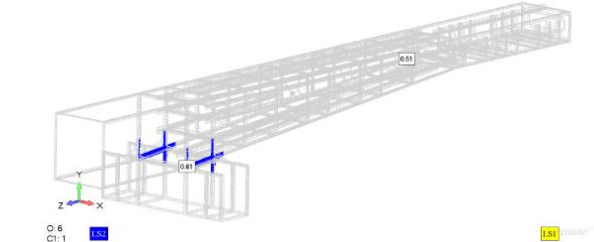


Check	[S2] 15..Weld Check Total	Load Group	LG1..Load Group 1
Parameter	Absolute UF Overall	Welds	335
View	1..Default View		

#### Governing Loads (LG1; All Entities)

Standard	2..DNV OS C101 LRFD	Direction	All
Check	15..Weld Check Total	Parameter	4..UF Overall
Criteria	Abs(value) > Abs(0.5)		

Load	Element Count	Peak Element Id	Peak Value
LS2..Load Set 2	144	36318	0.81
LS1..Load Set 1	2	1318	0.51



## DNV OS-C201

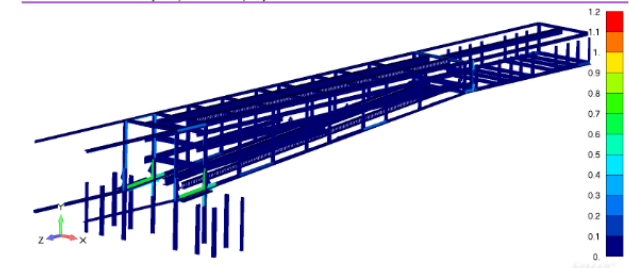
### 15..Weld Check Total

Property	Value
Category	Weld Check
Parameter Count	4

#### 1..Weld Extreme (LG1, 335 Welds)

Standard	3..DNV OS C201 WSD		Check	[S3] 15..Weld Check Total	
Load Group	LG1..Load Group 1		Welds	335	
Extreme	UF VM total	UF N total	UF material total	UF Overall	
Minimum	0.00	0.00	0.00	0.00	
Maximum	0.62	0.34	0.65	0.65	
Absolute	0.62	0.34	0.65	0.65	

#### 1..Absolute UF Overall (LG1, 335 Welds, v1)



Check	[S3] 15..Weld Check Total	Load Group	LG1..Load Group 1
Parameter	Absolute UF Overall	Welds	335
View	1..Default View		

#### Governing Loads (LG1; All Entities)

Standard	3..DNV OS C201 WSD	Direction	All
Check	15..Weld Check Total	Parameter	4..UF Overall
Criteria	Abs(value) > Abs(0.5)		

Load	Element Count	Peak Element Id	Peak Value
LS2..Load Set 2	72	36318	0.85

