



Tutorial

Plate Buckling DNV

ANSYS[®]

29 Jan 2020
version 5.3



- ▶ In this tutorial an DNV 2010 Plate Buckling Check is reviewed in details.
- ▶ A part of a plate model of the ship has been used as a start FEM model.
- ▶ Load Sets and Load Group (Envelope) are created.
- ▶ Recognition of plates using Panel Finder.
- ▶ Plate Buckling tables and plots.
- ▶ Reporting: preparing and generating the final report.

Launch SDC Verifier


1

Open in Ansys Workbench
PlateBucklingDNV.wbpj

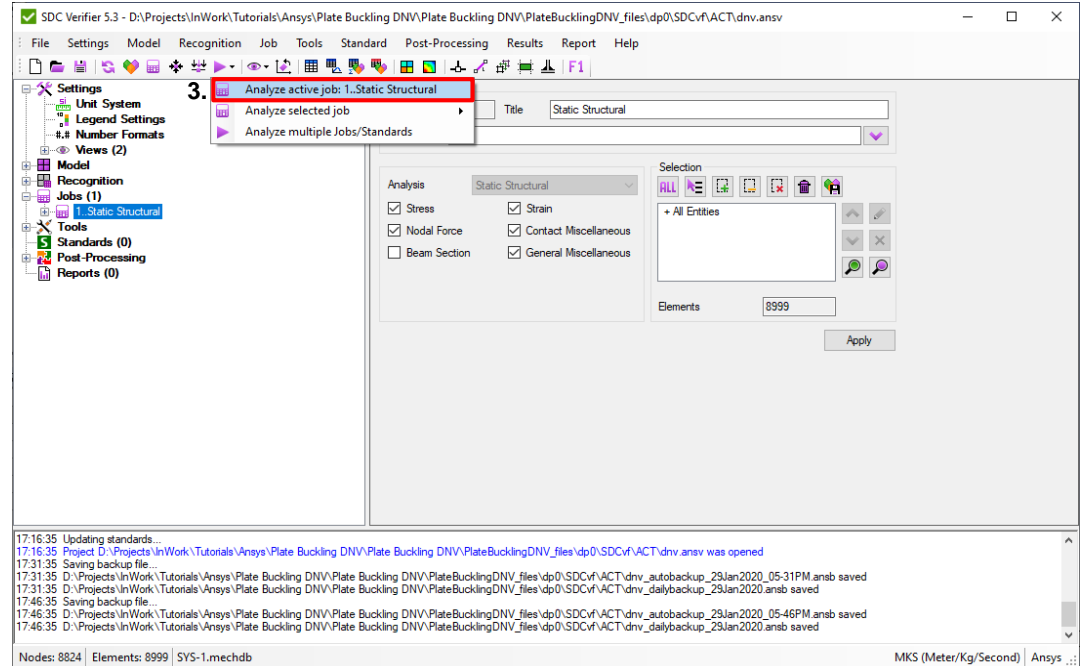
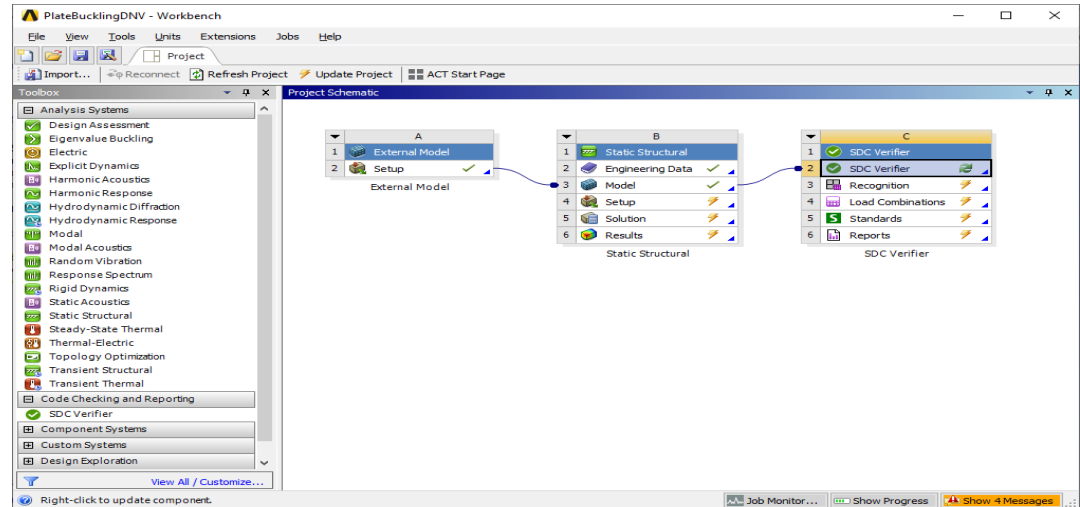
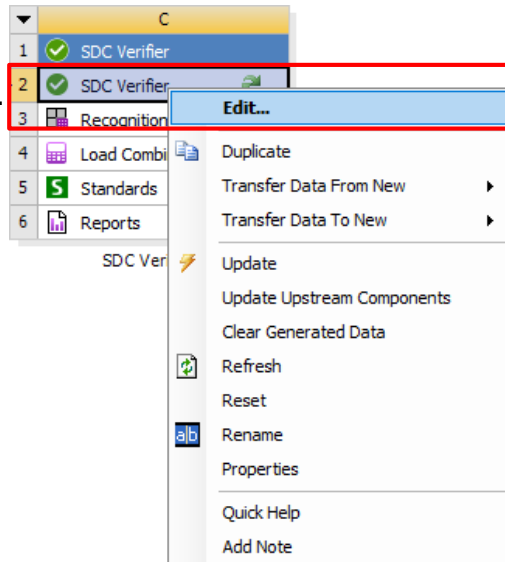
2

Double Click on  SDC Verifier 
or execute *Edit* from context menu

3

Press  on toolbar and "Analyze active job: 1.. Static Structural"

2.




Load Sets

1

Right click on *Load Sets* =>
Create/Edit multiple.

2

Fill in "4" into *Count* and press  to add four Load Sets.

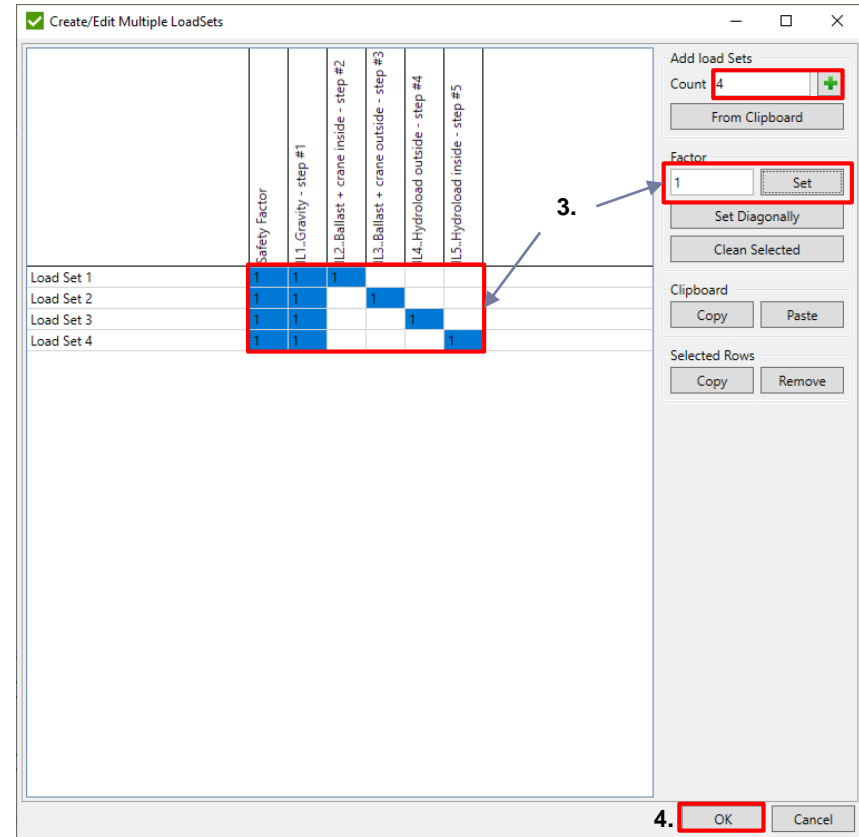
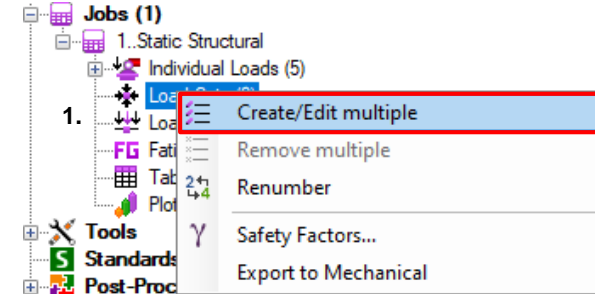
3

Select highlighted cells in the table like shown on the picture and press *Set* to define Factors of Load Sets. (By default LS Factor is 1)

4


Press *OK*

Load Sets are created with default titles "Load Set #". It is possible to rename them by double-click on the respective load set title. Alternatively, the titles and factors can be pasted from the Clipboard using *Paste* button.



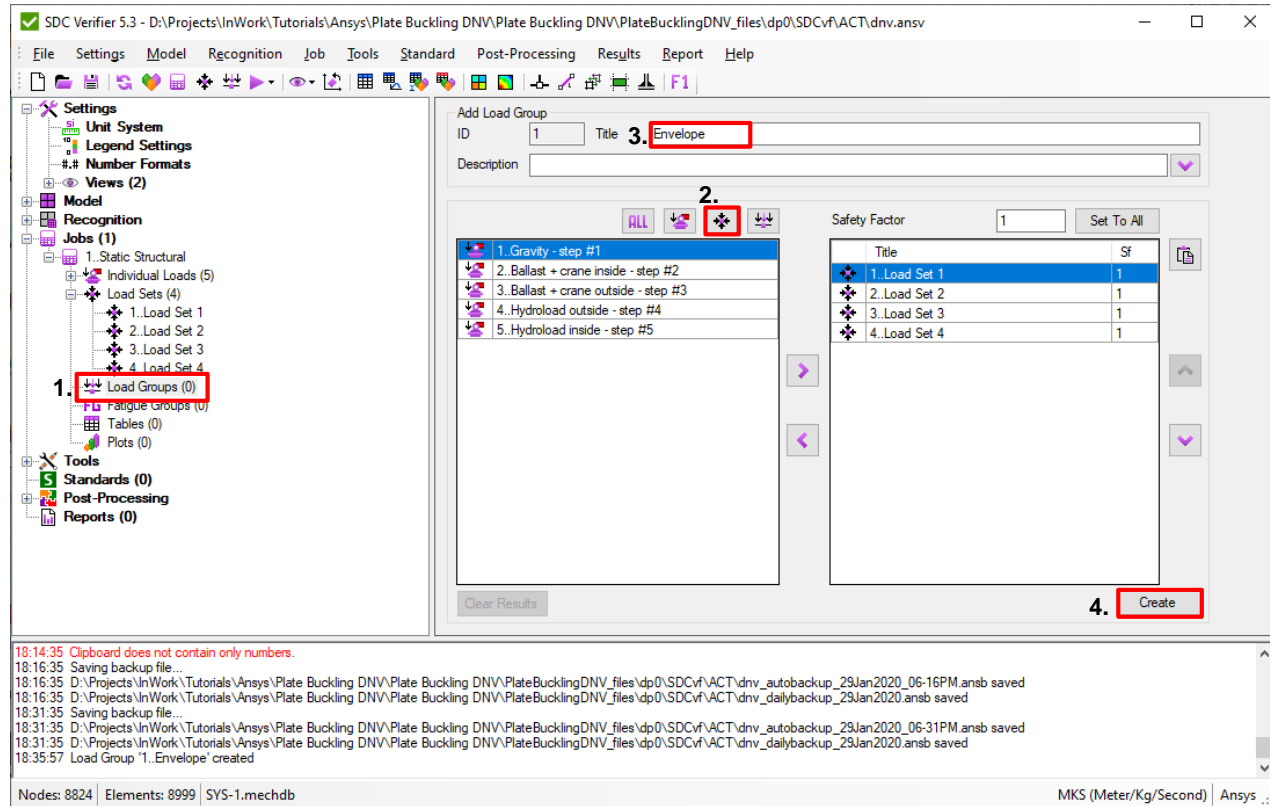
Load Groups

1 Click on *Load Groups*.

2 Press  to select all Load Sets.

3 *Title: Envelope*

4 Press *Create*



The screenshot shows the SDC Verifier 5.3 interface. The 'Add Load Group' dialog is open, with the 'Title' field set to '3. Envelope' and the 'ID' field set to '1'. The 'Description' field is empty. The 'Safety Factor' is set to '1'. The 'Create' button is highlighted. In the background, the project tree shows 'Load Groups (0)' selected, and the 'Load Sets' list contains five items: '1. Gravity - step #1', '2. Ballast + crane inside - step #2', '3. Ballast + crane outside - step #3', '4. Hydroload outside - step #4', and '5. Hydroload inside - step #5'. The 'Create' button is also highlighted in the bottom right corner of the dialog.

18:14:35 Clipboard does not contain only numbers.
18:16:35 Saving backup file...
18:16:35 D:\Projects\InWork\Tutorials\Ansys\Plate Buckling DNV\Plate Buckling DNV\PlateBucklingDNV_files\dp0\SDCvf\ACT\dnv_autobackup_29Jan2020_06-16PM.ansb saved
18:16:35 D:\Projects\InWork\Tutorials\Ansys\Plate Buckling DNV\Plate Buckling DNV\PlateBucklingDNV_files\dp0\SDCvf\ACT\dnv_dailybackup_29Jan2020.ansb saved
18:31:35 Saving backup file...
18:31:35 D:\Projects\InWork\Tutorials\Ansys\Plate Buckling DNV\Plate Buckling DNV\PlateBucklingDNV_files\dp0\SDCvf\ACT\dnv_autobackup_29Jan2020_06-31PM.ansb saved
18:31:35 D:\Projects\InWork\Tutorials\Ansys\Plate Buckling DNV\Plate Buckling DNV\PlateBucklingDNV_files\dp0\SDCvf\ACT\dnv_dailybackup_29Jan2020.ansb saved
18:35:57 Load Group '1. Envelope' created

Nodes: 8824 | Elements: 8999 | SYS-1.mechddb | MKS (Meter/Kg/Second) | Ansys ...

Load Sets and Load Groups are analyzed by SDC Verifier.

Panel Finder. Recognize Sections.

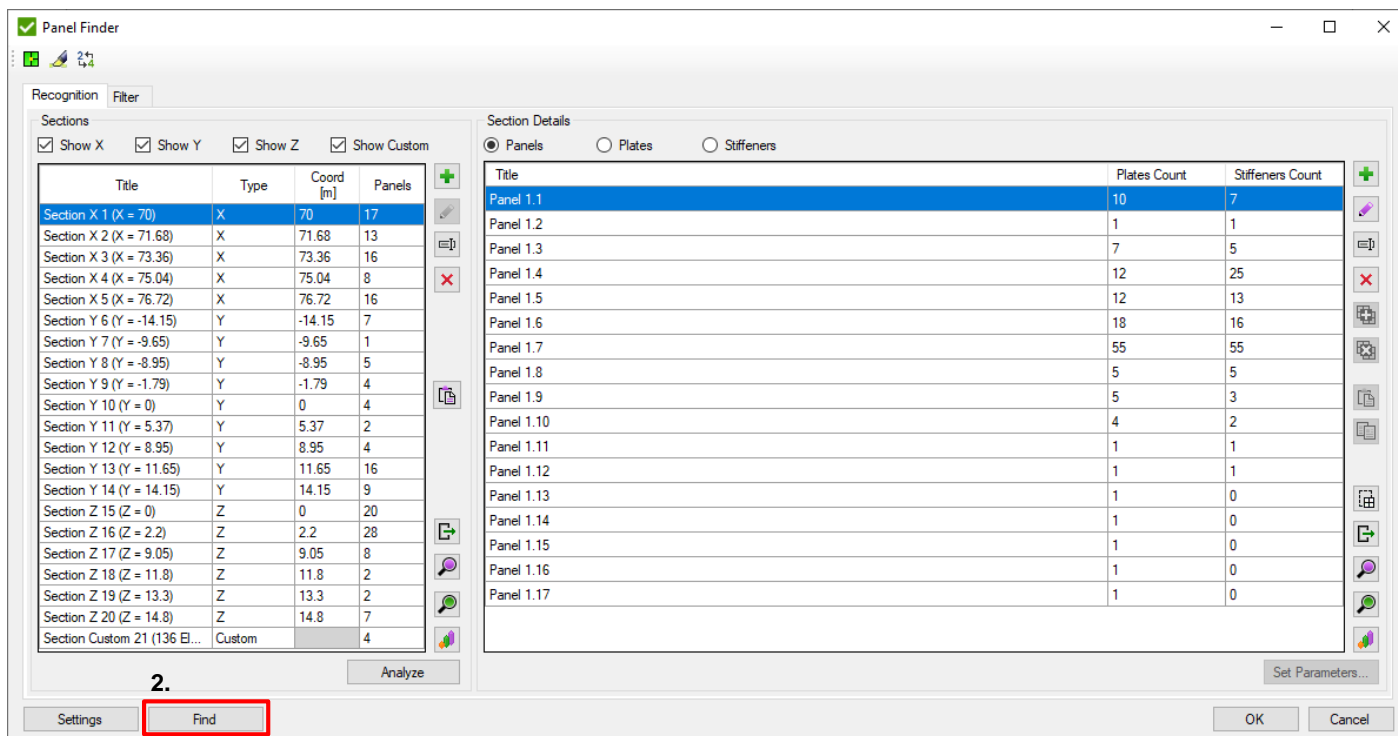
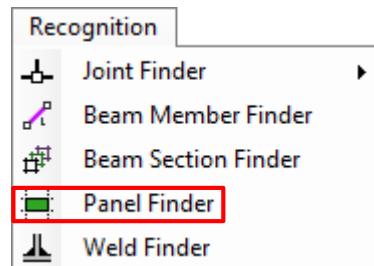
1

Execute *Recognition - Panel Finder* from main menu

2

Click on *Find*

1.



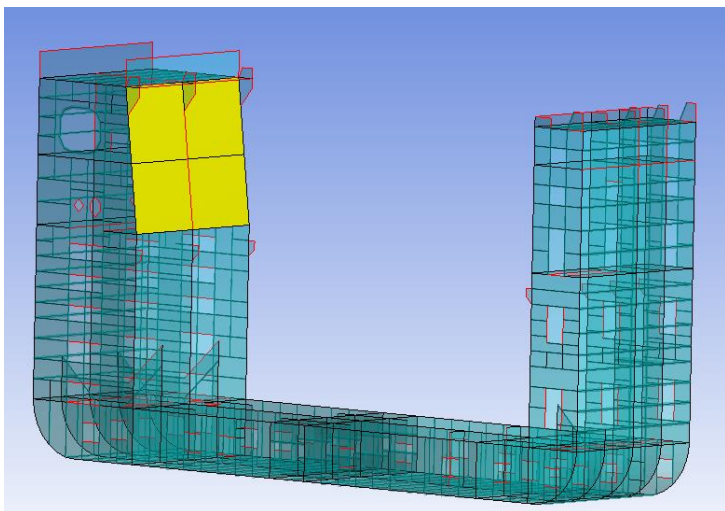
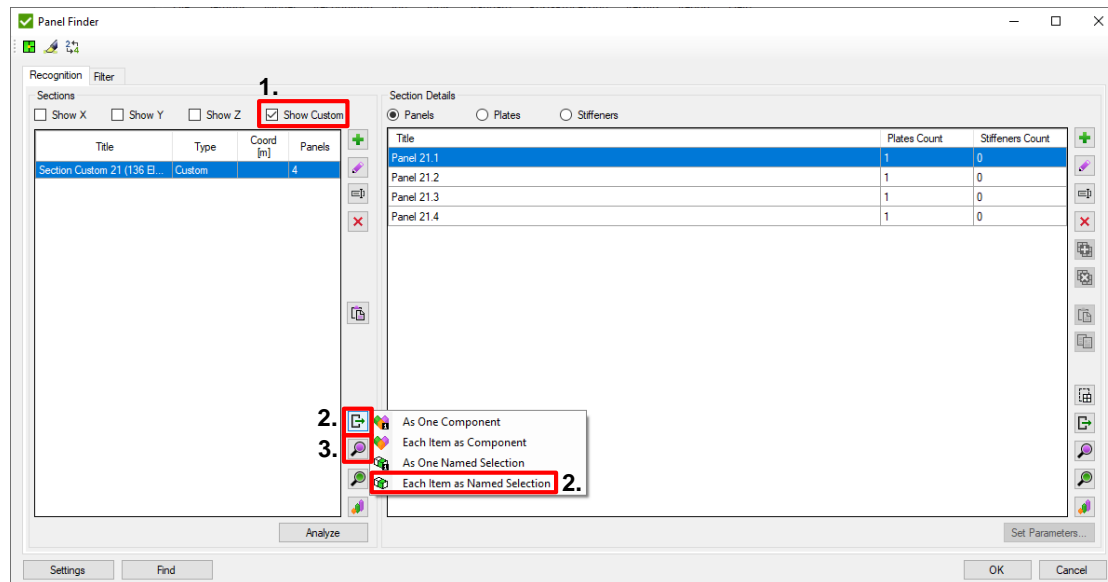
Panel Finder. Custom Section

1 Show Custom: **ON** (rest OFF)

2 Press  and  to export selected sections to Named Selection

3 Press 

Custom Section should be used for inclined/curved sections and selections like hull.



Example: It is possible to create custom section based on hull selection:


Panel Finder. Find Free Edges

Note: Before plates recognition, the model should be checked on free edges. Not correct plate dimensions/direction, plates with undefined dimensions and as result wrong buckling factor – possible consequences of free edges.

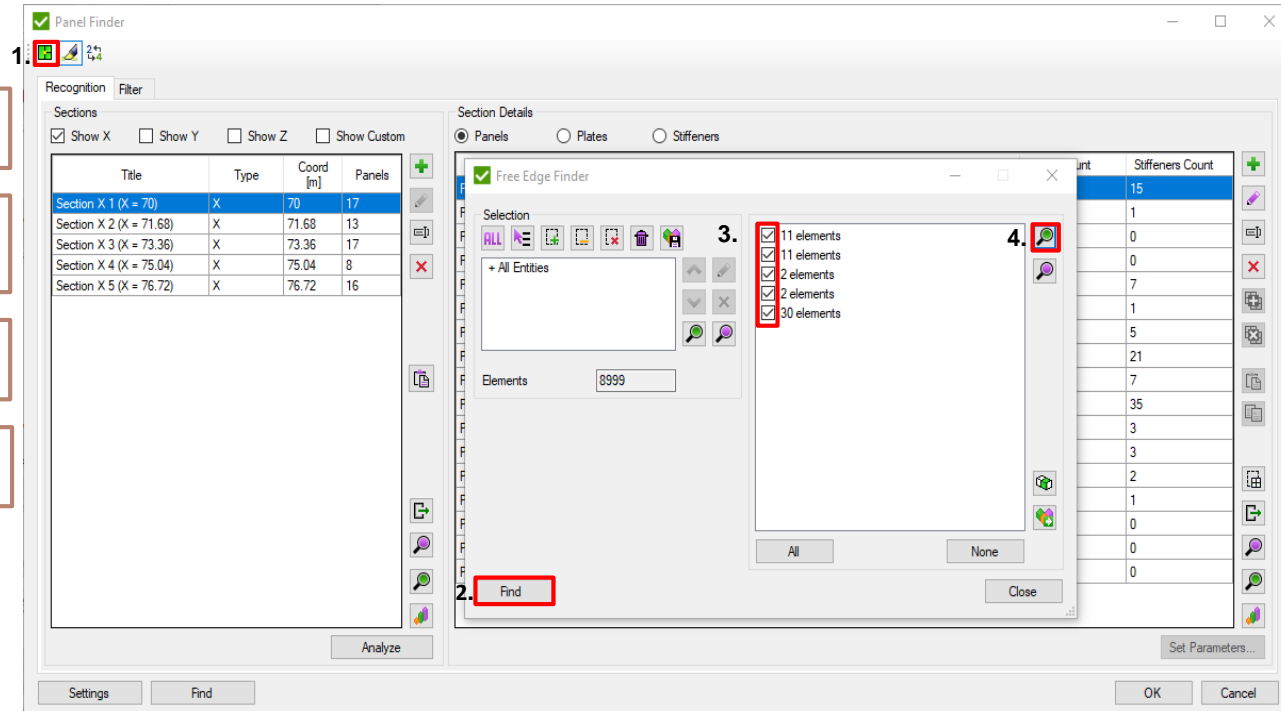
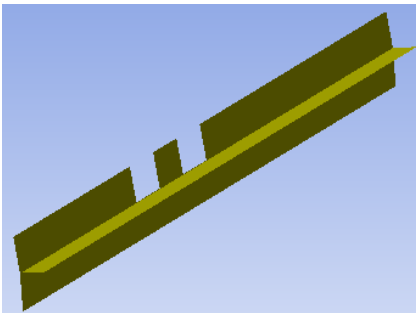
1. Click  to find free edges

2. Press **Find**

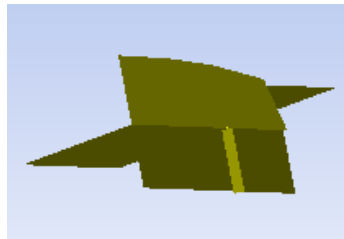
3. Select all free edges

4. Press  to preview elements with free edges

2 elements connected to 1



Mesh does not coincide



Note: Free edges should be fixed by remeshing the model and run recognition of plates. (In tutorial we skipped step with remeshing but for commercial project it is crucial step to do).

Panel Finder. Recognize plates

1 In Selection details Press **Plates**

2 Select **Section X3**.

Tip: If it is necessary to recognize plates only for one section press *Analyze*

Panel Finder

Recognition Filter

Sections

☒ Show X ☐ Show Y ☐ Show Z ☐ Show Custom

Title	Type	Coord [m]	Panels
Section X 1 (X = 70)	X	70	17
Section X 2 (X = 71.68)	X	71.68	13
Section X 3 (X = 73.36)	X	73.36	17
Section X 4 (X = 75.04)	X	75.04	8
Section X 5 (X = 76.72)	X	76.72	16

Section Details 1.

☐ Panels ☒ Plates ☐ Stiffeners

Title	Length [m]	Width [m]	Direction	Stiffeners along Length	Stiffeners along Width	Rectangular	Same Material	Thickness [m]	Related Panel	C1	C2	PaX	PaY
Plate 3.1.1 (Y = 13.38; Z = 1.18)	1.4667	0.8333	(0;0;1)	0	0	Edges: 11	Yes	0.01539855	Panel 3.1	1	1.1	1	1
Plate 3.1.2 (Y = 12.07; Z = 1.1)	2.2	0.8333	(0;0;1)	0	0	Edges: 5	Yes	0.01539855	Panel 3.1	1	1.1	1	1
Plate 3.1.3 (Y = 12.9; Z = 2.39)	2.5	1.5333	(0;-1;0)	0	0	Edges: 8	Yes	0.01539855	Panel 3.1	1	1.1	1	1
Plate 3.1.4 (Y = 13.73; Z = 3.4)	0.8333	0.8	(0;1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 3.1	1	1.1	1	1
Plate 3.1.5 (Y = 12.07; Z = 3.4)	0.8333	0.8	(0;-1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 3.1	1	1.1	1	1
Plate 3.1.6 (Y = 13.73; Z = 4.2)	0.8333	0.8	(0;1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 3.1	1	1.1	1	1
Plate 3.1.7 (Y = 12.07; Z = 4.2)	0.8333	0.8	(0;-1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 3.1	1	1.1	1	1
Plate 3.1.8 (Y = 12.9; Z = 5)	2.5	0.8	(0;-1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 3.1	1	1.1	1	1
Plate 3.1.9 (Y = 12.9; Z = 5.7)	2.5	0.6083	(0;-1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 3.1	1	1.1	1	1
Plate 3.1.10 (Y = 12.75; Z = 6.26)	2.5	0.6083	(0;-1;0)	0	0	Edges: 6	Yes	0.01539855	Panel 3.1	1	1.1	1	1
Plate 3.1.11 (Y = 13.73; Z = 6.62)	0.8333	0.4867	(0;1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 3.1	1	1.1	1	1
Plate 3.1.12 (Y = 12.07; Z = 6.92)	0.8333	0.6083	(0;-1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 3.1	1	1.1	1	1
Plate 3.1.13 (Y = 13.73; Z = 7.1)	0.8333	0.4867	(0;-1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 3.1	1	1.1	1	1
Plate 3.1.14 (Y = 12.07; Z = 7.53)	0.8333	0.6083	(0;-1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 3.1	1	1.1	1	1
Plate 3.1.15 (Y = 13.73; Z = 7.59)	0.8333	0.4867	(0;-1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 3.1	1	1.1	1	1
Plate 3.1.16 (Y = 12.9; Z = 8.14)	2.5	0.6083	(0;1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 3.1	1	1.1	1	1
Plate 3.1.17 (Y = 12.9; Z = 8.75)	2.5	0.6083	(0;1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 3.1	1	1.1	1	1
Plate 3.2.1 (Y = 13.81; Z = 15.11)	0.8333	0.7333	(0;1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 3.2	1	1.1	1	1
Plate 3.3.1 (Y = 11.53; Z = 8.2)	0.6083	0.3	(0;0;1)	0	0	Edges: 4	Yes	0.01539855	Panel 3.3	1	1.1	1	1
Plate 3.4.1 (Y = -8.82; Z = 8.22)	0.6083	0.3	(0;0;1)	0	0	Edges: 4	Yes	0.01539855	Panel 3.4	1	1.1	1	1

Analyze

Settings Find

Set Parameters... OK Cancel

Title	Length [m]	Width [m]	Direction	Stiffeners along Length	Stiffeners along Width	Rectangular	Same Material	Thickness [m]
Plate 3.5.10 (Y = -2.24; Z = 1.1)	2.2	0.895	(0;0;-1)	0	0	Edges: 4	Yes	0.01539855
Plate 3.6.1 (Y = -0.89; Z = 0.37)	1.79	0.7333	(0;1;0)	0	0	Edges: 4	Yes	0.01539855

Section ID. Panel ID. Plate ID

Plate Dimensions and Thicknesses

Dimensions: Results depend on plate dimensions and direction and it is important to understand how Panel Finder performs recognition. Length is considered the longest edge of plate and width the longest perpendicular to the longest edge:

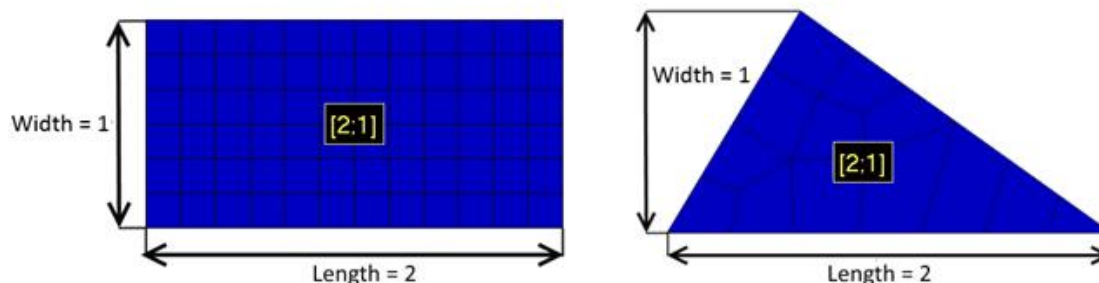
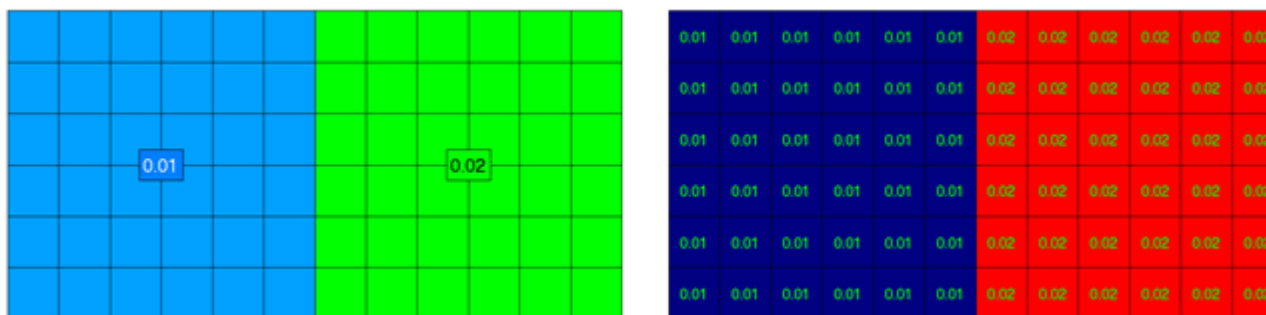


Plate Thickness: Calculations are performed on every element and thickness is taken directly from each element. It is possible to set thickness manually for plate, in this case element thickness will be ignored and user defined thickness will be used. Example: Plate with 2 properties 0.01 and 0.02 thicknesses. Left picture displays property labels with property thicknesses and right presents plate buckling plot of thickness parameter:



☒ Panel Finder Recognition Settings

Selection

☐ Use Selection

Predefined Girders

Predefined Stiffeners

Predefined Borders

Plates

Minimum Angle Between Plate Edges [0:90]

☐ Skip Not Four Edged Plates

☐ Skip Triangular Plates

☒ Skip Curved Stiffeners

☐ Split Plate on Thickness Difference

☐ Calculate Dimensions by CSR Method

Default Titles by Section Type

Section X

Section Y

Section Z

Section Custom

Sections

Coordinate Deviation Limit of Section Plane

Minimum Elements Count in a Section

Minimum Angle Between Inclined Plane Normals [0:90]

OK Cancel

2.3.2 Modelling of an unstiffened panel with irregular geometry

Unstiffened panels with irregular geometry are to be idealised to equivalent panels for plate buckling assessment according to the following procedure:

- e) The length of shorter side, b in mm, is to be taken as:

$$b = A/a$$

where:

A : Area of the plate, in mm²

a : length defined in (d), in mm

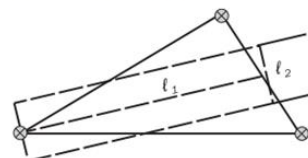


- c) The width of the model, ℓ_2 , in mm, is to be taken as:

$$\ell_2 = A/\ell_1$$

where:

A : Area of the plate, in mm²



Editing plates manually

To modify plates select them from the list and press *Set Parameters*. It is possible to edit (Length / Width / Thickness / Coefficients / Direction).

It is possible to define parametric stiffeners along the Length and Width.

If thickness is changed you can see in table what was the original thickness recognized from model:

Thickness [m]

0.012 (Original: 0.01539855)

0.012 (Original: 0.01539855)

0.012 (Original: 0.01539855)

Panel Finder

Recognition Filter

Sections

☒ Show X ☐ Show Y ☐ Show Z ☐ Show Custom

Title	Type	Coord [m]	Panels
Section X 1 (X = 70)	X	70	17
Section X 2 (X = 71.68)	X	71.68	13
Section X 3 (X = 73.36)	X	73.36	17
Section X 4 (X = 75.04)	X	75.04	8
Section X 5 (X = 76.72)	X	76.72	16

Section Details

☐ Panels ☒ Plates ☐ Stiffeners

Title	Length [m]	Width [m]	Direction	Stiffeners along Length	Stiffeners along Width	Rectangular	Same Material	Thickness [m]	Related Panel	C1	C2	Psi X	Psi Y
Plate 1.1.1 (Y = 13.64; Z = 1.48)	1.7077	0.8333	(0;0;1)	0	0	Edges: 7	Yes	0.01539855	Panel 1.1	1	1.1	1	1
Plate 1.1.2 (Y = 12.84; Z = 0.44)	0.8333	0.6799	(0;1;0)	0	0	Edges: 5	Yes	0.01539855	Panel 1.1	1	1.1	1	1
Plate 1.1.3 (Y = 12.07; Z = 1.1)	2.2	0.8333	(0;0;1)	0	0	Edges: 5	Yes	0.01539855	Panel 1.1	1	1.1	1	1
Plate 1.1.4 (Y = 12.9; Z = 2.39)	2.5	1.5333	(0;-1;0)	0	0	Edges: 8	Yes	0.01539855	Panel 1.1	1	1.1	1	1
Plate 1.1.5 (Y = 13.73; Z = 3.4)	0.8333	0.8	(0;1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 1.1	1	1.1	1	1
Plate 1.1.6 (Y = 12.07; Z = 3.4)	0.8333	0.8	(0;-1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 1.1	1	1.1	1	1
Plate 1.1.7 (Y = 13.73; Z = 4.2)	0.8333	0.8	(0;1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 1.1	1	1.1	1	1
Plate 1.1.8 (Y = 12.07; Z = 4.2)	0.8333	0.8	(0;-1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 1.1	1	1.1	1	1
Plate 1.1.9 (Y = 12.9; Z = 5)	2.5	0.8	(0;-1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 1.1	1	1.1	1	1
Plate 1.1.10 (Y = 12.9; Z = 5.7)	2.5	0.6083	(0;-1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 1.1	1	1.1	1	1
Plate 1.1.11 (Y = 12.75; Z = 6.26)	2.5	0.6083	(0;-1;0)	0	0	Edges: 6	Yes	0.01539855	Panel 1.1	1	1.1	1	1
Plate 1.1.12 (Y = 13.73; Z = 6.62)	0.8333	0.4867	(0;1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 1.1	1	1.1	1	1
Plate 1.1.13 (Y = 12.07; Z = 6.92)	0.8333	0.6083	(0;-1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 1.1	1	1.1	1	1
Plate 1.1.14 (Y = 13.73; Z = 7.1)	0.8333	0.4867	(0;-1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 1.1	1	1.1	1	1
Plate 1.1.15 (Y = 12.07; Z = 7.53)	0.8333	0.6083	(0;-1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 1.1	1	1.1	1	1
Plate 1.1.16 (Y = 13.73; Z = 7.59)	0.8333	0.4867	(0;-1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 1.1	1	1.1	1	1
Plate 1.1.17 (Y = 12.9; Z = 8.14)	2.5	0.6083	(0;1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 1.1	1	1.1	1	1
Plate 1.1.18 (Y = 12.9; Z = 8.75)	2.5	0.6083	(0;1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 1.1	1	1.1	1	1

Settings Find Analyze

Set Parameters...

OK Cancel

Usually you should not modify plate directions. But in case it is required press *Set Direction*.

Set Plates Parameters (Leave Empty Field to not to Set a Value)

Dimensions

☒ Set Length/Width Value

Length [m]

Width [m]

☐ Set Stiffeners Amount along Plate's:

Length

Width

Thickness [m]

Coefficients

C1

C2

Psi X

Psi Y

Direction

☐ Swap Direction for

☒ Plates where Width > Length

☐ All Plates

☒ Set Direction

Direction X

Y

Z

OK Cancel

Panel Finder. Plates Plot


1

Select **Section X1**


2

Select All *Plates* (Ctrl+A)

3

Press 

4

Click on  Colors + Labels of Ids

Panel Finder

Recognition Filter

Sections

☒ Show X ☐ Show Y ☐ Show Z ☐ Show Custom

Title	Type	Coord [m]	Panels
Section X 1 (X = 70)	X	70	17
Section X 2 (X = 71.68)	X	71.68	13
Section X 3 (X = 73.36)	X	73.36	17
Section X 4 (X = 75.04)	X	75.04	8
Section X 5 (X = 76.72)	X	76.72	16

Section Details

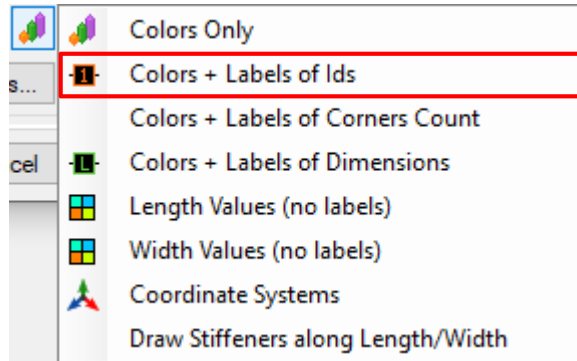
☐ Panels ☒ Plates ☐ Stiffeners

Title	Length [m]	Width [m]	Direction	Stiffeners along Length	Stiffeners along Width	Rectangular	Same Material	Thickness [m]	Related Panel	C1	C2	PaX	PaY
Plate 1.1.1 (Y = 13.64, Z = 1.48)	1.7077	0.8333	(0;0;1)	0	0	Edges: 7	Yes	0.01539855	Panel 1.1	1	1.1	1	1
Plate 1.1.2 (Y = 12.94, Z = 0.44)	0.8333	0.6799	(0;1;0)	0	0	Edges: 5	Yes	0.01539855	Panel 1.1	1	1.1	1	1
Plate 1.1.3 (Y = 12.07, Z = 1.1)	2.2	0.8333	(0;0;1)	0	0	Edges: 5	Yes	0.01539855	Panel 1.1	1	1.1	1	1
Plate 1.1.4 (Y = 12.9, Z = 2.39)	2.5	1.5333	(0;-1;0)	0	0	Edges: 8	Yes	0.01539855	Panel 1.1	1	1.1	1	1
Plate 1.1.5 (Y = 13.73, Z = 3.4)	0.8333	0.8	(0;-1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 1.1	1	1.1	1	1
Plate 1.1.6 (Y = 12.07, Z = 3.4)	0.8333	0.8	(0;-1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 1.1	1	1.1	1	1
Plate 1.1.7 (Y = 13.73, Z = 4.2)	0.8333	0.8	(0;-1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 1.1	1	1.1	1	1
Plate 1.1.8 (Y = 12.07, Z = 4.2)	0.8333	0.8	(0;-1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 1.1	1	1.1	1	1
Plate 1.1.9 (Y = 12.9, Z = 5)	2.5	0.8	(0;-1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 1.1	1	1.1	1	1
Plate 1.1.10 (Y = 12.9, Z = 5.7)	2.5	0.6083	(0;-1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 1.1	1	1.1	1	1
Plate 1.1.11 (Y = 12.75, Z = 6.26)	2.5	0.6083	(0;-1;0)	0	0	Edges: 6	Yes	0.01539855	Panel 1.1	1	1.1	1	1
Plate 1.1.12 (Y = 13.73, Z = 6.62)	0.8333	0.4867	(0;-1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 1.1	1	1.1	1	1
Plate 1.1.13 (Y = 12.07, Z = 6.92)	0.8333	0.6083	(0;-1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 1.1	1	1.1	1	1
Plate 1.1.14 (Y = 13.73, Z = 7.1)	0.8333	0.4867	(0;-1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 1.1	1	1.1	1	1
Plate 1.1.15 (Y = 12.07, Z = 7.53)	0.8333	0.6083	(0;-1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 1.1	1	1.1	1	1
Plate 1.1.16 (Y = 13.73, Z = 7.59)	0.8333	0.4867	(0;-1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 1.1	1	1.1	1	1
Plate 1.1.17 (Y = 12.9, Z = 8.14)	2.5	0.6083	(0;-1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 1.1	1	1.1	1	1
Plate 1.1.18 (Y = 12.9, Z = 8.79)	2.5	0.6083	(0;-1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 1.1	1	1.1	1	1
Plate 1.2.1 (Y = 13.81, Z = 15.11)	0.8333	0.7333	(0;1;0)	0	0	Edges: 4	Yes	0.01539855	Panel 1.2	1	1.1	1	1
Plate 1.3.1 (Y = 11.53, Z = 8.2)	0.6083	0.3	(0;0;1)	0	0	Edges: 4	Yes	0.01539855	Panel 1.3	1	1.1	1	1

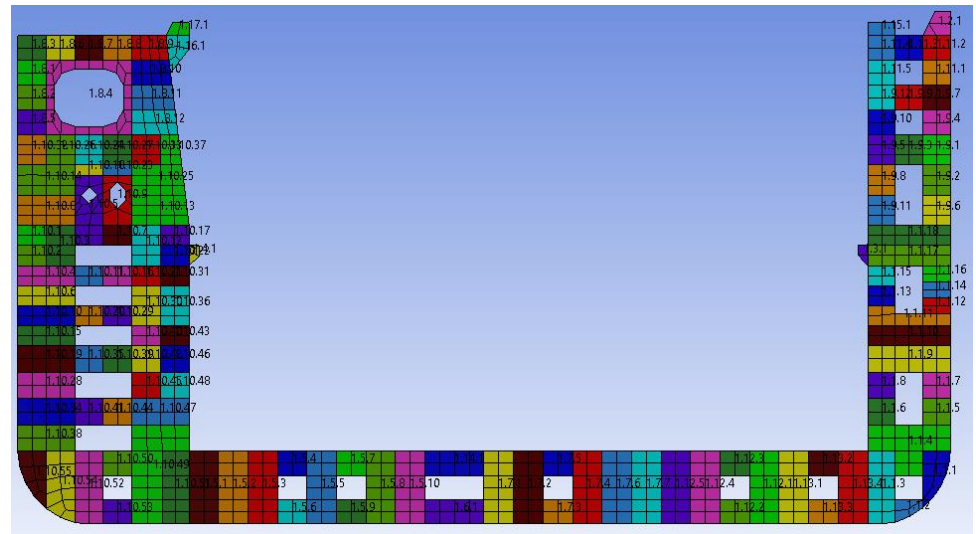
Analyze

Settings Find

Set Parameters... OK Cancel



4.



Panel Finder. Stiffeners Plot

1 Select *Stiffeners*

2 Select All *Stiffeners* (Ctrl+A)

3 Press 

4 Click on  Colors + Labels of Ids

Panel Finder

Recognition Filter

Sections

☒ Show X ☐ Show Y ☐ Show Z ☐ Show Custom

Title	Type	Coord [m]	Panels
Section X 1 (K = 70)	X	70	17
Section X 2 (K = 71.68)	X	71.68	13
Section X 3 (K = 73.36)	X	73.36	17
Section X 4 (K = 75.04)	X	75.04	8
Section X 5 (K = 76.72)	X	76.72	16

Analyze

Section Details


☐ Panels ☐ Plates ☒ Stiffeners


Title	Length [m]	Width [m]	Lg [m]	Lt [m]	Is same Y Axis	Is curved	Property	Related Panel	Stiffener Type	Related Plates count
Stiffener 1.1.1 [70; 13.32; 1.35]	1.708	0.7435	0	1.708	Yes	No	7.CrossSection:10	Panel 1.1	Continuous	3
Stiffener 1.1.2 [70; 12.48; 1.11]	2.147	0.7549	0	2.147	Yes	No	9.CrossSection:9	Panel 1.1	Continuous	3
Stiffener 1.1.3 [70; 12.9; 3]	2.5	0.8815	0	2.5	Yes	No	9.CrossSection:9	Panel 1.1	Continuous	3
Stiffener 1.1.4 [70; 13.73; 3.8]	0.833	0.8	0	0.833	Yes	No	9.CrossSection:9	Panel 1.1	Continuous	2
Stiffener 1.1.5 [70; 12.07; 3.8]	0.833	0.8	0	0.833	Yes	No	9.CrossSection:9	Panel 1.1	Continuous	2
Stiffener 1.1.6 [70; 12.9; 4.6]	2.5	0.8	0	2.5	Yes	No	9.CrossSection:9	Panel 1.1	Continuous	3
Stiffener 1.1.7 [70; 12.9; 5.4]	2.5	0.7042	0	2.5	Yes	No	9.CrossSection:9	Panel 1.1	Continuous	2
Stiffener 1.1.8 [70; 12.9; 6.01]	2.5	0.5272	0	2.5	Yes	No	9.CrossSection:9	Panel 1.1	Continuous	2
Stiffener 1.1.9 [70; 13.32; 6.37]	1.667	0.4258	0	1.667	Yes	No	9.CrossSection:9	Panel 1.1	Continuous	2
Stiffener 1.1.10 [70; 12.07; 6.37]	0.833	0.6083	0	0.833	Yes	No	9.CrossSection:9	Panel 1.1	Continuous	2
Stiffener 1.1.11 [70; 13.73; 6.37]	0.833	0.4867	0	0.833	Yes	No	9.CrossSection:9	Panel 1.1	Continuous	2
Stiffener 1.1.12 [70; 12.07; 7.1]	0.833	0.6083	0	0.833	Yes	No	9.CrossSection:9	Panel 1.1	Continuous	2
Stiffener 1.1.13 [70; 13.73; 7.1]	0.833	0.4867	0	0.833	Yes	No	9.CrossSection:9	Panel 1.1	Continuous	2
Stiffener 1.1.14 [70; 12.9; 7.83]	2.5	0.5678	0	2.5	Yes	No	9.CrossSection:9	Panel 1.1	Continuous	3
Stiffener 1.1.15 [70; 12.9; 8.44]	2.5	0.6083	0	2.5	Yes	No	9.CrossSection:9	Panel 1.1	Continuous	2
Stiffener 1.2.1 [70; 13.49; 15.1]	0.815	0.522	0	0.815	Yes	No	7.CrossSection:10	Panel 1.2	Continuous	1
Stiffener 1.5.1 [70; -8.06; 1.1]	2.2	0.895	0	2.2	Yes	No	7.CrossSection:10	Panel 1.5	Continuous	2


Settings Find


Set Parameters... OK Cancel


Colors Only


 Colors + Labels of Ids


 Colors + Labels of Lengths


 Colors + Labels of Widths

 Length Values (no labels)

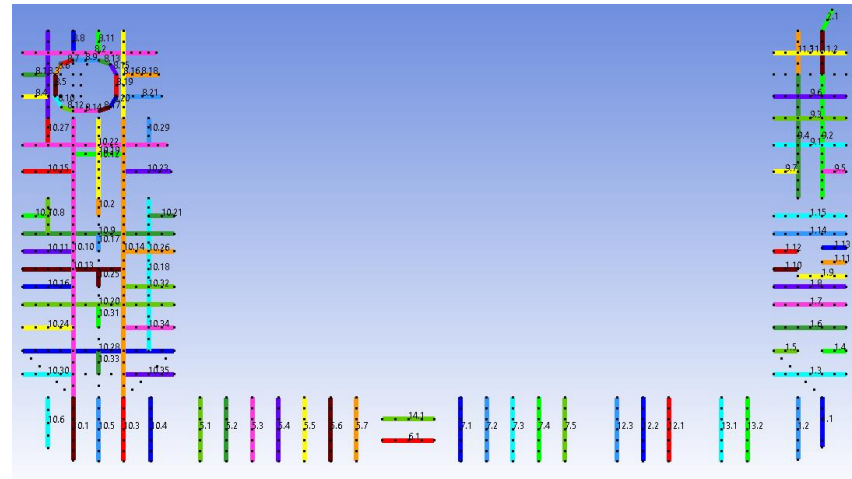
 Width Values (no labels)

 Max Girder Length, Lg (no labels)

 Torsional Length, Lt (no labels)

 Sniped or Continuous

4.



Panel Finder. Filter

Note: It is very important to check that all plates dimensions were recognized. If in the model, there are coincident nodes, coincident elements or free edges Panel Finder cannot recognize plate dimensions.

1

Click on *Filter* tab

2

Selection: **All Entities**

3

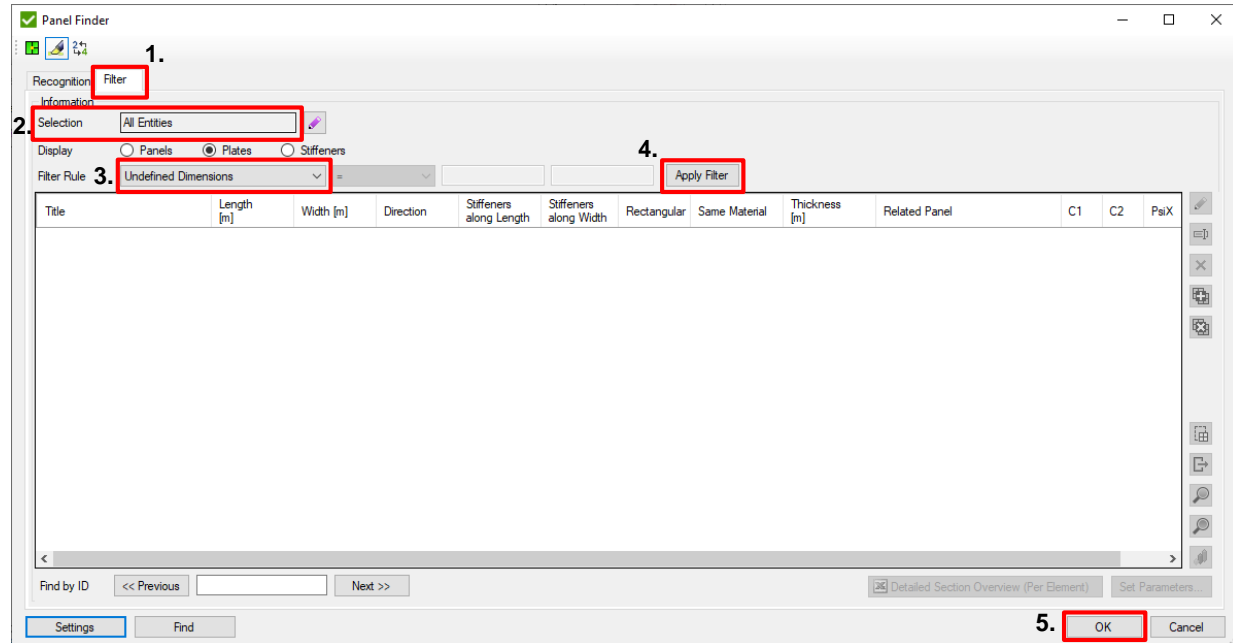
Filter: **Undefined dimensions**

4

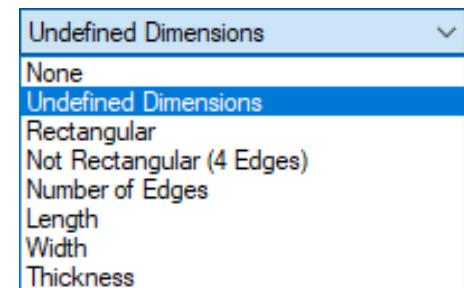
Press *Apply Filter*

5

Table with plates is empty means that there is no plates with undefined dimensions. Press *OK*



Tip: It is also possible to filter plates by shape (triangle, rectangular) or number of edges parameters.
E.g. Plates with numbers of edges > 4 can be displayed.
Control using Selection plates from which Sections should be filtered.

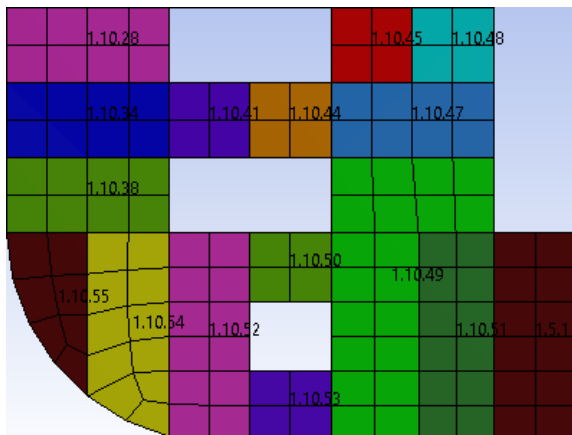


Panel Finder. Plot Options

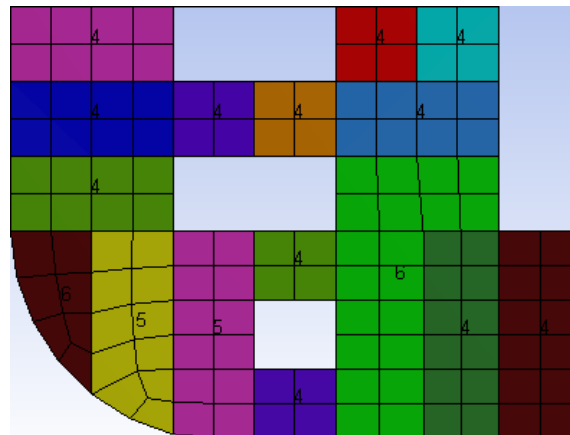
Note: Plate Plot can be displayed with different colors labels (labels of ids, labels of corners count or labels of dimensions). Also it is possible to show plates in length and width, coordinate systems etc.



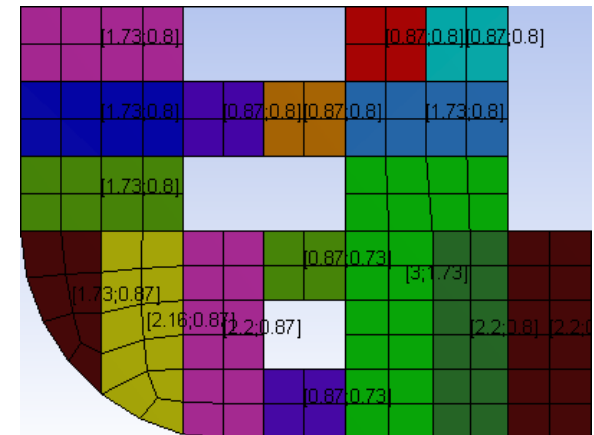
Labels of Ids



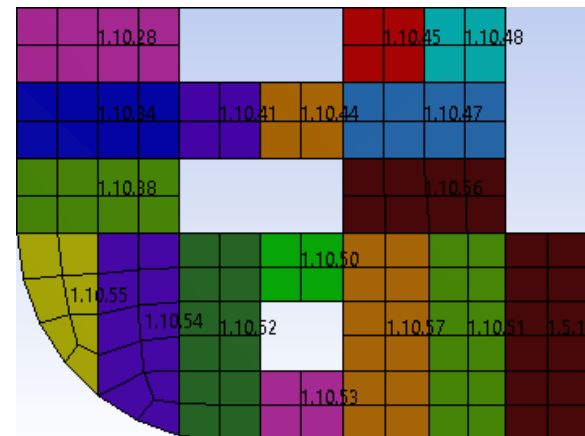
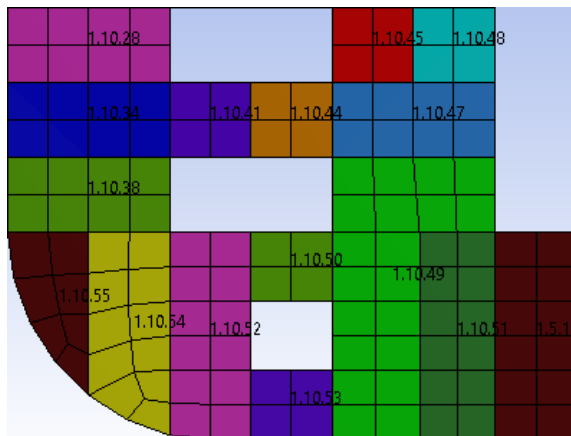
Labels of Corners Count



Labels of dimensions



In some cases (e.g. stiffener is not modeled) plate is recognized not correctly, dimensions are bigger than in reality which leads to wrong results. Plate has to be updated manually. In Section X1 plate with Id = 1.10.49 should be split on 2 plates



Add Plate Buckling DNV 2010 standard

1

In Standards Context menu execute
*Add => DNV => DNV RP-C201
Plate/Stiffener Buckling (2010)*

2

Utilization Factor (Eta) = **1.15**

3

Press 

4

Press *Update from Ansys*

5

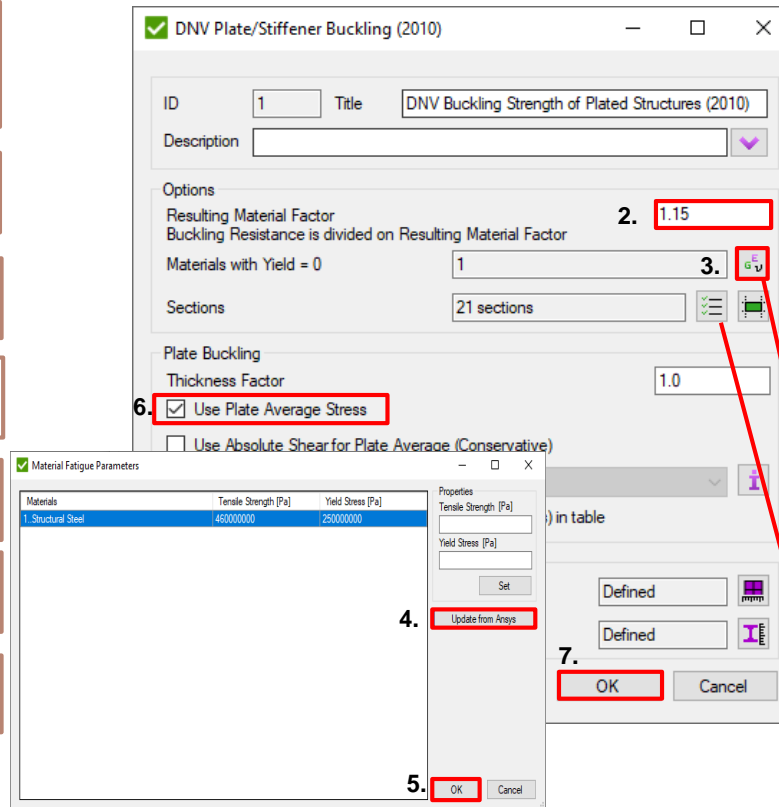
Press *OK*

6


Use Plate Average Stress: **On**


7

Press *OK*



Thickness factor gives a possibility to increase / decrease all plates thicknesses without reanalyzing the model. E.g. 1.2 means increase thickness on 20% and decrease stresses

Materials with Yield Stress = 0 shows how many materials have yield equal to 0. If value is > 0 press  to define yield.

By default all sections will be checked. Click  to modify.

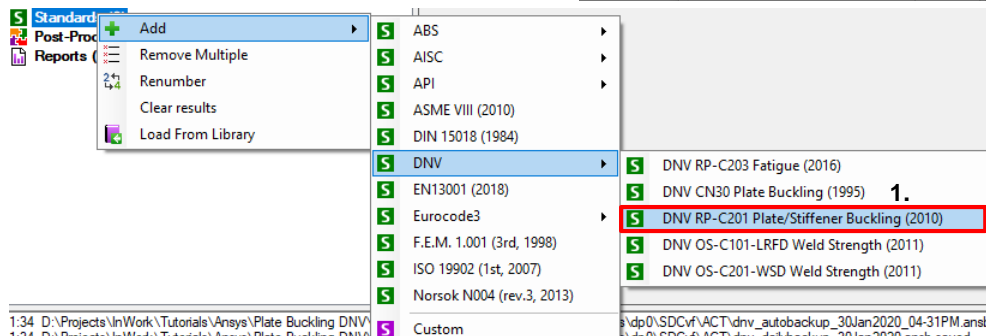
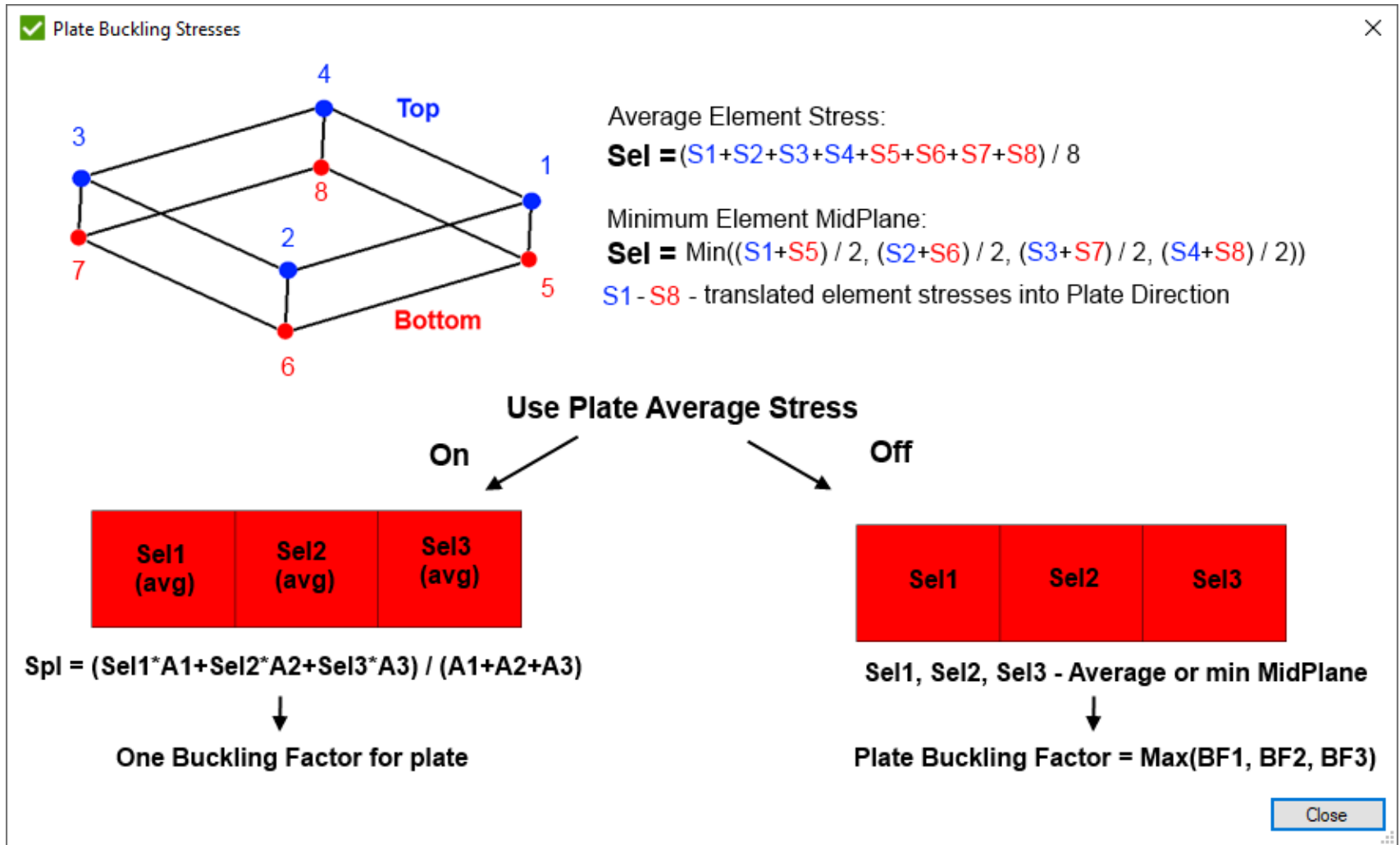


Plate Buckling transforms stresses automatically into plate direction. Options about element stresses and plate stresses are described on the next slide



Views

1 Execute Views => **Add**

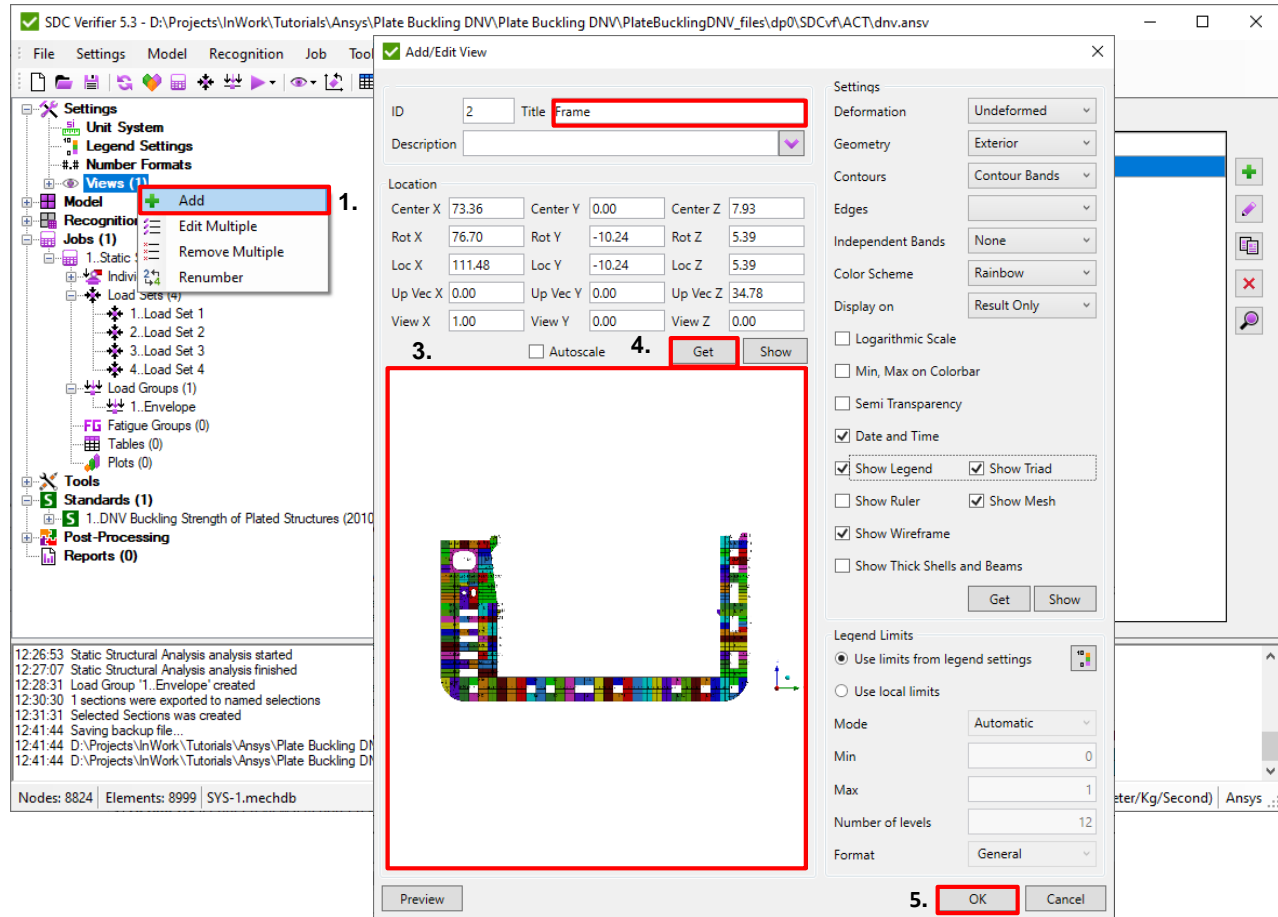
2 Title: **Frame**

3 Orient model in Ansys as shown on picture below (ZY plane)

4 Press **Get**

5 Press **OK**

To make nice plots first Views should be created (set of settings how to display plot).



Views

1 Execute Views => **Add**

2 Title: **Stiffeners**

3 Orient model in Ansys as shown on picture below (ZY plane)

4 Press **Get**

5 Press **OK**

To make nice plots first Views should be created (set of settings how to display plot).

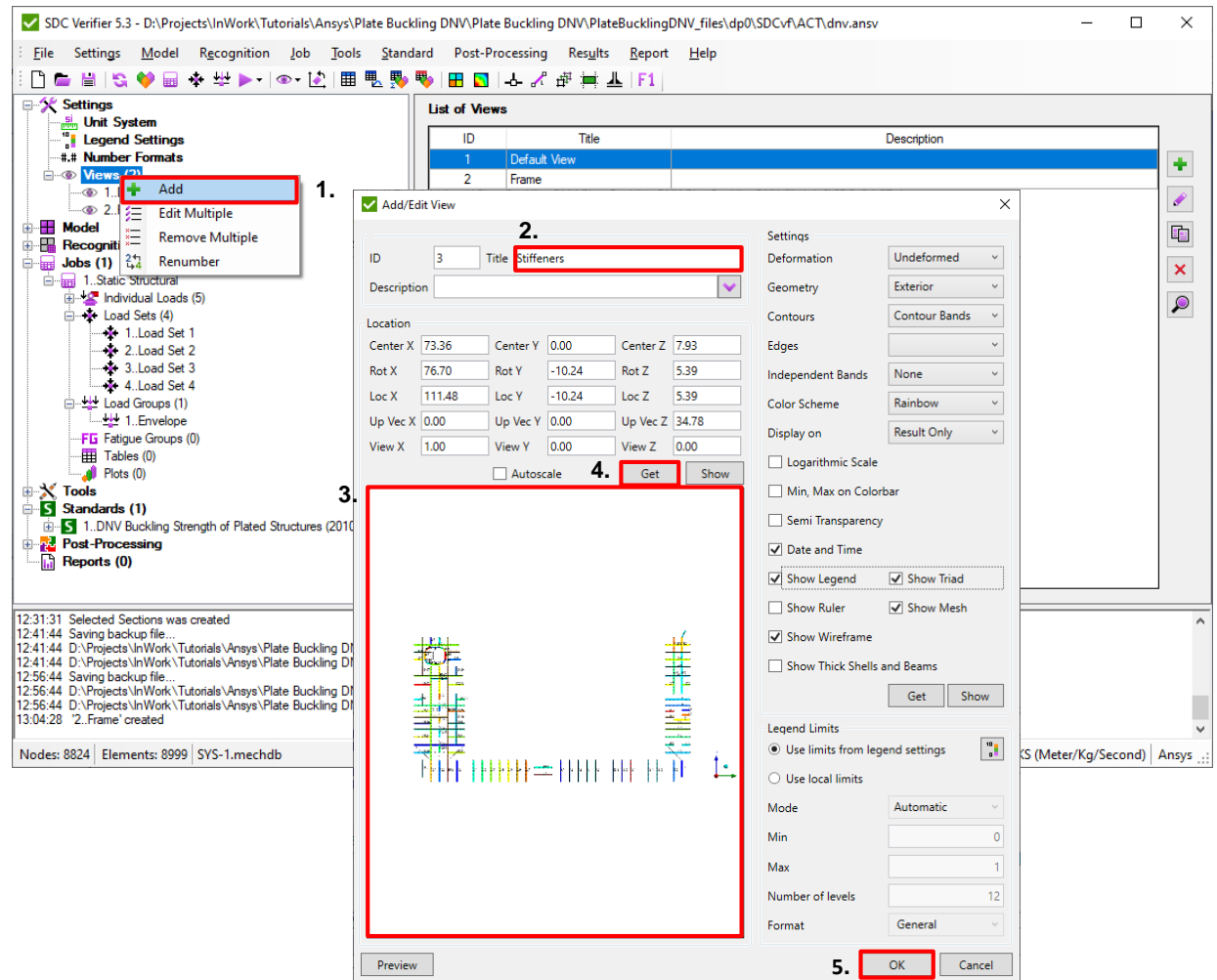


Plate Buckling Plot

1

Execute *Criteria Plot* from Plate Buckling DNV 2010 context menu

2

Load Group: **1..Envelop**

3

View: **2..Frame**

4

Press  and Select: **1..Section X1**

5

Press *OK*

6

Press  *Preview*

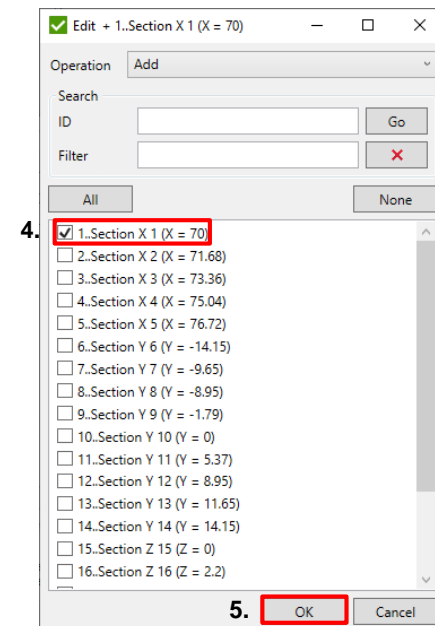
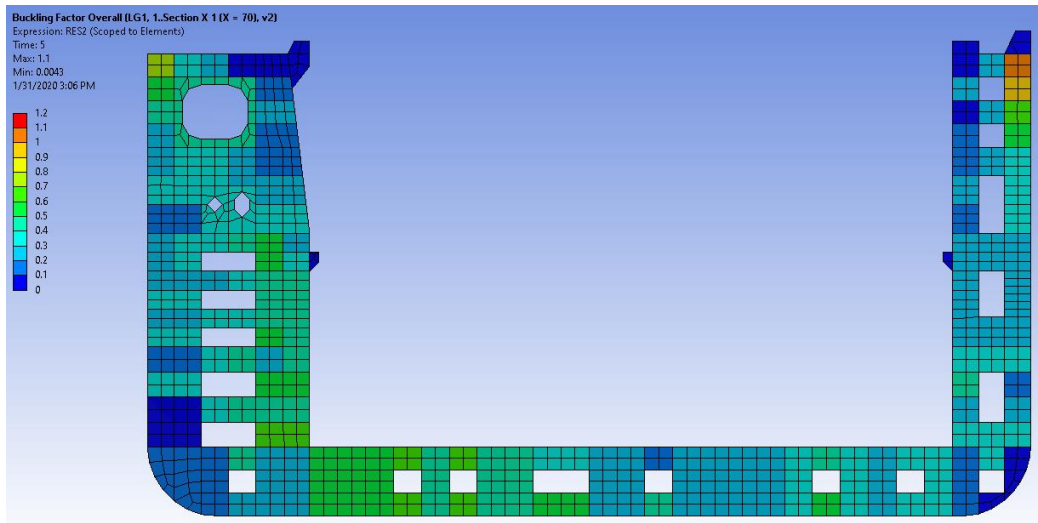
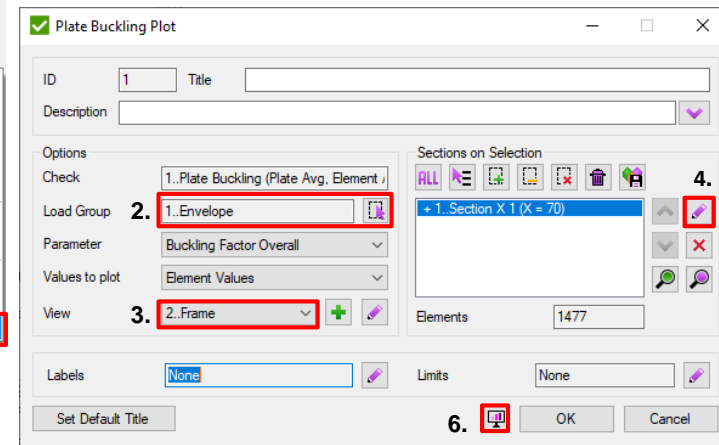
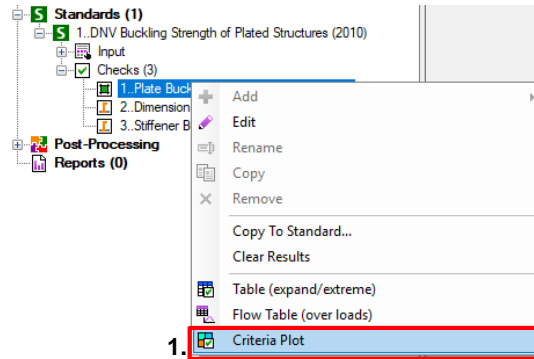


Plate Buckling Table

1

Execute *Table(expand/extreme)* from Plate Buckling DVN 2010 context menu

2

Load Group: **1..Envelop**

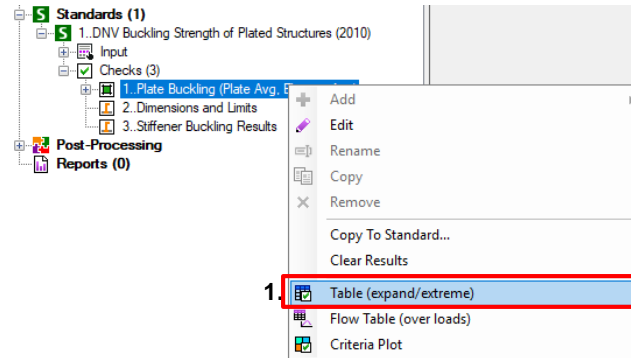
3

Show plates results: **OFF**

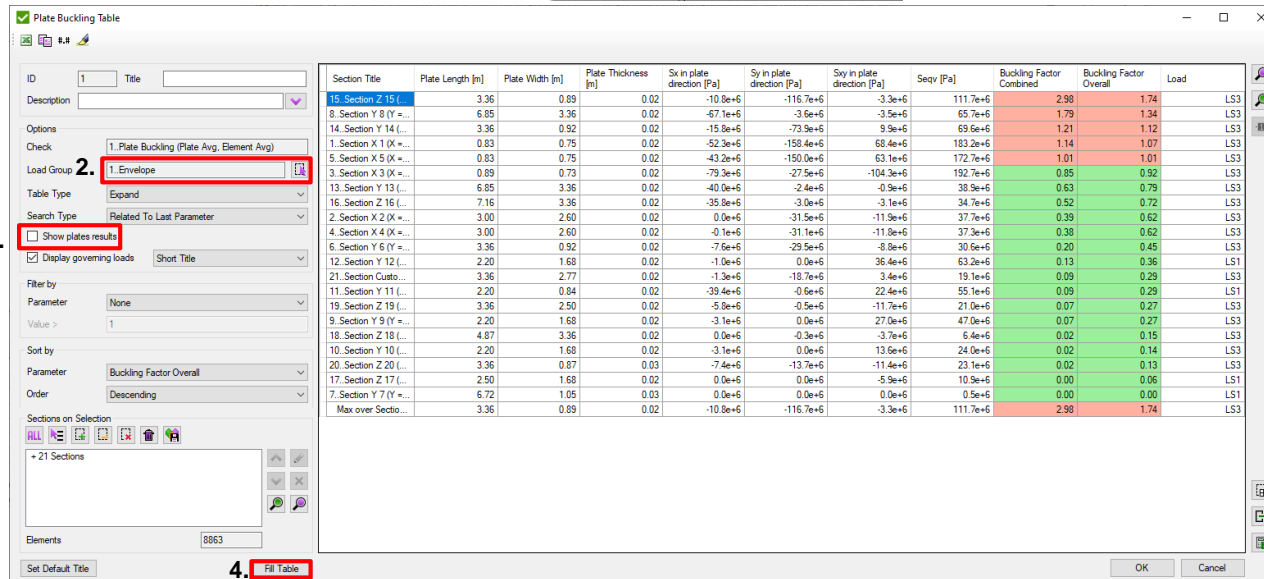
4

Press *Fill Table*

Use **Show plates results** for detailed table with results for all plates. Otherwise only the worst results over Sections will be shown.



3.



Report. Tables

1

Execute Reports => Add =>
Designer - Results


2

Plate Buckling DNV 2010 check
context menu in model tree =>
Table(expand/extreme)

3

Type: **Expand**

4

Press  and select **LS; LG** loads.

5

Press **OK**

6

Press  and Execute  **From List**

7

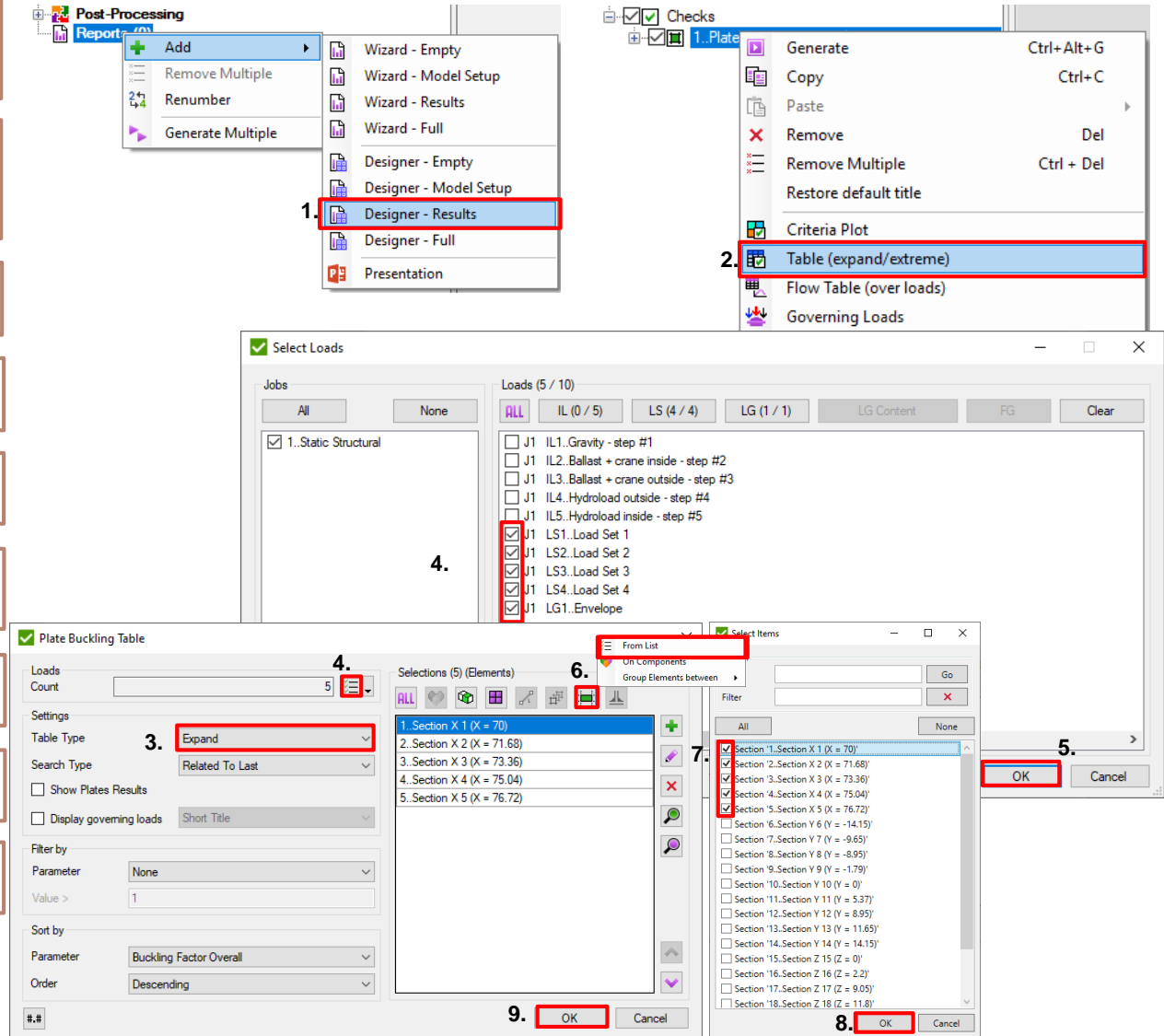
Select all **X Sections**

8

Press **OK**

9

Press **OK**



Post-Processing
Report
+ Add
Remove Multiple
Renumber
Generate Multiple

Wizard - Empty
Wizard - Model Setup
Wizard - Results
Wizard - Full
Designer - Empty
Designer - Model Setup
1. Designer - Results
Designer - Full
Presentation

Checks
1..Plate
Generate Ctrl+Alt+G
Copy Ctrl+C
Paste
Remove Del
Remove Multiple Ctrl+Del
Restore default title
Criteria Plot
2. Table (expand/extreme)
Flow Table (over loads)
Governing Loads

Select Loads
Jobs: All, None
Loads (5 / 10): ALL, IL (0 / 5), LS (4 / 4), LG (1 / 1), LG Content, FG, Clear
1..Static Structural
J1 IL1.Gravity - step #1
J1 IL2.Ballast + crane inside - step #2
J1 IL3.Ballast + crane outside - step #3
J1 IL4.Hydroload outside - step #4
J1 IL5.Hydroload inside - step #5
J1 LS1.Load Set 1
J1 LS2.Load Set 2
J1 LS3.Load Set 3
J1 LS4.Load Set 4
J1 LG1.Envelope

Plate Buckling Table
Loads Count: 5
Settings: Table Type: 3. Expand, Search Type: Related To Last, Show Plates Results, Display governing loads: Short Title
Filter by: Parameter: None, Value: 1
Sort by: Parameter: Buckling Factor Overall, Order: Descending

Selections (5) (Elements)
1. Section X 1 (X = 70)
2. Section X 2 (X = 71.68)
3. Section X 3 (X = 73.36)
4. Section X 4 (X = 75.04)
5. Section X 5 (X = 76.72)

From List
On Components
Group Elements between

Select Items
Filter: All, None
7. Section '1..Section X 1 (X = 70)'
8. Section '2..Section X 2 (X = 71.68)'
9. Section '3..Section X 3 (X = 73.36)'
10. Section '4..Section X 4 (X = 75.04)'
11. Section '5..Section X 5 (X = 76.72)'
12. Section '6..Section Y 6 (Y = -14.15)'
13. Section '7..Section Y 7 (Y = -9.65)'
14. Section '8..Section Y 8 (Y = -8.95)'
15. Section '9..Section Y 9 (Y = -1.79)'
16. Section '10..Section Y 10 (Y = 0)'
17. Section '11..Section Y 11 (Y = 5.37)'
18. Section '12..Section Y 12 (Y = 8.95)'
19. Section '13..Section Y 13 (Y = 11.65)'
20. Section '14..Section Y 14 (Y = 14.15)'
21. Section '15..Section Z 15 (Z = 0)'
22. Section '16..Section Z 16 (Z = 2.2)'
23. Section '17..Section Z 17 (Z = 9.05)'
24. Section '18..Section Z 18 (Z = 11.8)'

OK

OK

Report. Plots

1

Click **Criteria Plot** in *Plate Buckling DNV 2010* check context menu


2

Parameter: **Buckling Factor Overall.**

3

Views: **Frame.**

4

Press , select **LS; LG** Loads and Press **OK**.

5

Press  and Execute  **From List**

6

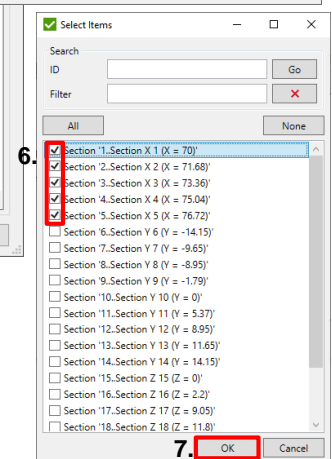
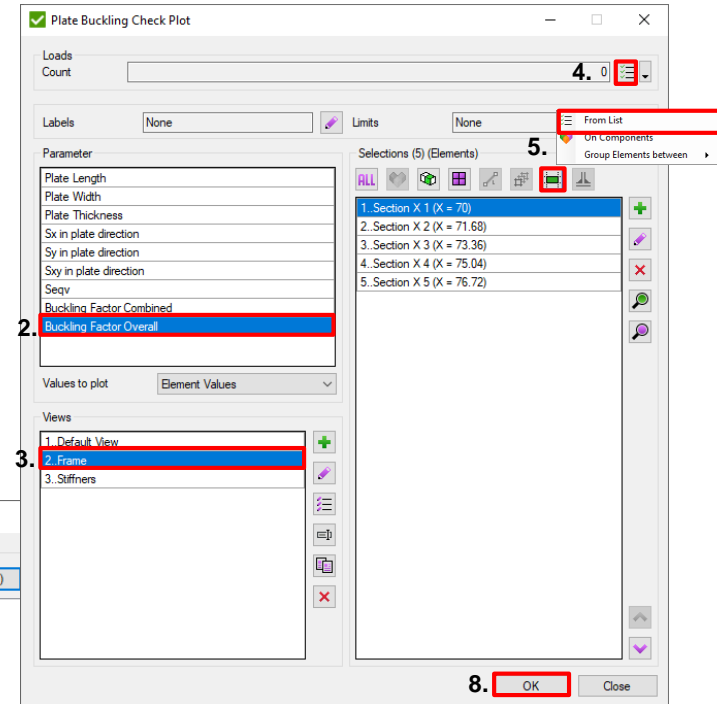
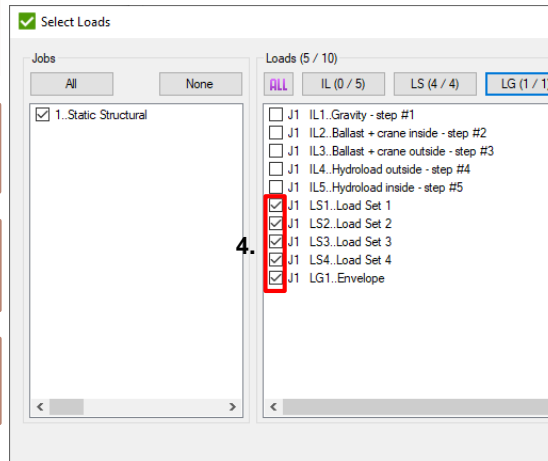
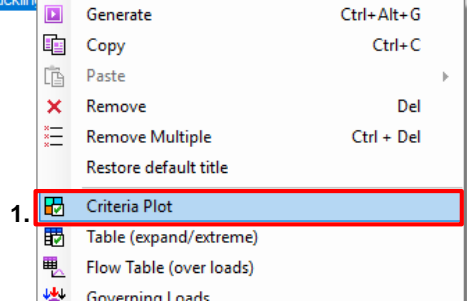
Select all **X** sections.

7

Press **OK**.

8

Press **OK**.



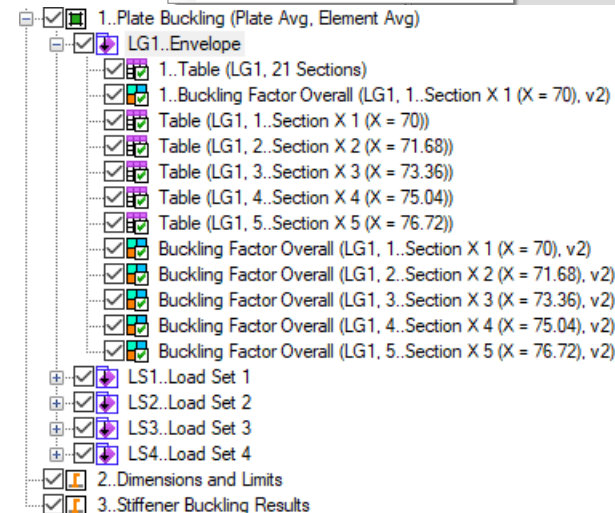
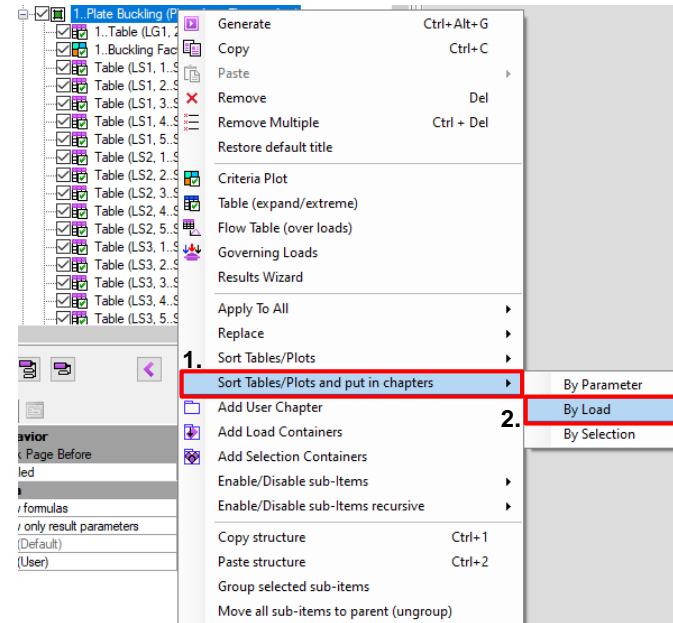
Report. Sort tables and plots by Load

1

Right click on *Plate Buckling DNV 2010* => *Sort Tables/Plots and put in chapters*

2

Click => *By Load*



All tables and plots are sorted by loads. It is possible to sort it *By Parameter; By Selection; By section* as well.

Report. First Page

1

Right click on *First Page* => **Edit**.

2

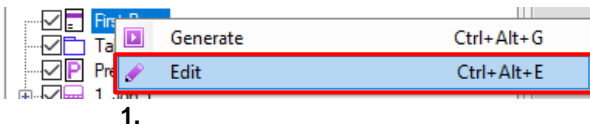
Fill in information about project.

3



Select Image *From View* and pick '*2..Frame*'.

4

Press *OK*.



The 'First Page Editor' dialog box is shown. It contains fields for 'Engineer details' (Engineer: Support, Company: SDC Verfier, E-mail: support@sdcverfier.com, Phone: +31 15 30-10-310, Address: Zijlvest 25 [...], Web Site: sdcverfier.com, Logo: SDC VERIFIER logo) and '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). There is a checkbox 'Put logo on report plots' which is checked. Below these are 'Project Details' (Number: [empty], Version: 1, Name: [empty]). At the bottom, there is a 'Custom Fields' button. On the right, there is an 'Image' section with a radio button 'From file' and a 'From View' section. The 'From View' section has a dropdown menu showing '2..Frame'. The 'OK' button is highlighted with a red rectangle. The number '3.' is next to the 'From View' section, and '4.' is next to the 'OK' button.

Press  to generate complete report and press  to convert report to word



Report



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Engineer: Support

Customer: customer

Project Number:

Version: 1

Date: 03/02/2020

Checks

This paragraph contains checks descriptions with their results.

1..Plate Buckling (Plate Avg, Element Avg)

Property	Value
Category	Plate Buckling
Parameter Count	37
Use Absolute Shear	No
Convert Stresses into plate direction	Yes

LG1..Envelope

1..Table (LG1, 21 Sections)

Standard	1..DNV Buckling Strength of Plated Structures (2010)				Check Selection		(S1) 1..Plate Buckling (Plate Avg, Element Avg)		21 Sections	
Load Group	LG1..Envelope									
Search Type	Related To Last									
Section Title	Plate Length [m]	Plate Width [m]	Plate Thickness [m]	Sx in plate direction [Pa]	Sy in plate direction [Pa]	Sxy in plate direction [Pa]	Buckling [Pa]	Buckling Factor g	Buckling Factor g Combin	Load Overall
15..Section Z 15 (Z = 0)	3.36	0.89	0.02	-10.8e+6	-	-3.3e+6	111.7e+6	2.98	1.74	LS3
8..Section Y 8 (Y = -3.95)	6.85	3.36	0.02	-67.1e+6	-3.6e+6	-3.5e+6	65.7e+6	1.79	1.34	LS3
14..Section Y 14 (Y = 14.15)	3.36	0.92	0.02	-15.8e+6	-73.9e+6	9.9e+6	69.6e+6	1.21	1.12	LS3
1..Section X 1 (X = 70)	0.83	0.75	0.02	-52.3e+6	-	68.4e+6	183.2e+6	1.14	1.07	LS3
5..Section X 5 (X = 76.72)	0.83	0.75	0.02	-43.2e+6	-	63.1e+6	172.7e+6	1.01	1.01	LS3
3..Section X 3 (X = 73.36)	0.89	0.73	0.02	-79.3e+6	-27.5e+6	-	192.7e+6	0.85	0.92	LS3
13..Section Y 13 (Y = 11.55)	6.85	3.36	0.02	-40.0e+6	-2.4e+6	-0.9e+6	38.9e+6	0.63	0.79	LS3
16..Section Z 16 (Z = 2.2)	7.16	3.36	0.02	-35.8e+6	-3.0e+6	-3.1e+6	34.7e+6	0.52	0.72	LS3
2..Section X 2 (X = 71.88)	3.00	2.60	0.02	0.0e+6	-31.5e+6	-11.9e+6	37.7e+6	0.39	0.62	LS3
4..Section X 4 (X = 75.04)	3.00	2.60	0.02	-0.1e+6	-31.1e+6	-11.8e+6	37.3e+6	0.38	0.62	LS3
6..Section Y 6 (Y = -14.15)	3.36	0.92	0.02	-7.6e+6	-29.5e+6	-8.8e+6	30.6e+6	0.20	0.45	LS3
12..Section Y 12 (Y = 8.55)	2.20	1.68	0.02	-1.0e+6	0.0e+6	36.4e+6	63.2e+6	0.13	0.36	LS1
21..Section Custom 21 (136 Elements)	3.36	2.77	0.02	-1.3e+6	-18.7e+6	3.4e+6	19.1e+6	0.09	0.29	LS3
11..Section Y 11 (Y = 5.37)	2.20	0.84	0.02	-39.4e+6	-0.6e+6	22.4e+6	55.1e+6	0.09	0.29	LS1
19..Section Z 19 (Z = 13.3)	3.36	2.50	0.02	-5.8e+6	-0.5e+6	-11.7e+6	21.0e+6	0.07	0.27	LS3
9..Section Y 9 (Y = -1.79)	2.20	1.68	0.02	-3.1e+6	0.0e+6	27.0e+6	47.0e+6	0.07	0.27	LS3
18..Section Z 18 (Z = 11.8)	4.87	3.36	0.02	0.0e+6	-0.3e+6	-3.7e+6	6.4e+6	0.02	0.15	LS3
10..Section Y 10	2.20	1.68	0.02	-3.1e+6	0.0e+6	13.6e+6	24.0e+6	0.02	0.14	LS3

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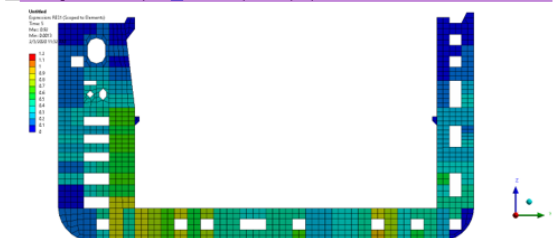
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Buckling Factor Overall (LG1, 2..Section X 2 (X = 71.88), v2)



Check	(S1) 1..Plate Buckling (Plate Avg, Element Avg)	Load Group	LG1..Envelope
Parameter	Buckling Factor Overall	Selection	2..Section X 2 (X = 71.88)
View	2..Frame		

Buckling Factor Overall (LG1, 3..Section X 3 (X = 73.36), v2)



Check	(S1) 1..Plate Buckling (Plate Avg, Element Avg)	Load Group	LG1..Envelope
Parameter	Buckling Factor Overall	Selection	3..Section X 3 (X = 73.36)
View	2..Frame		

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