

ANYstructure documentation

ANYstructure | File Geometry Help Reporting

DNVGL-OS-C101 based structural calculations

Input point coordinates [mm]

Point x (horizontal) [mm]: 0.0

Point y (vertical) [mm]: 0.0

Add point (coords)

Copy point (relative)

Move point (relative)

Input line from "point number" to "point number"

From point number: 0

To point number: 0

Add line

Delete lines and points (input line or point number)

Delete line: 0

Delete point: 0

Structural and calculation properties input below:

span s pt_thk web_h web_thk fl_w fl_thk

0.0 0.0 0.0 0.0 0.0 0.0 0.0

[m] [mm] [mm] [mm] [mm] [mm] [mm]

kpp kps km1 km2 k3

1 1 12 24 12

sig_y1 sig_y2 sig_x tau_y1 off type pressure side

90 90 40 5 T p

FLS

Material yield [MPa]: 355

Select structure type -> GENERAL_INTERNAL_WT

Internal pressure from comp.

Add structure to list

Show structure types

Find compartments

External pressures

Display current compartments

Comp. no.:

2

3

4

5

Tank content: 1000

Set compartment properties

Tank density: 1025 [kg/m³]

Overpressure: 25000 [Pa]

Max elevation: 0.0

Min elevation: 0.0

Acceleration [m/s²]:

Properties displayed here (select line):

Static and dynamic accelerations

Static acceleration [m/s²]: 9.81

Dyn. acc. loaded [m/s²]: 3.0

Dyn. acc. ballast [m/s²]: 3.0

Optimize selected line/structure (right click line):

OPTIMIZE MultiOpt SPAN

Combination for line (select line). Change with slider:

OS-C101 Table 1 1: DNV a) 2: DNV b) 3: TankTest

1

Name: Stat LP Dyn LP Include?

Pressures for this line:

[DNV a/b (loaded/ballast), tank test, manual]

Note that ch. 4.3.7 and 4.3.8 is accounted for.

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Modelling

Modelling is done in upper left corner.

Right click: select point

You can copy or move the selected point by shortcut or clicking Buttons.

Left click: select line

A line is made by right clicking two points (or input point number)

Input point coordinates [mm]		Add point (coords)
Point x (horizontal) [mm]:	<input type="text" value="0.0"/>	Copy point (relative)
Point y (vertical) [mm]:	<input type="text" value="0.0"/>	Move point (relative)

Input line from "point number" to "point number"		
From point number:	<input type="text" value="0"/>	Add line
To point number:	<input type="text" value="0"/>	

Delete lines and points (input line or point number)			
<input type="text" value="0"/>	Delete line	<input type="text" value="0"/>	Delete point

Speed up your modelling significantly by using the shortcuts:

CTRL-Z Undo modelling

CTRL-C Copy a selected point

CTRL-M Move a selected point

CTRL-Q New line between two selected points

CTRL-S Assign properties to a selected line

Assigning properties

Input properties manually or click the button indicated below to set the values. Values are set by clicking “Add structure to line”. This also applies to fatigue properties.

Define plate and beam properties.

Define calculation properties.

Define fatigue properties.

Define structure properties here --

Stiffener type: T

Spacing: 750.0 [mm]

Plate thk.: 18.0 [mm]

Web height: 350.0 [mm]

Web thk.: 12.0 [mm]

Flange width: 150.0 [mm]

Flange thk.: 20.0 [mm]

Plate: 750.0x18.0
Web: 350.0x12.0
Flange: 150.0x20.0

Girder length (Lg) 10

Save and return structure

Define tanks

Tanks are searched for when clicking “Find compartments”. Non watertight structure are ignored. For information on structure types click “Show structure types”.

Ather tanks are found content and overpressure must be defined as seen next.

The screenshot shows a software interface with two main tabs: "Find compartments" and "External pressures". The "Find compartments" tab is active, showing a list of compartments (2, 3, 4, 5) on the left. Compartment 2 is selected, and its properties are displayed on the right. The properties include Tank content (crude_oil), Tank density (1025.0 [kg/m^3]), Overpressure (25000.0 [Pa]), Max elevation (30.9), and Min elevation (2.5). There are buttons for "Set compartment properties" and "Delete all tanks". At the bottom, accelerations are listed: static: 9.81, dynamic loaded: 3.0, dynamic ballast: 3.0.

Find compartments

External pressures

Display current compartments

Comp. no.: **2**

2
3
4
5

Tank content : crude_oil

Tank density : 1025.0 [kg/m³]

Overpressure : 25000.0 [Pa]

Max elevation : 30.9

Min elevation : 2.5

Set compartment properties.

Delete all tanks

Accelerations [m/s²]:
static: 9.81 , dynamic loaded: 3.0 , dynamic ballast: 3.0

Define external pressures

Click “External pressures” to define pressures acting on the structures.

NOTE:

FOR DYNAMIC EQUATION THE FOLLOWING APPLIES

X (horizontal) used for BOTTOM, BBT, HOPPER, MD

Y (vertical) used for BBS, SIDE_SHELL, SSS

After new window is opened:

- 1. Make dynamic loads**
 - a. Dynamic loads are made by defining up to 3rd degree equations. X or Y direction depends on the defined structure type.**
 - b. Note that you can define a constant dynamic load by using Constant (Constant (C)) only.**
- 2. Static loads are calculated according to depth.**
- 3. To apply a defined load to a line or multiple lines:**

- a. a. Select load by clicking the created load
4. Click the lines that shall have the load. Click the button “Press to add selected lines to selected load”
5. When finished press the button in the upper right corner.

Load properties

1. Dynamic loads

Define dynamic loads as an polynomial curve.
Can be third degree, second degree, linear or constant

Input load name:

Third degree poly [x^3]:

Second degree poly [x^2]:

First degree poly [x]:

Constant [C]:

Load condition:

Limit state:

Create dynamic load

2. Static loads

Hydrostatic loads defined by draft.

Define name of static load:

Create static load

Define static draft from sea:

Select load condition:

3. Slamming pressure

Load name:

Pressure [Pa]:

Create slamming load

Press this to: Save loads and close the load window.

3. Created loads are seen below (double click to select):

Select to see associated lines:

ballast_side
ballast_bottom
loaded_static
ballast_static
slamming
loaded_bottom

line50
line51
line52
line53
line54
line55

Delete selected load

Properties selected load is:

Name of load: ballast_side

Polynomial (x^3): 0.0

Polynomial (x^2): 303.0

Polynomial (x): -3750.0

Constant (C): 153000.0

Load condition: ballast

Limit state: ULS

Is external?: True

Static draft: None

Press to add selected lines to selected load

Select a load in "3." to and then choose lines to apply to load (select by clicking lines). Alternatively define manually ----->

House left click: select lines to loads
House right click: clear all selection
Shift key: add selected line
Control key press: remove selected line

Load combinations

Load combinations are created automatically after external pressures are defined.
Some comments on the loads.

1. According to DNVGL-OS-C101
2. Highest pressure are chosen w.r.t. tank filling.

3. You can deselect a load by manually inputting load factor to 0 or deselect include.

Optimization

Single optimization

Single optimization is done by clicking a line and clicking the “OPTIMIZE” button.

1. Set the upper and lower bounds of the optimization.
2. Set the delta to be used for the searched. This is the step size of the optimization when using brute force method (for example anysmart).
3. Run the optimization.
4. If you are happy, return the properties by clicking the top button.

Multiple optimization

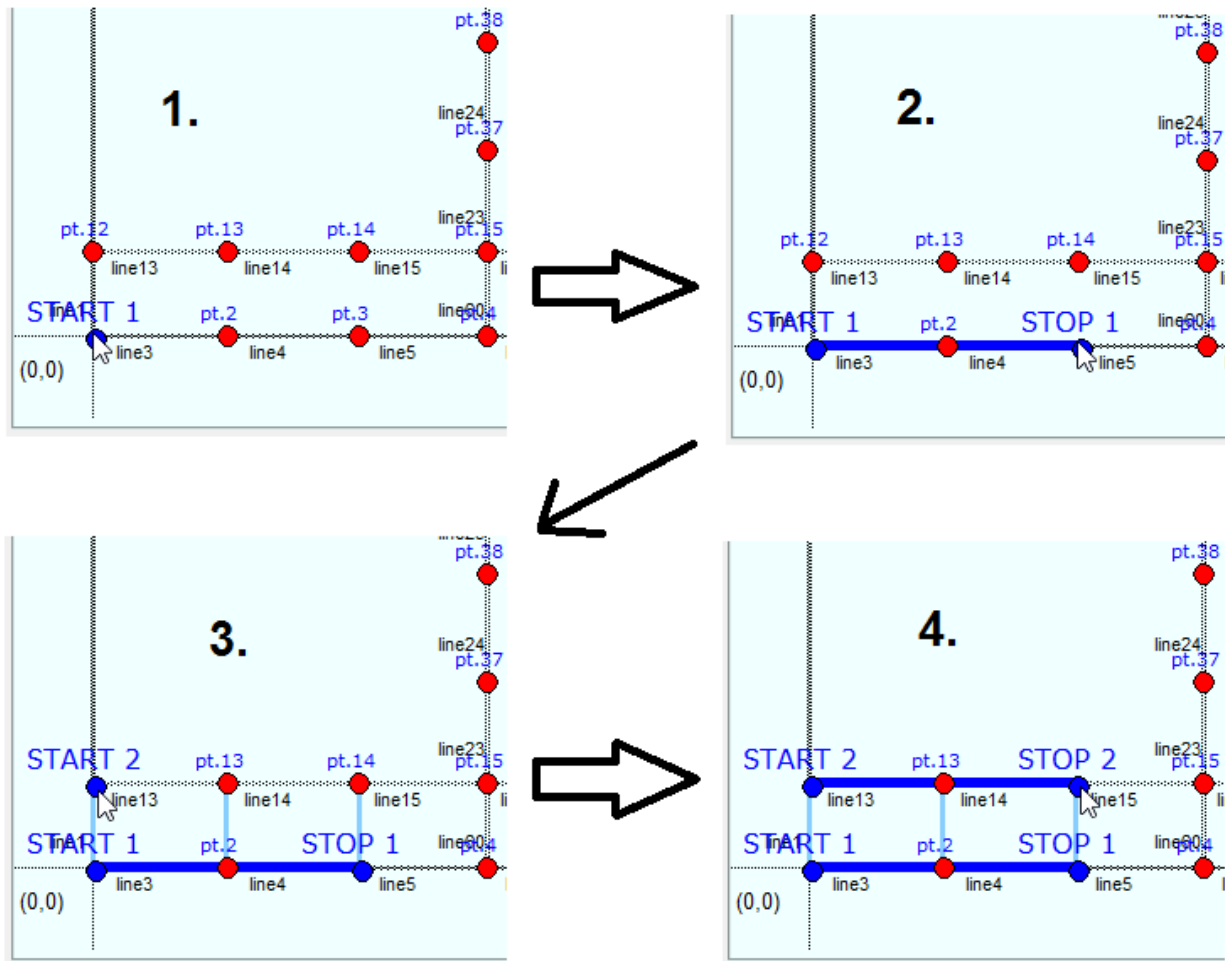
Multiple optimization is done by clicking the “MultiOpt” button.

1. Same input on upper bounds, lower bounds and delta.
2. Click all the lines you want to include in the optimization.
3. Run the optimization.
4. Check the properties by right clicking the line.
5. If you are happy return the properties by clicking the top button

Span optimization

NOTE: The span optimization is computationally heavy.

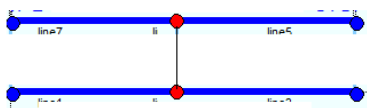
1. Start by clicking as illustrated next:



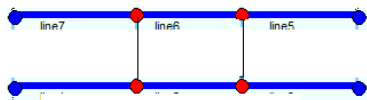
2. Then run optimization.

The program will calculate variations of even spans in your structure as illustrated next. This is an example and number of plate fields may vary.

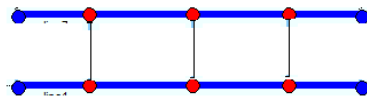
4 plate fields



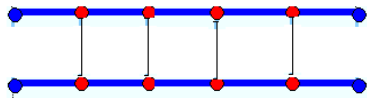
6 plate fields



8 plate fields



10 plate fields



Results are presented as seen next.

RUN OPTIMIZATION!

anysmart

algorithm information

Results seen next. Weight index is $\text{tot_weight} / \text{max_weight}$
max_weight is the highest total weight of the checked variations.
Weight index of 1 is the heaviest calculated variation.

Plate fields	Fields length	Weight index	All OK?
4	6.0	1.0	True
6	4.0	0.768	True
8	3.0	0.765	True
10	2.4	0.825	True

In this case 8 plate fields with length of 3 meter will give the lowest weight. 6 plate fields is almost equal.

Now close the window. Results are not currently returned to main window.