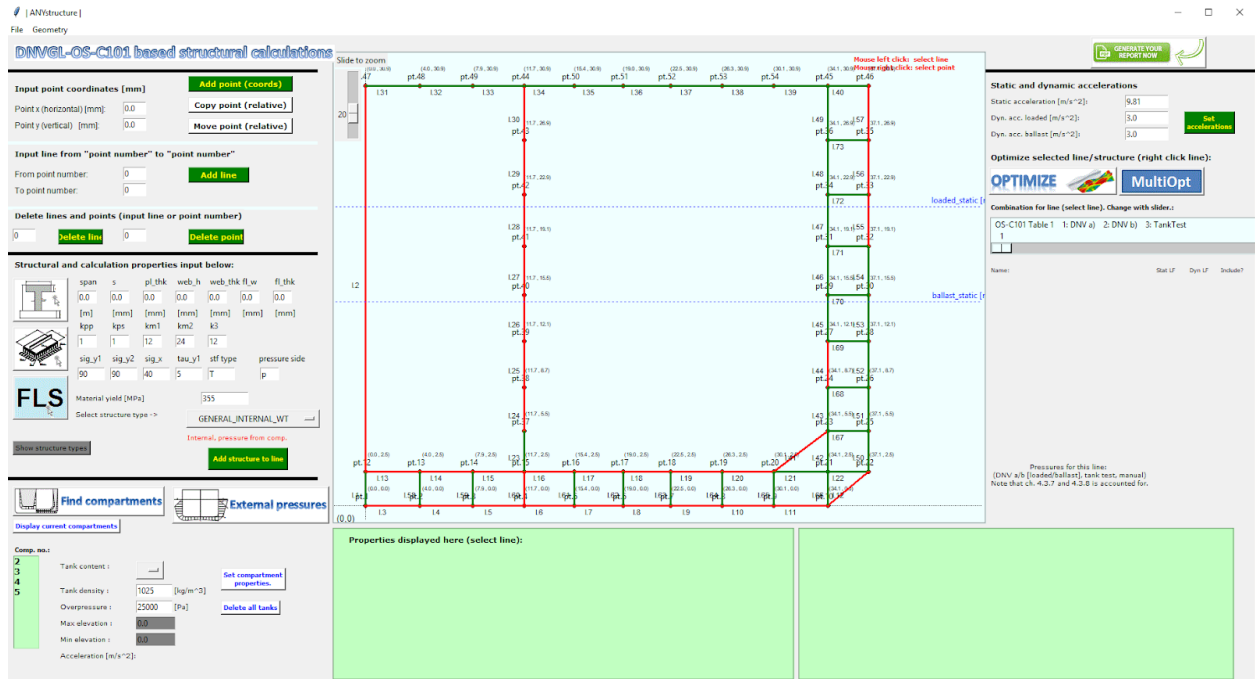


ANYstructure documentation



27.04.2018
Version 0.2.0

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)

 | ANYstructure |

File Geometry

DNVGL-OS-C101 based structural calculations

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
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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.

One values are set click “Add structure to line” to set the properties to the selected line.

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.

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

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

Set compartment properties.

Delete all tanks

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
 - a. Dynamic loads are made by defining up to 3rd degree equations. X or Y direction depends on the defined structure type.
2. Static loads are calculated according to depth.
3. To apply a defined load to a line or multiple lines:
 - 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:

ballast_side

Third degree poly [x^3]:

0.0

Second degree poly [x^2]:

303.0

First degree poly [x]:

-3750.0

Constant [C]:

153000.0

Load condition:

ballast

Limit state:

ULS

Create dynamic load

2. Static loads

Hydrostatic loads defined by draft.

Define name of static load:

static0

Define static draft from sea:

0.0

Select load condition:

Create static load

3. Slamming pressure

Load name:

slamming

Pressure [Pa]:

0.0

Create slamming load

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

Press to add selected lines to selecte load

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

ballast_side

20

line2

line31

line32

line33

line34

line35

line36

line37

line38

line39

line40

line41

line42

line43

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Load combinations

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

- According to DNVGL-OS-C101
- Highest pressure are chosen w.r.t. tank filling.
- You can deselect a load by manually inputting load factor to 0 or deselect include.

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.

Optimize structure

-- Structural optimizer --

Return and replace initial structure with optimized

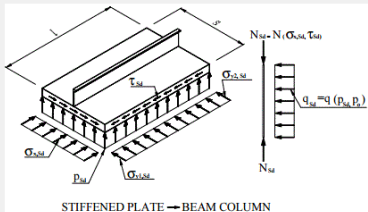
	Spacing [mm]	Plate thk. [mm]	Web height [mm]	Web thk. [mm]	Flange width [mm]	Flange thk. [mm]
Upper bounds [mm]	850.0	28.0	450.0	22.0	250.0	30.0
Iteration delta [mm]	50.0	2.0	50.0	2.0	50.0	2.0
Lower bounds [mm]	650.0	10.0	250.0	10.0	50.0	10.0

Estimated running time for algorithm: 5 seconds

RUN OPTIMIZATION!

Select algorithm
anysmart
algorithm information

Initial - Pl.: 750.0x18.0 Stf.: 350.0x12.0+150.0x20.0
Weight (per Lg width): 7946



STIFFENED PLATE → BEAM COLUMN

Check for minimum section modulus ☒
 Check for minimum plate thk. ☒
 Check for minimum shear area ☒
 Check for buckling (RP-C201) ☒
 Check for fatigue (RP-C203) ☒
 Check for bow slamming ☒

Optimized values

s	0.0	web_h	0.0	fl_thk	0.0
pl_thk	0.0	web_htk	0.0	fl_ttk	0.0

Applied pressure: 428.112 kPa
 Plate or stiffener side (p/s): p

Span: 3.7 m
 Girder length, Lg: 10 m
 Slamming pressure: 0 Pa
 Fatigue pressure: internal= 0 external= 0

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