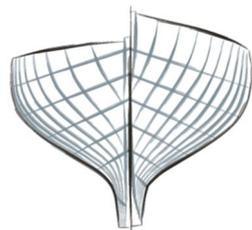


LoadmatePlus

On-board loading software

Tutorial 5 – Unit Loads, Cranes & Anchor Handling



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Introduction

LoadmatePlus is intended as an on-board stability, strength and load planning program. The program complies with the IMO rules, and the primary purpose is to ensure that the vessel is safe to sail with respect to stability and longitudinal strength.

This is the fifth in the series of tutorials to demonstrate **LoadmatePlus** and its various features. This one demonstrates the special **unit load**, **crane** and **anchor handling** features. Other tutorials will explore the other advanced or specialised features.

In these tutorials, use will be made of a series of demonstration vessels that are included with the special demonstration installation, which can be obtained by filling out a contact form on our website: <http://shipdesign.co.uk/contact/> .

The demo ships may borrow features from similar ships, but are not direct copies of any actual ship. No proprietary information has been used and the hull forms, in particular, have been specially designed in house.

To follow this tutorial, it is assumed that the user has downloaded and run the demonstration setup program.

The **unit load**, **crane** and **anchor handling** features, which are commonly associated with offshore supply boats and the **Demo Supply** vessel is used for the tutorial. It should be noted that this demo vessel is completely fictitious and the tank arrangement, in particular, is not representative of actual vessels. However, as the purpose is to demonstrate other special features, this is of no consequence.

Unit Loads

Unit Loads are treated as box-shaped weights that can be located anywhere on the ship.

There are two prerequisites for using the Unit Loads feature:

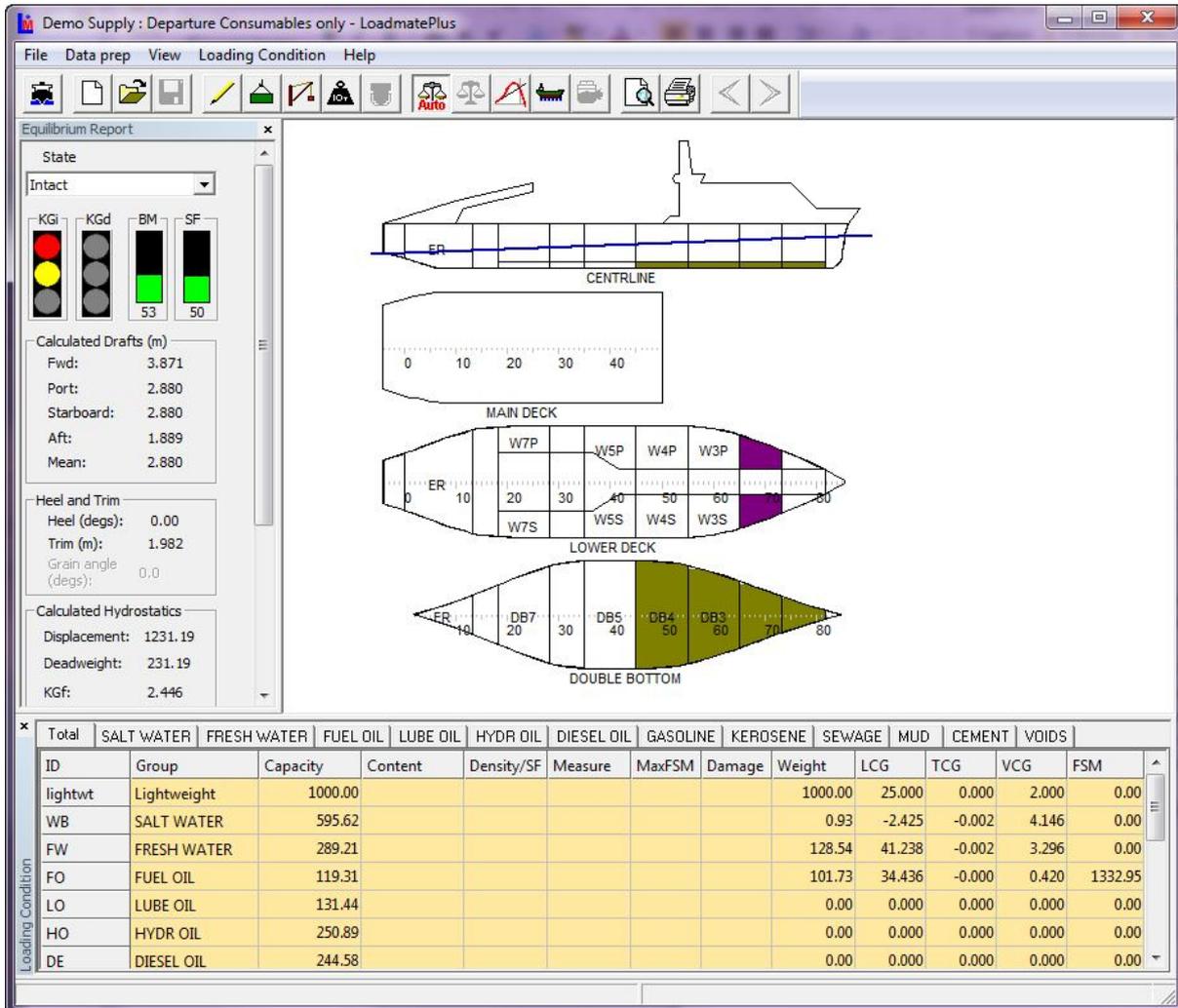
1. The Unit Loads option must be set for the particular vessel.
2. A file called **UnitLoadTypes.csv** must be created and placed in the same folder as the ship's *vessel* data file.

The **UnitLoadTypes** file is a simple comma separated data file containing dimensions, weights, etc. for the permitted types of unit load. More about this later.

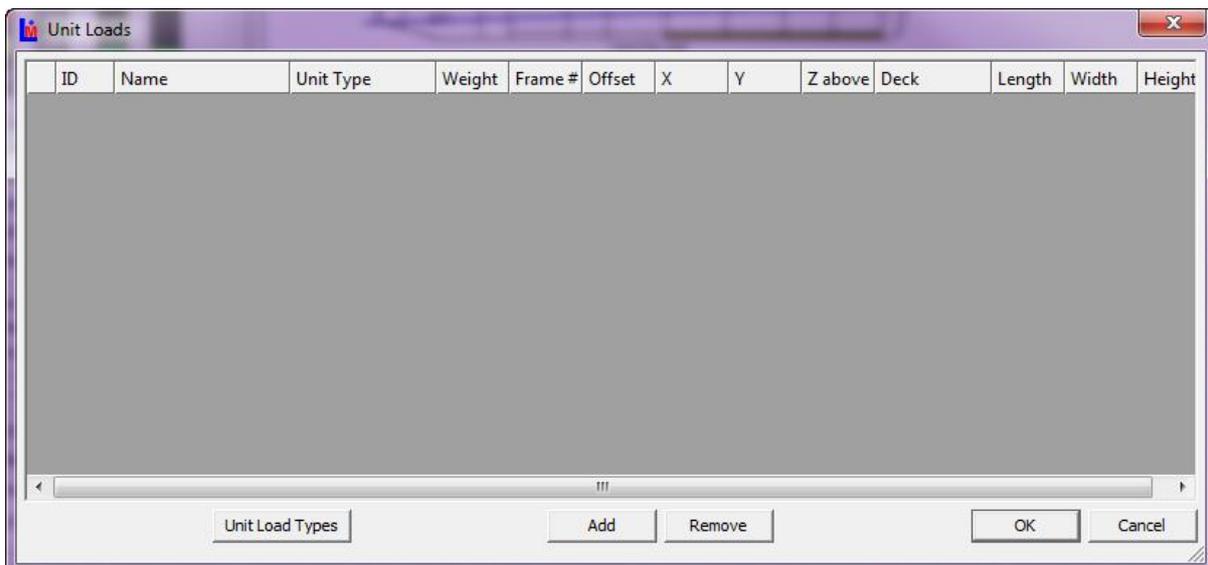
Adding Unit Loads to a Loading Condition

To demonstrate using unit loads, we will use the **Demo Supply** vessel. The vessel opens with the default lightship condition active. For the purposes of this tutorial, we will open a special loading condition called **Departure Consumables only.state**. This contains fuel, water and other consumables but nothing else. It is convenient to use a template condition like this, as a starting point to save having to specify the consumables individually for each new condition.

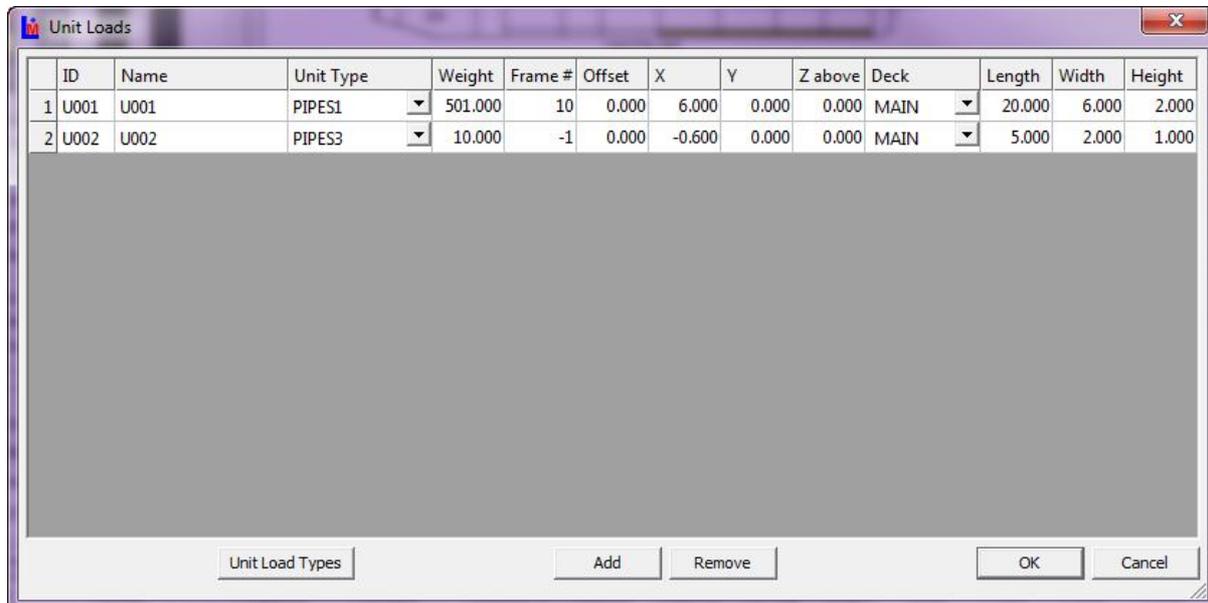
The LoadmatePlus screen should now look like this:



Selecting the command Unit Loads... from the Loading State menu or by pressing the  button on the tool bar, bring up the following **Unit Loads** dialog:



To add unit loads, press the Add button one or more times.



Here we have loaded two unit loads. Initially the type of both units was set to PIPES1, which is the first item in the **Unit Load Types file**, mentioned earlier. Other types can be selected from the drop down menu. Here the type of the second unit load has been changed to PIPES3. The weight and dimensions are set to their default values, but the position of both unit loads have been changed to more suitable values.

The *longitudinal*, or x-position, can either be given as a frame position, or in metres from the origin (Aft Perpendicular). The program will automatically convert a frame position to distance from the AP, or visa-versa including an offset from the frame, if necessary. The x-position is the position of the *aft end* of the unit.

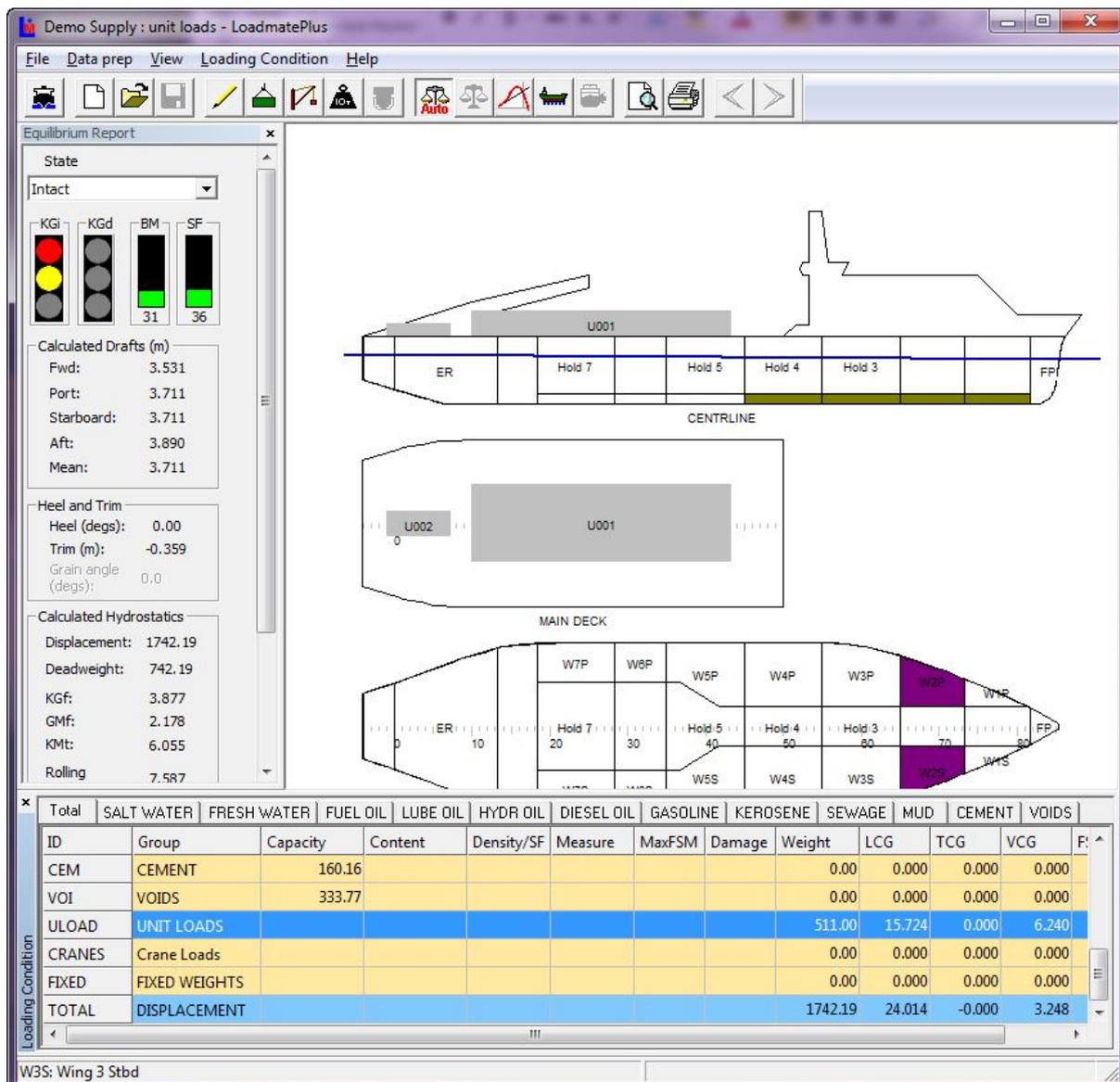
The *transverse*, or y-position, is the distance of the *centre* of the unit to *starboard* of the centreline. If the unit is on the *port* side, then the distance will be negative.

The *vertical* z-position is given as a height of the bottom above the loading deck, which can be selected from the Deck drop-down list, Here the MAIN deck is selected. For this vessel, the MAIN deck is the only one designated as a loading are for unit loads, but there may be multiple decks for other vessels, and the *Baseline* is always one option in the list, which enables the unit load to be located at any height.

Units can be unloaded by selecting the appropriate row in the list and pressing the **Remove** button.

Pressing the OK button will cause the unit loads to be added to the loading condition and, if **Auto Balance** is selected, then the ship will be re-balanced. It may be advisable to turn off the Auto Balancing while adding large unit loads to avoid instability.

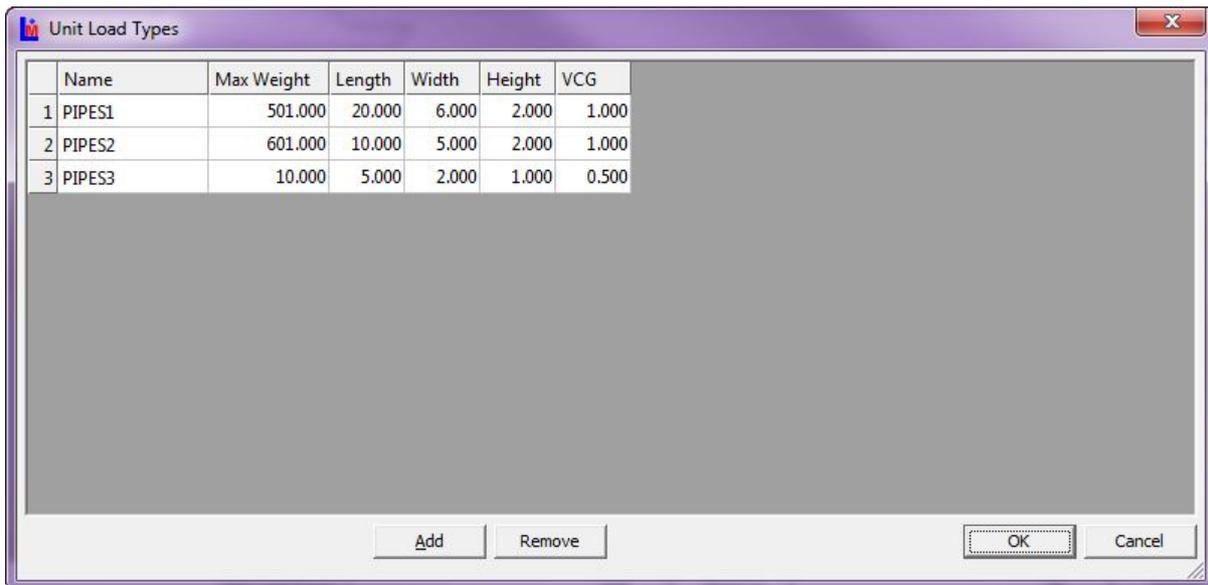
The loading screen should now look something like this:



The unit loads are shown as grey boxes in the diagram. Note the Unit Loads row in the grid, which displays the total weight and centre of gravity of the unit loads. Incidentally, *double-clicking* on this row, is another way to bring up the **Unit Loads** dialog.

Unit Load Types blue

Going back to the **Unit Loads** dialog, pressing the *Unit Load Types* button will bring up the following dialog for editing Unit Types:



The VCG is relative to the base of the Unit Load. When a unit load is added to the loading condition, its type will default to the first item in this list, but this can be changed as described above.

Unit Load Types data is stored in the *UnitLoadTypes.csv* file, which is a standard *comma delimited* text file, which can be edited in a spreadsheet, such as Microsoft Excel. However, make sure to save the file as a *comma-delimited file* with name *UnitLoadTypes.csv*. Note that the first row in this file contains column headers, which must be in the file, but are ignored by the program when reading the file.

Name,Weight,Length,Width,Height,VCG above base of unit PIPES1,501,20,6,2,1 PIPES2,601,10,5,2,1 PIPES3,10,5,2,1,0.5

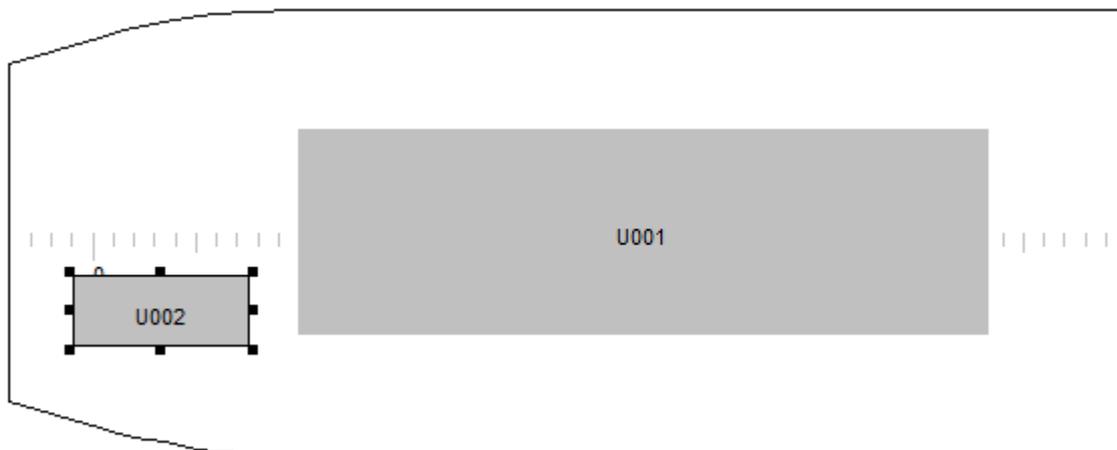
Drag and Drop

If Unit Loads are located on a designated deck, they can be moved horizontally by dragging and dropping them using the mouse.

The unit loads to be moved must first be selected by:

- clicking on a unit load using the left mouse button (LMB). One unit load will be selected.
- several unit loads may be selected by holding down the CTRL key while clicking with the LMB.
- alternatively, click and drag whilst holding down the LMB. All unit loads completely enclosed by the resulting rectangle, will be selected.

Outlines will be drawn round the selected unit loads as shown:



To move the selected unit loads, click inside any outline and move the mouse while holding down the LMB.

When the LMB is released, the vessel state and the loading grid will be updated, and, if AUTO BALANCE is enabled, the vessel will be re-balanced.

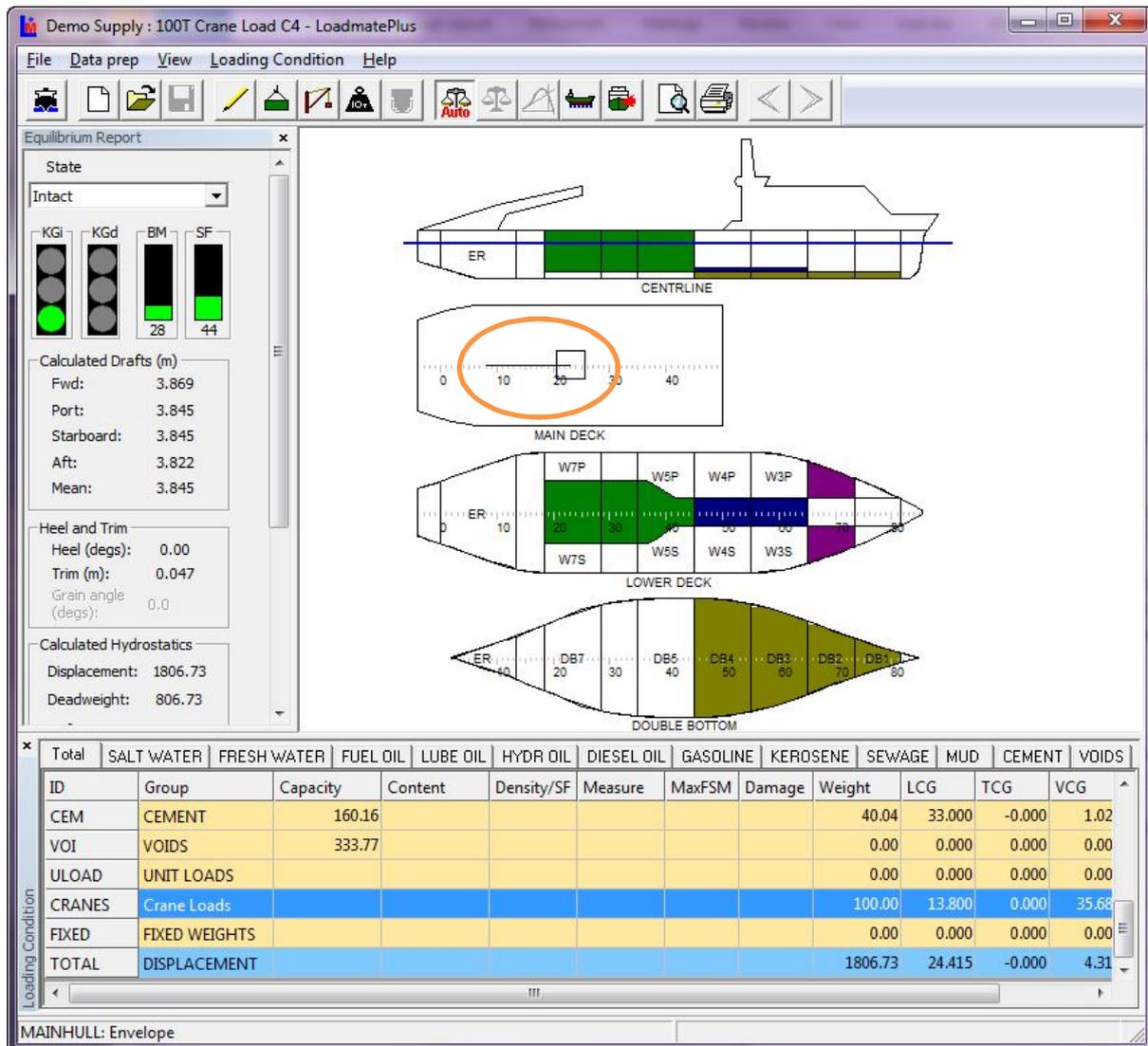
Note that unit loads can only be moved horizontally on a deck using drag and drop. Moving to another deck, is not supported. Also the program does not check whether a unit load remains within the confines of the deck or conflicts with another unit load.

Cranes

If one or more cranes have been defined for the vessel, crane operations can be simulated. The User can load and position cranes to see the effect on the vessel's heel and trim.

To illustrate this, we will use the Demo Supply example, which has one 100t SWL crane located on the MAIN deck aft.

Open the **Demo Supply** vessel and the **100T Crane Load C4** loading state.

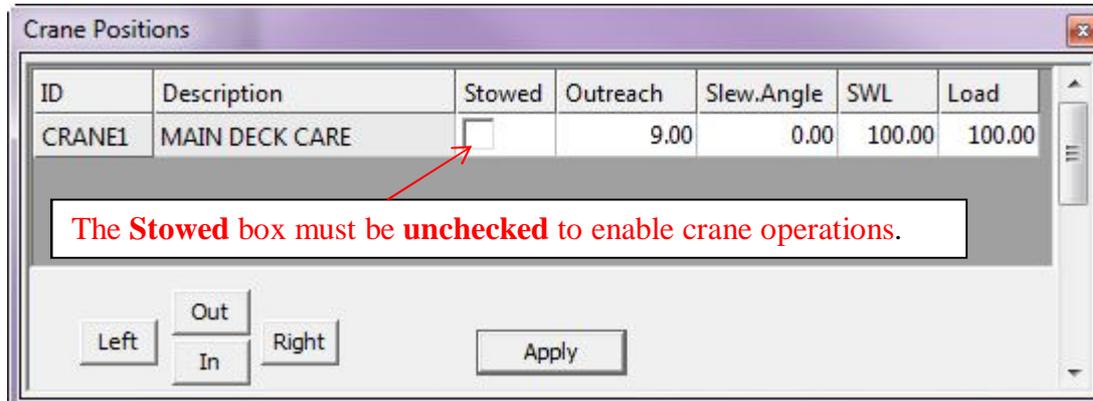


Note that the crane is depicted rather crudely as a line in the deck view with the load shown as a box, which is not to scale. Note also the extra row in the grid, which gives the crane load and its centre of gravity. This row will not be shown, if no cranes are specified.

Crane Position

To adjust the position and load on the crane, the **Crane Position** view must first be opened

by pressing the **Cranes** toolbar button, , or by selecting **Crane Positions** from the **View** menu. The **Crane Positions** view will normally be docked to the right of the screen.

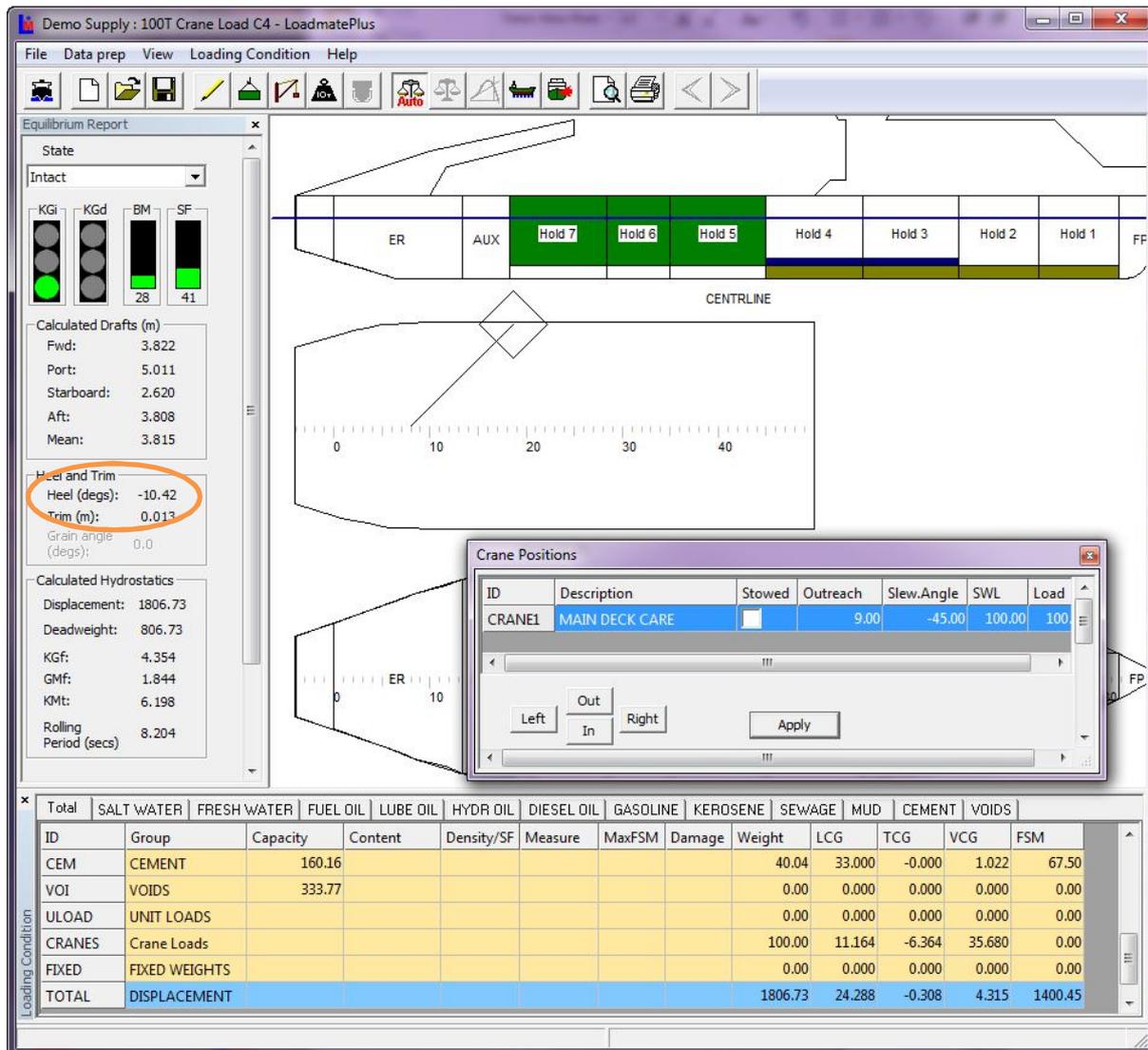


*Note that before the crane can be positioned and loaded, the **Stowed** box must be unchecked.*

Pressing the **Left** and **Right** buttons, will slew the crane to the left or right respectively in 5 degree increments. Similarly, pressing the **In** and **Out** buttons will raise or lower the jib in 5 degree increments, hence decreasing or increasing the outreach. **Note that the relevant crane must be selected.** In this case there is only one crane, but it must still be selected before using the **Left**, **Right**, **In** and **Out** buttons.

Checks are made to ensure that the maximum specified outreach for the load, is not exceeded and that the load does not exceed the safe working load (SWL) for the given outreach. The SWL is adjusted according to the outreach and if the load exceeds the SWL+20%, it will be automatically reduced. The additional 20% is to allow crane safety tests to be simulated.

The **Apply** button must be pressed to update the **Loading Grid** and, if **Auto Balance** is selected, to re-balanced the ship.



Here the crane has been slewed 45 degrees to port with an outreach of 9 metres. The vessel is now heeling about 10 degrees to port.

Lightship adjustment for crane movement

When the position of the crane changes, so does its centre of gravity. To account for this, a correction is made to the lightship by subtracting the stowed weight and position and adding the new weight and position. This correction is documented in the condition report:

CRANES							
MAIN DECK CRANE					100.0	11.16	-6.36 35.68 0.0
Total CRANES					100.0	11.16	-6.36 35.68 0.0
DEADWEIGHT							
MAIN DECK CRANE stowed					-150.0	6.00	0.00 17.25 0.0
MAIN DECK CRANE working					150.0	4.27	0.53 19.91 0.0
Lightweight					1000.0	25.00	0.00 2.00 0.0
DISPLACEMENT					1806.7	24.29	-0.31 4.31 1400.4

Crane Stability Test

For crane operations the normal intact and damaged stability rules do not apply. Instead the condition is checked for compliance with the *Det norske Veritas (DNV) Ship Rules Pt.5 Ch.7 paragraph D 200*, which states:

D 200 Accidental load drop

201 The effect of accidental drop of crane load shall be investigated and shall meet the following criteria:

- The restoring energy represented by area A2 in Fig.1 is to be at least 40% in excess of the potential energy represented by area A1.
- The angle of static equilibrium Θ_e after loss of crane load shall not be more than 15 degrees from the upright.

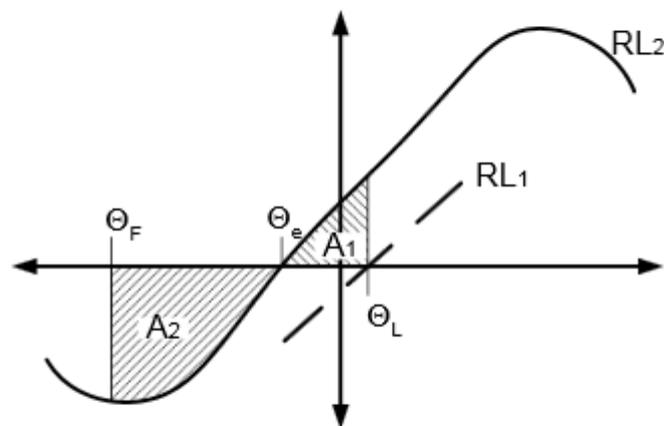


Fig. 1
Stability with loss of crane load

RL1 = Net righting lever (GZ) curve for the condition before loss of crane load, corrected for crane heeling moment and for the righting moment provided by the counter ballast if applicable.

RL2 = Net righting lever (GZ) curve for the condition after loss of crane load, corrected for the transverse moment provided by the counter ballast if applicable.

Θ_L = Static angle of equilibrium before loss of crane load.

The results of applying these criteria, are given in the condition report and success or failure is indicated in the usual way. Note that in order to calculate the various parameter, the righting lever (GZ) curve must be calculated.

DNV Crane Drop Load Rules

ID	Name	Value	Units	Limit	OK?
1	Downflood angle	50.00	degs		
2	Load dropped	100.000	t		
2	Net Heeling moment arm	0.666	m		
3	Area 1	0.0640	m-rads		
4	Area 2	0.8684	m-rads		
5	Area 2/Area 1	13.5661		> 1.4000	Yes
6	Heel before load loss	-10.42	degs		
7	Heel after load loss	0.90	degs	< 15.00	Yes

Anchor Handling

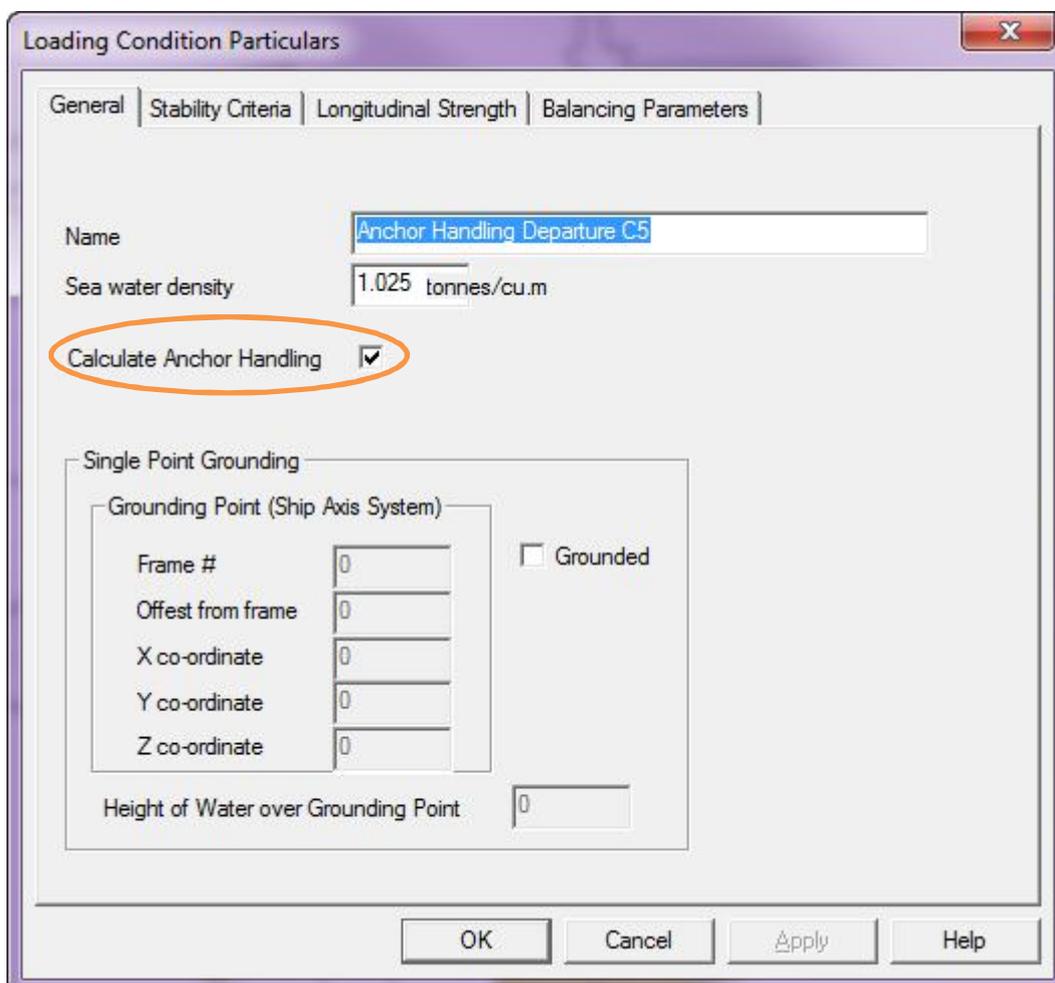
The document: *Emergency Guidelines for Supply Boats and Tugs engaged in Anchor Handling*

Sjøfartsdirektoratet (Norwegian Maritime Directorate) 16.05.2007

Paragraph 3.1, states that the maximum allowed heeling moment that gives the least of the following angles of heel, shall be calculated:

1. The angle corresponding to a GZ value, which is 50% of the maximum GZ.
2. The angle that gives water on the working deck, assuming a flat deck.
3. 15 degrees.

To enable anchor handling calculations, the **Calculate Anchor Handling** option must be selected on the **Loading Condition Particulars/General** dialog page:



The screenshot shows a software dialog box titled "Loading Condition Particulars" with a close button (X) in the top right corner. The dialog has four tabs: "General", "Stability Criteria", "Longitudinal Strength", and "Balancing Parameters". The "General" tab is selected. The "Name" field contains "Anchor Handling Departure C5". The "Sea water density" field contains "1.025 tonnes/cu.m". The "Calculate Anchor Handling" checkbox is checked and circled in orange. Below this is a "Single Point Grounding" section with a "Grounding Point (Ship Axis System)" sub-section containing five input fields: "Frame #", "Offset from frame", "X co-ordinate", "Y co-ordinate", and "Z co-ordinate", all containing the value "0". To the right of these fields is a "Grounded" checkbox, which is unchecked. Below the grounding point section is a "Height of Water over Grounding Point" field containing "0". At the bottom of the dialog are four buttons: "OK", "Cancel", "Apply", and "Help".

When this option is selected, the maximum allowable moment is calculated and printed in the report.

IMO Res.A.749(18) Ch.4.5 & 3.2

ID	Name	Value	Units	Limit	OK?
1	Area to 30 degs	0.5180	m-rads	> 0.0550	Yes
2	Area 30 to 40 degs	0.3270	m-rads	> 0.0300	Yes
3	Initial GM	3.379	m	> 0.150	Yes
4	Max GZ at angle > 30degs	1.913	m	> 0.200	Yes
5	Position of Max GZ	39.45	degs	> 15.00	Yes
6	0.8 x deck immersion angle	14.24	degs		
7	Wind steady state angle	0.50	degs	< 14.24	Yes
8	Wind gust angle	0.74	degs		
9	Rollback angle	19.50	degs		
10	Heeling moment arm	0.029	m		
11	Area A	0.2293	m-rads		
12	Area B	1.1368	m-rads		
13	AreaB/AreaA	4.9571		> 1.0000	Yes
14	Deck Immersion angle	17.80	degs		
15	Maximum GZ	1.913	m		
16	Heel at half max GZ	14.01	degs		
17	Angle for GZ measure	14.01	degs		
18	GZ	0.957	m		

Max Allowed Anchor Handling Moment = 1431 x 0.957 = 1369 tonnes-m

The ship's personnel must ensure that the actual moment applied, when handling an anchor, does not exceed the maximum moment.

Conclusion

This tutorial has explored the unit loads, crane and anchor handling features of **LoadmatePlus**.

Please contact us if you have comments or queries, preferably using the contact form on our website: <http://shipdesign.co.uk/contact> which can also be used to request a demonstration version of **LoadmatePlus** including a selection of demo vessels.