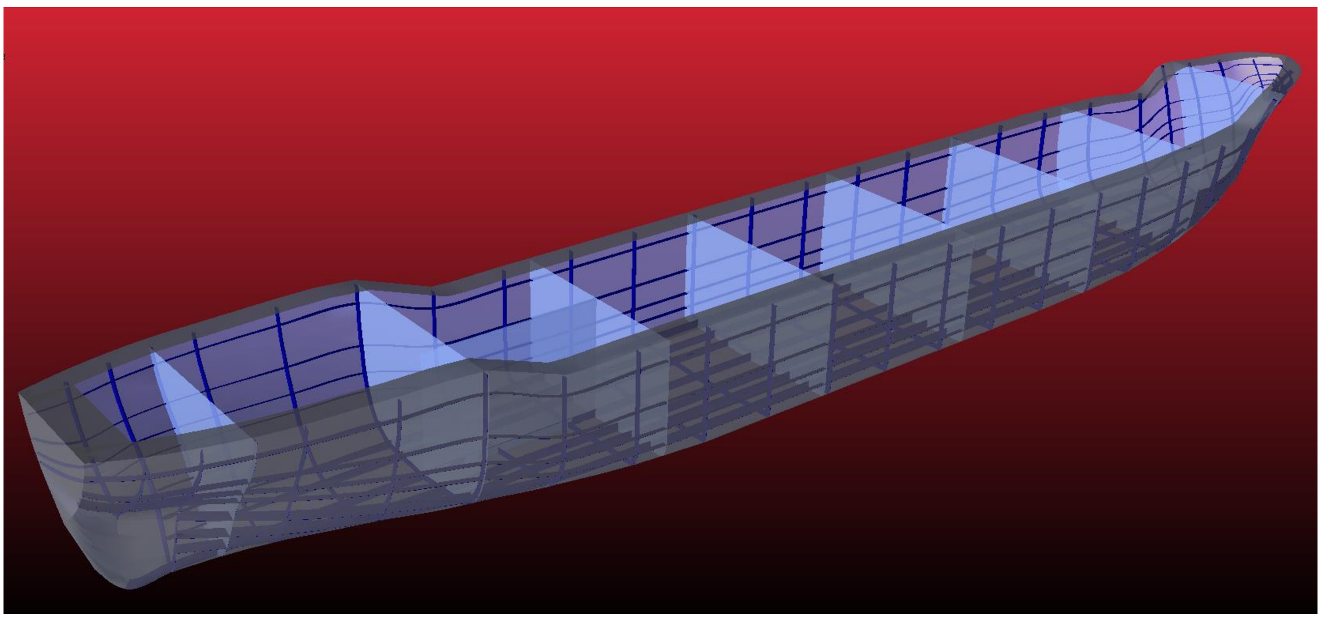
Maritime Systems Engineering Department

Texas A&M University at Galveston

A Guide on Using DNV Sesam for Design and Analysis of Ships



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Preface

This report provides a reference capable of enabling the user with knowledge and skills needed to perform a hydrostatic and structural analysis of a ship using DNV Sesam modules GeniE, HydroD, and Sestra. In order for this report to remain effective, it must be updated to the current revision of the DNV software that is available to the user, and tailored to the projects assigned within the department. The original report was constructed with GeniE V6.4-08, HydroD V4.6-03, and Sestra V8.5-01.

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Abstract

The hydrostatic and structural analysis of a vessel is presented using DNV Sesam modules GeniE, HydroD, and Sestra. The report focuses on the design and modelling of the hull, primary, secondary, and tertiary structural elements of the ship. In addition to the physical modelling of the ship, the report will include the necessary steps required to migrate the model between software modules.

Nomenclature

Acronym	Explanation
ABS	American Bureau of Shipping
FEM file	SESAM Input Interface File
LMB	Left Mouse Button
RMB	Right Mouse Button
PORT	Left Side of Ship When Facing Forward
STBD	Right Side of Ship When Facing Forward (Starboard)
DNV	DET NORSKE VERITAS
XVERSE	Transverse
T	Draft (Ship Still Waterline)
AP	Aft Perpendicular
Fwd	Forward
FP	Fwd Perpendicular

Table of Contents

Chapter 1- Introduction

Student feedback as well as instructors observations have consistently expressed a need for supplemental training materials outside of those provided with the DNV Sesam software package. The materials provided by DNV presents a comprehensive reference needed to navigate and utilize the software when creating objects that comprise of basic and complex geometric shapes. However, student feedback as well as instructors observations have consistently noted that DNV's supplemental training guides could be shortened to a concise guide that better suits the needs of the department. It was also suggested that more focused information regarding the navigation between DNV modules would be beneficial too.

Prior to this guide, a formal mechanism in which senior generations of students could transfer knowledge and expertise related to the DNV Sesam software suite was not available. Through proper upkeep and maintenance, this document would facilitate a steeper learning curve with respect to DNV Sesam for upcoming students, thereby allowing them to update this document with further detail pertinent to department curricula, and thus the cycle continues.

This report utilizes DNV's "A2_GeniE_Semisub_pontoon" PDF guide, "GeniE_UM_Vol3", "HydroD_UM", and "Sestra_UM", as well as information that was obtained from the first-hand use of DNV Sesam that was not explicitly delineated in their training materials. The main objectives of this guide is to perform and concisely document the steps used to perform the hydrostatic and structural analysis of a ship using DNV Sesam modules GeniE, HydroD, and Sestra.

Initially, this guide begins with steps taken from DNV's "A2_GeniE_Semisub_pontoon" PDF guide. Beginning at the 'Poly-Curve Dialogue' section of Chapter 3, the images and text are almost entirely created by the author unless otherwise noted. The report is organized and structured following the general progression of steps taken in order to complete the stated goals. Chapter 3 is divided into two sections: Section 1, Panel Model, utilizes Sesam GeniE to create a panel model of the ship's hull and export it as a T1FEM file; Section 2, presents the generation of a structural model of the ship to be exported as a T3FEM file. It is important to understand that Chapter 3, Section 2 is written as a continuation of the previous section. In Chapter 4, the hydrostatic and stability analysis of the ship are performed using Sesam HydroD. Structural analysis of the ship is covered in Chapter 5 utilizing Sesam Sestra which is executed through the GeniE module. Chapter 6 contains Suggestions/Common Errors that pertain to the use of DNV Sesam in the context of this guide.

Chapter 2- Vessel Information

The ship modelled in this report is based on the Armfield ship model located in the Naval Architecture laboratory. The laboratory model is a 1/70th scale model, and in this report it is modelled to full scale. The Table of Offsets of the ship are provided in Appendix 1. An image of the Armfield Ship Model is shown and resembles the model located in the Naval Architecture laboratory. In addition to the hull and bulkheads, the ship will be modelled with structural members determined utilizing American Bureau of Shipping (ABS) Rules for Building and Classing Steel Vessels 2009. In this guide, the ships: machinery, superstructure, and propeller are not modelled or analysed. However, in the complete study of a ship, the aforementioned elements of the ship should be evaluated.

http://discoverarmfield.com/media/filter/l/img/general_cargo_vessel.jpg

The hull lines of the vessel are provided in Appendix 3. There are 8 transverse bulkheads and 1 longitudinal bulk head. There locations in the vessel are annotated in the diagram below.

Bulk Head #	Distance From A.P. (meters)
1	12.53
2	33.53
3	53.48
4	74.34
5	95.2
6	116.27
7	136.92
8	156.38
Transverse Bulk Head	Centerline from Bulkhead 2 - 3

This guide was performed using a draft of 9.403 meters and a KG of 5.2 meters. This yielded a metacentric height of 1.101 meters

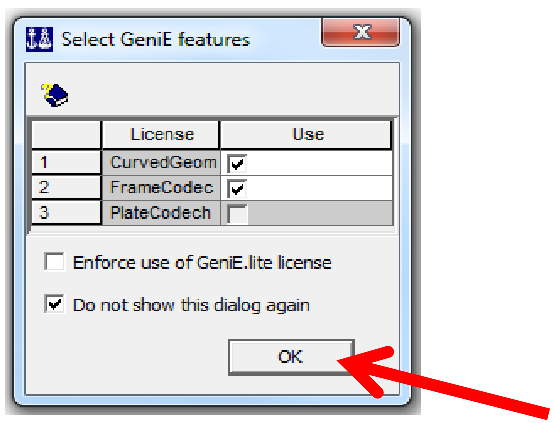
Chapter 3- GeniE

In this guide, Sesam GeniE is used to generate and export two FEM files for use in HydroD, that consist of the hull (shell) and structural (beams) elements of the ship. The 'Panel Model' contains the shell only, while the 'Structural Model' consists of the hull and beams. The initial portion of the first section begins with steps taken from DNV's "A2_GeniE_Semisub_pontoon" PDF guide. Beginning at the 'Poly-Curve Dialogue' section, the remainder of the images and text are entirely created by the author.

Section 1 – Panel Model

Establishing a Workplace

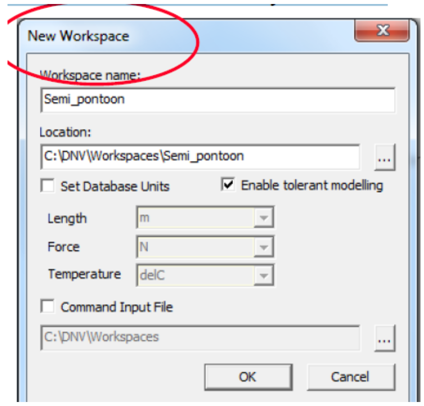
- When GeniE is first opened, the user is prompted with the dialog box shown below. Ensure the boxes are selected as shown and select "OK"



Define units:

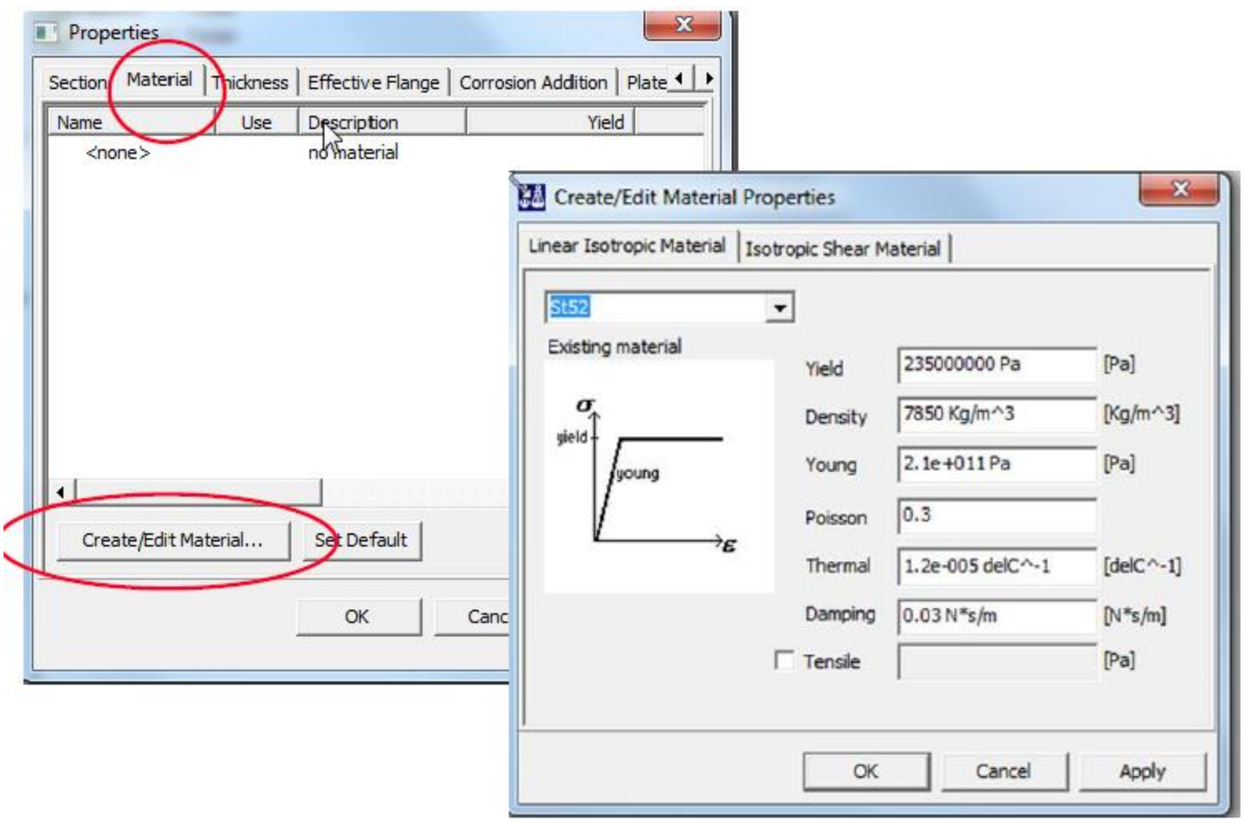
Meters and Newtons

- Start the program and open a new workspace File|New Workspace
- Specify name 'Panel_Model' and use the default values for database units
- Click OK when done



Define material

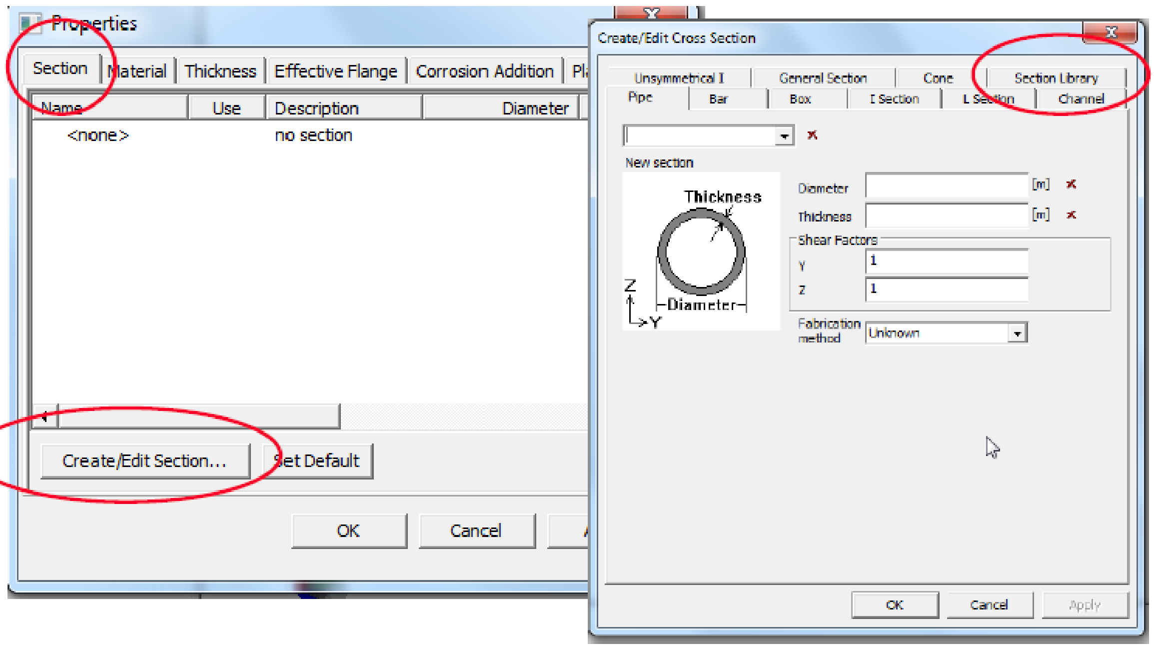
- Use the command Edit|Properties and select Material. Select Create/Edit Material to give the details for St52 (remember to tick “Allow edit”).
- Set the material type to default
- Click OK when done.



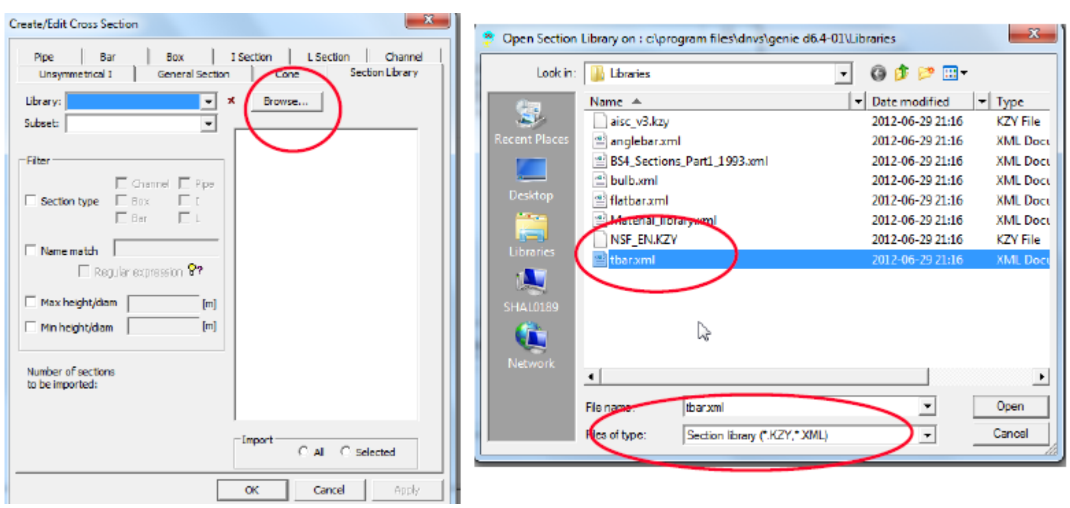
Define section properties

The Section profiles required for the user's vessel should be determined by the appropriate "Code Manual" (ABS was used to determine the structural components utilized in this report.)

- Use the command Edit|Properties and select Section. Select Create/Edit section to start defining the sections. Select "Section Library"
- Section profiles Tbar425x120x12x25, Tbar575x150x12x25, and Tbar885x200x14x35 are found from section libraries.



- Find the right section library from "Browse" and select the library 'tbar' (a library containing typical Tbar ship profiles)

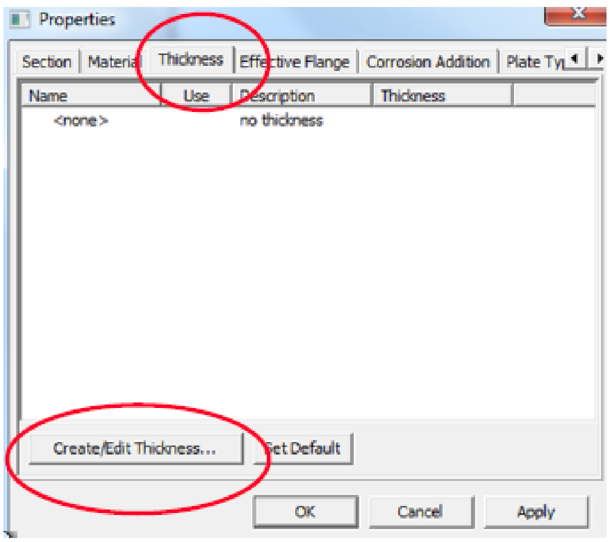


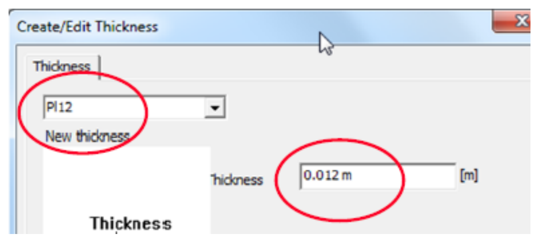
Define Plate Thicknesses

Plate thicknesses were determined following **ABS Rules for Building and Classing Steel Vessels 2009:** 5B, Common Structural Rules for Bulk Carriers: 5B Chapter 6 Section 1 Table 2 (Minimum net thickness of plating), and 5B, Chapter 3 Section 3 Table 1 (Corrosion addition on one side of structural members)

Define the plate thicknesses Pl12, Pl16 and Pl21 as follows:

- Use the command Edit|Properties and select Thickness.
- Select Create/Edit Thickness to start defining the thickness properties
- Click OK when the desired values have been entered

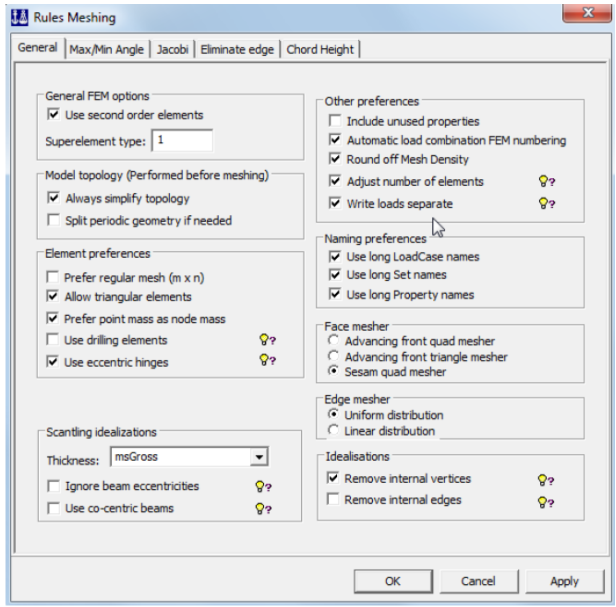




Specifying Mesh Settings

The mesh settings for automatic mesh creation will be set next, but these values can be adjusted at any time prior to the mesh generation.

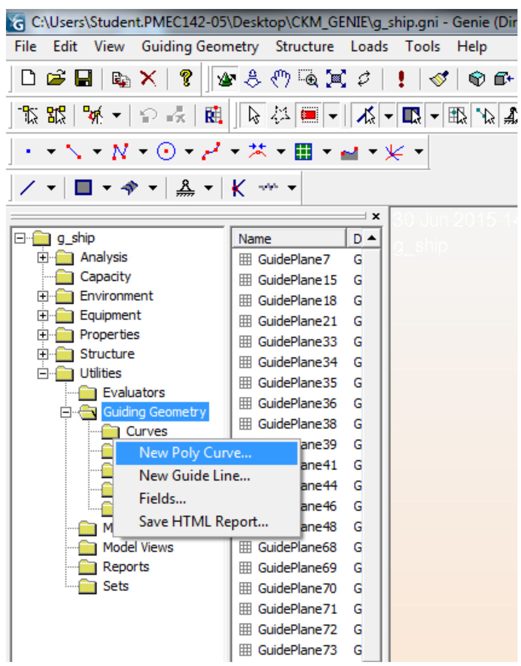
- Edit|Rules|Meshing. In addition to default settings select:
  - Use second order elements
  - Round off Mesh Density



Poly-Curve Dialog

This will be the mechanism by which the ships offsets are transformed into Guiding Geometry.

- In the model tree, right-click on Curves and select 'New Poly Curve.'



One approach to creating the station curves involves utilizing the station line coordinates in the format shown in Appendix 2. Coordinates can be copied into the poly-curve dialogue box to generate the PORT half of the stations.

These values can be entered into the dialogue box manually from Appendix 1 as well.

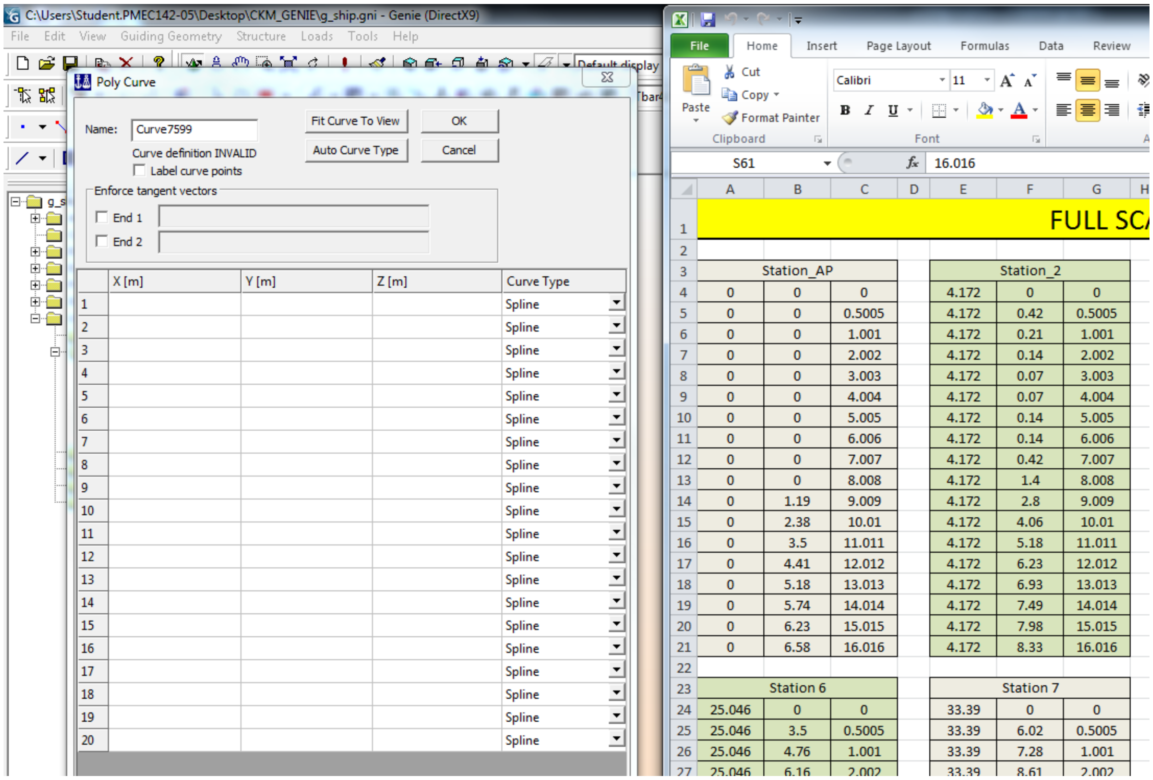


Figure 1, resembles what should be visible after the initial 25 PORT stations have been entered (AFT perpendicular is on the left).

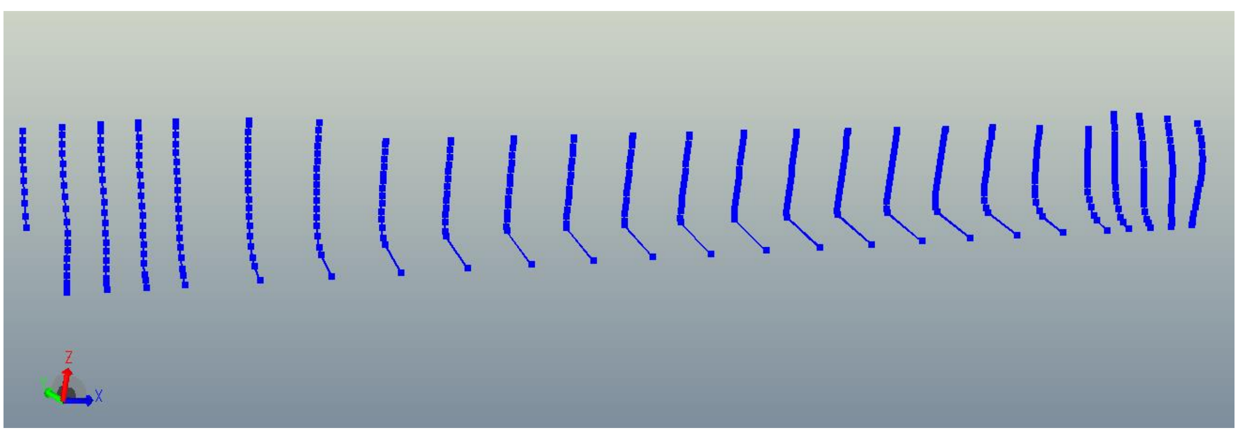
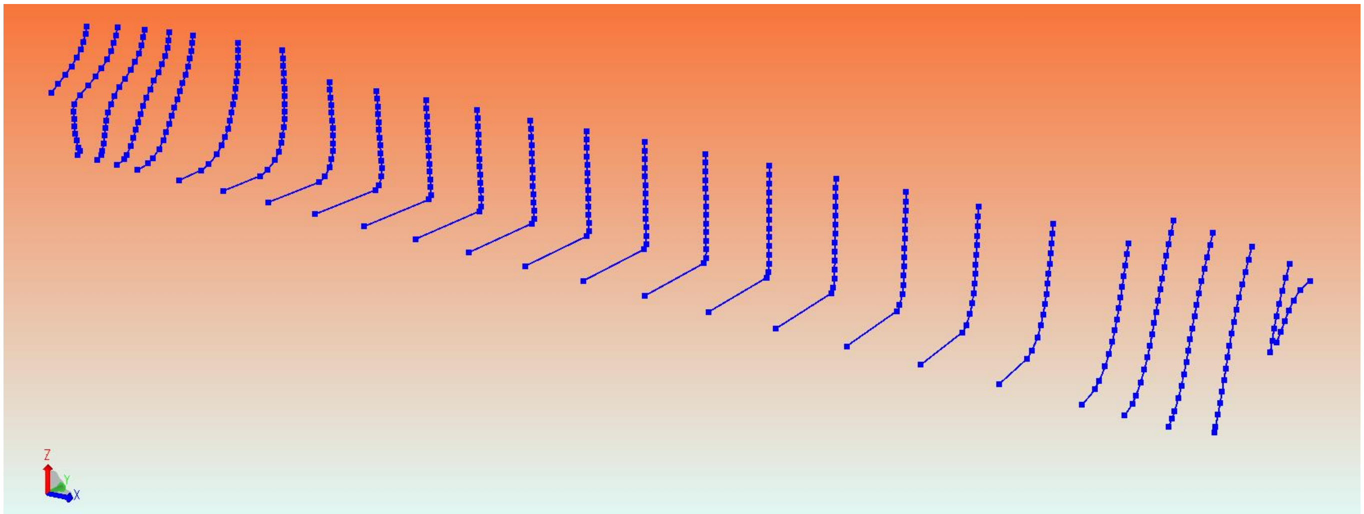


Figure 1: 25 PORT Stations

- Next, the forward most station labelled BOW Extra (Appendix 2) is added to the model using the method explained previously.

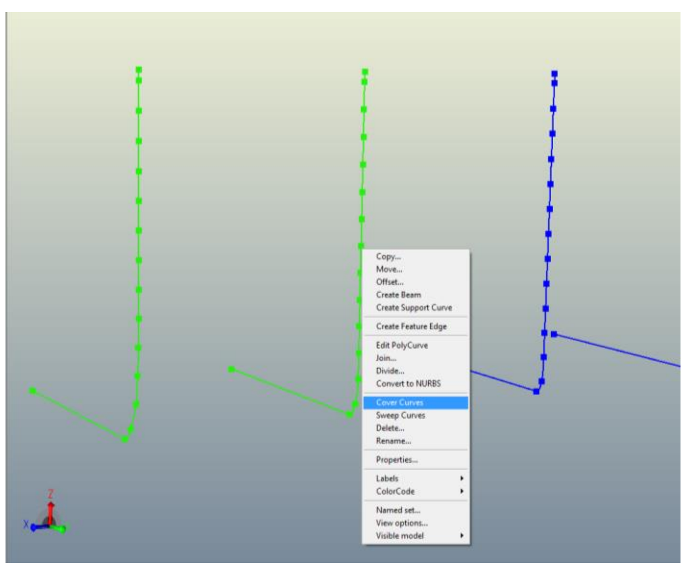
This is done to complete the fore section of the ship, beyond FP. At this point, the user should have the 26 poly-curves comprising of the 25 stations from the table of offsets plus the additional BOW Extra station.



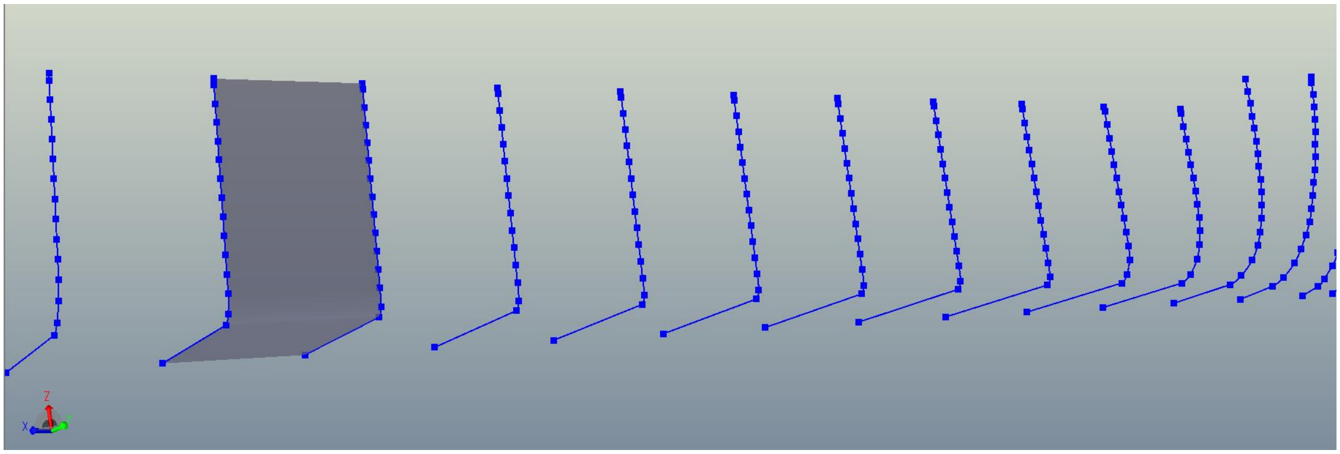
Cover Curves/Plating

The outer hull will be modelled for the panel model needed for later analysis in HydroD.

- This is accomplished by selecting two adjacent stations
- Right Mouse Button (RMB)
- Then selecting Cover Curves.



After plating the first set of stations, the model should look similar to the image shown below. This image will vary based on the order in which stations are plated.



- This method will be repeated until all stations are covered to include to extra BOW station.

At this point, the ship will resemble Fig. 2, shown below with the FWD perpendicular located on left.

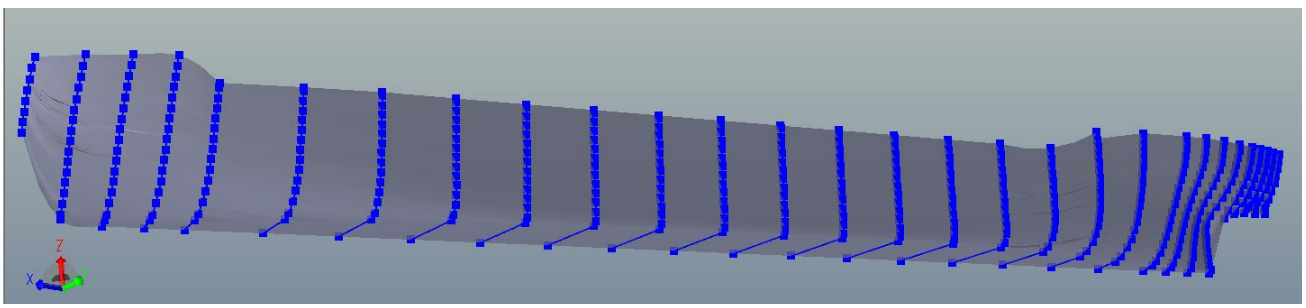


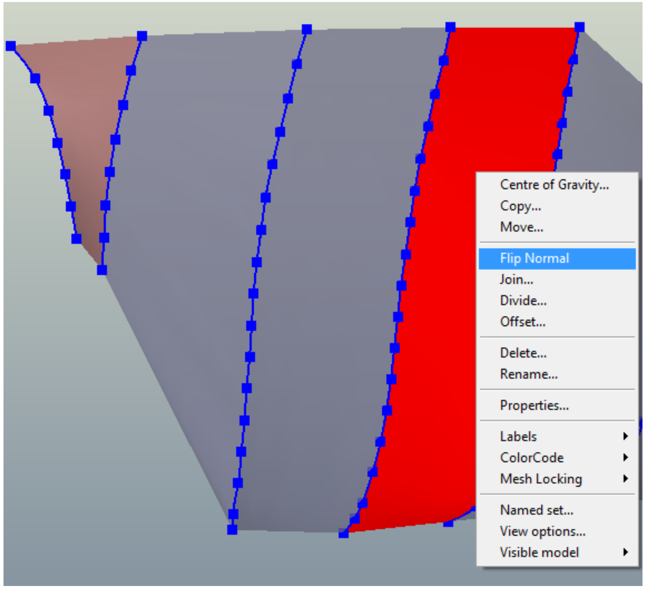
Figure 2: Completed PORT-Side Plating

Plate/Shell Orientation

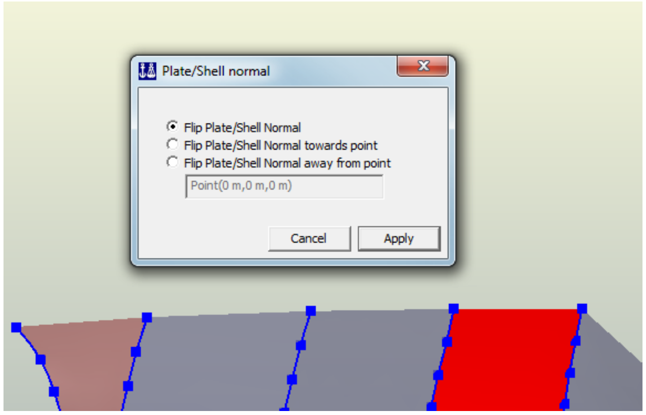
After creating all of the plates (panels) you may notice that some appear red as opposed to grey. The color represents the orientation of the plating (i.e. what is the front and back side). All of the plates should have the grey side facing outward, away from centerline.

- To change the orientation, Left Mouse Button (LMB) a plate
- Then RMB and select Flip Normal

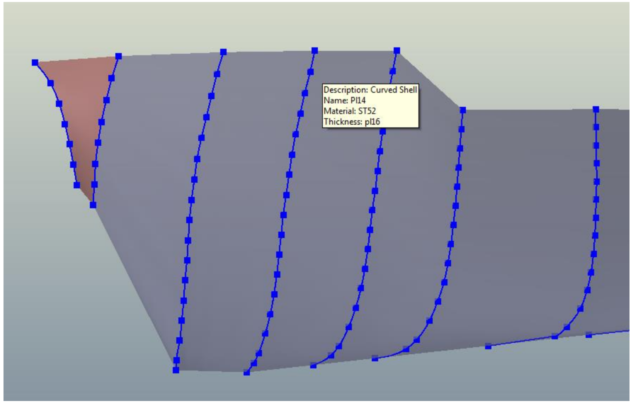
Note that background, plating and beam colors may be modified by the user to enhance visibility.



- In the Plate/Shell Normal dialogue, select APPLY, then click cancel.



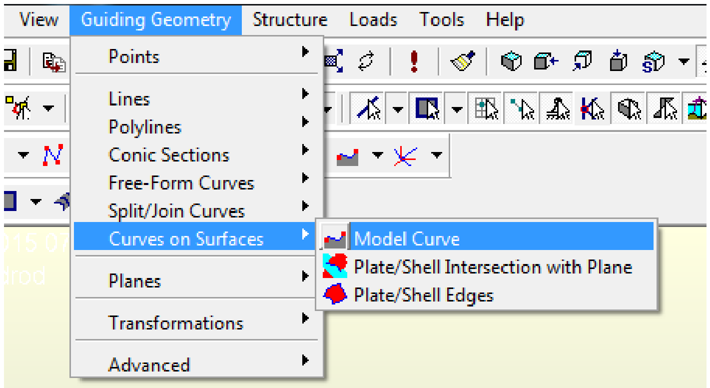
The plate should now appear grey.



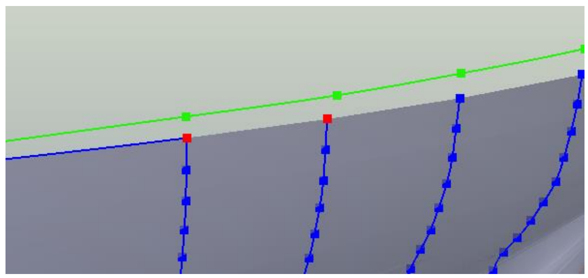
- Perform this method until all plates are oriented properly (grey facing outward).

Next, create a model curve (curve following surface topology) along the top edge of the newly created PORT plates.

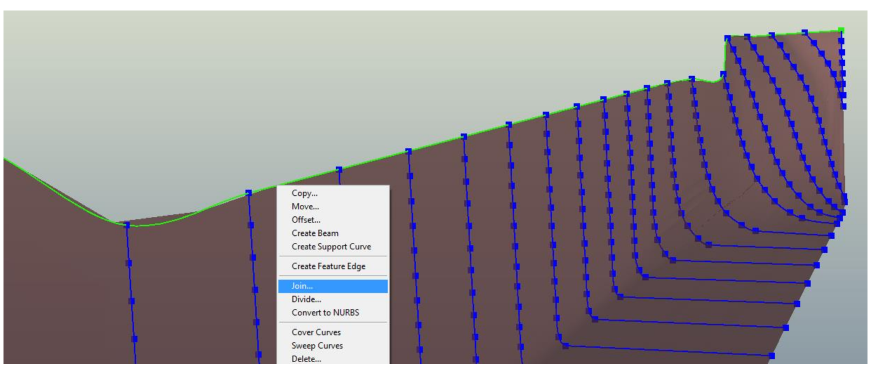
- Select Guiding Geometry| Curves on Surfaces |Model Curves



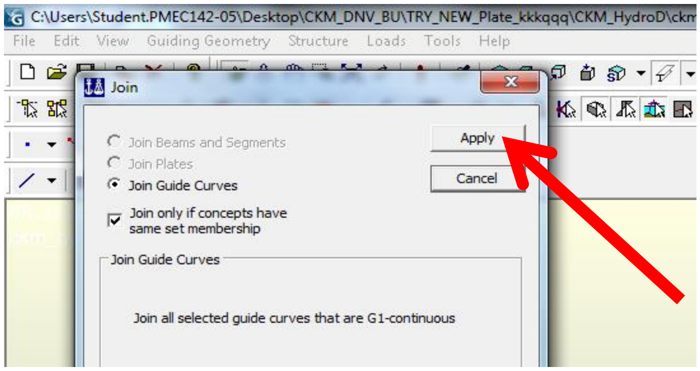
- Click the upper most point of station, followed by the upper most point of an adjacent station (Example points shown in red).



  - Once all of the curves have been created along the top edge of the PORT hull, select all of them.
    - First select the first line and press and hold the SHIFT key
    - While holding SHIFT, select the remaining lines until all are highlighted
    - Now, release the SHIFT key, RMB on the highlighted line and select JOIN



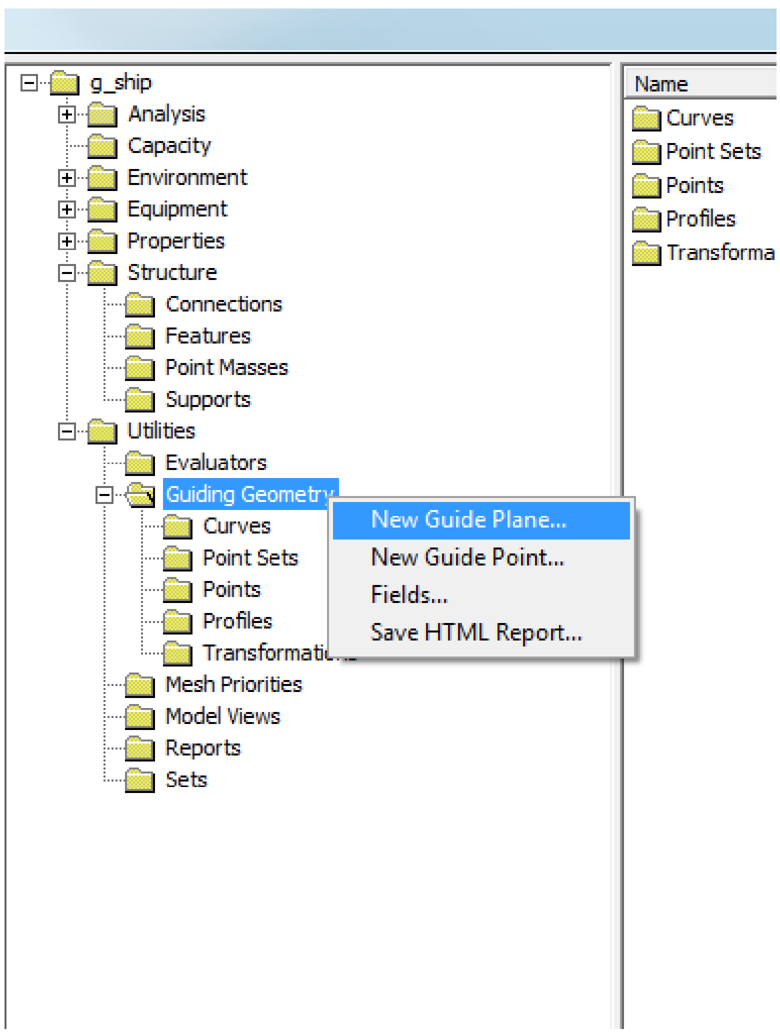
- Now complete the JOIN command by selecting Apply.



Guide Planes

Now, we will create horizontal guide planes that intersect the newly created hull at the T= 9.403m waterline.

- In the model tree, RMB on Guiding Geometry and select New Guide Plane…
- Enter the coordinates for the T= 9.403m waterline, and create a guide plane.



The T= 9.403 meter draft is shown below in Fig. 3, and is specific to this vessel and guide.

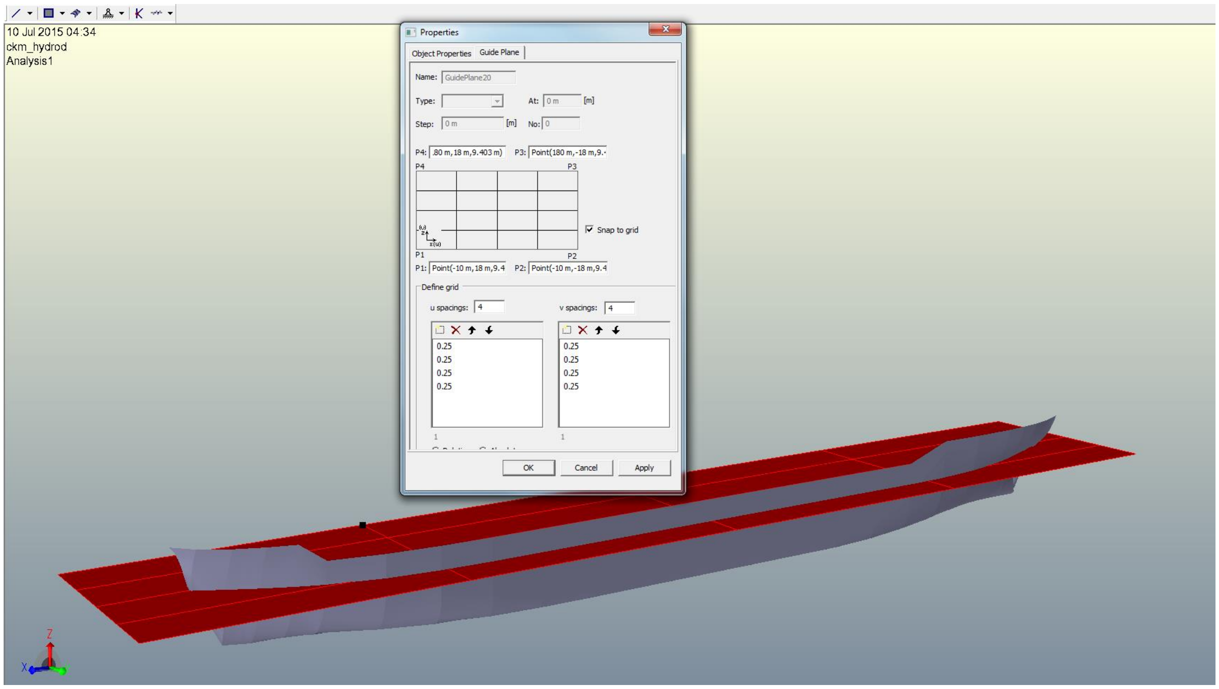
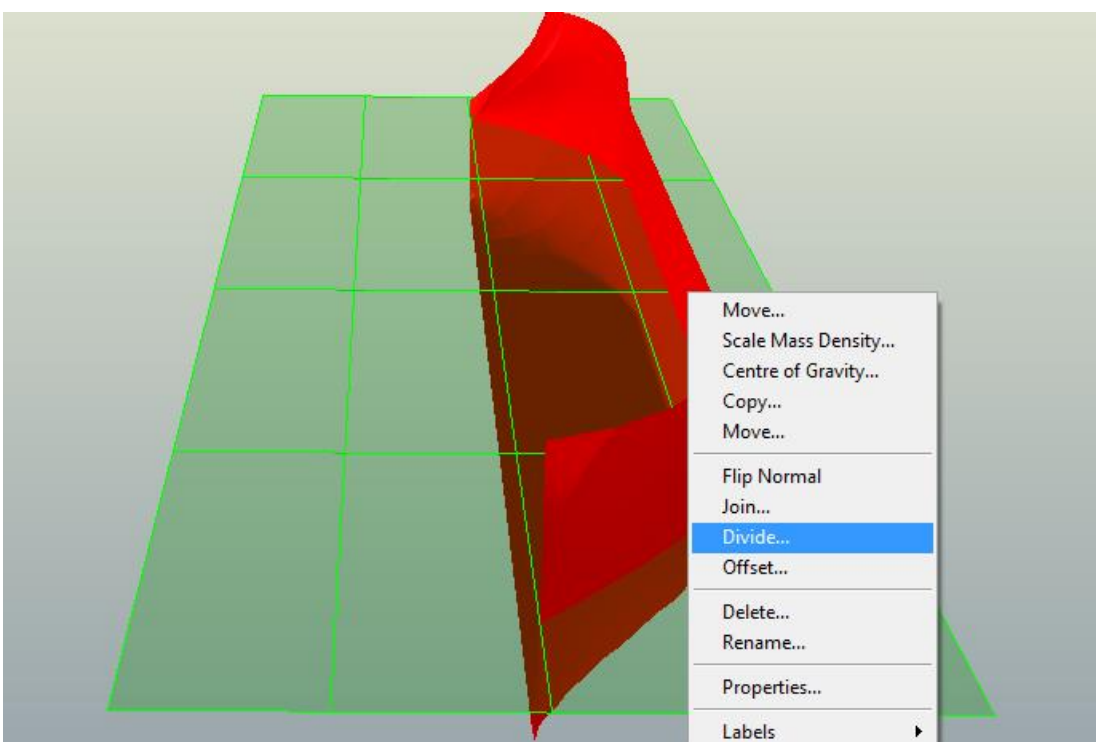


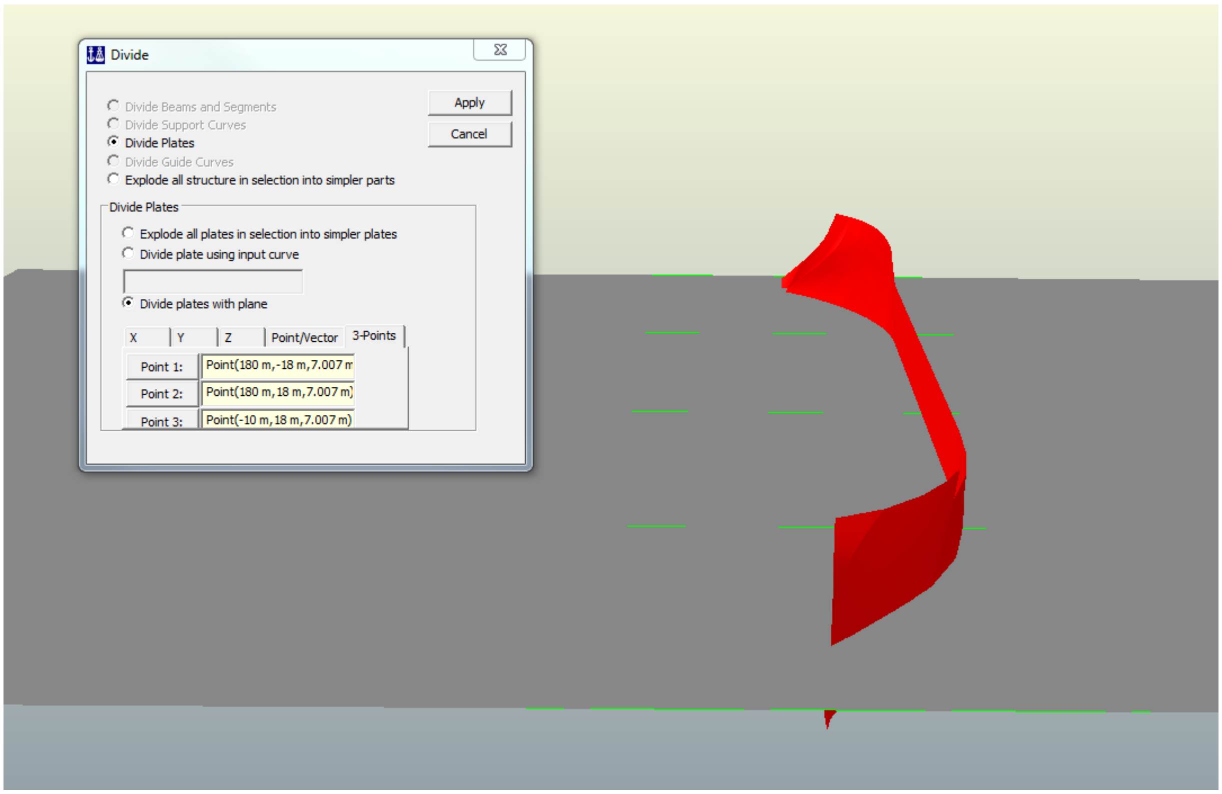
Figure 3: 9.403m Waterline Guide Plane

Dividing Plates

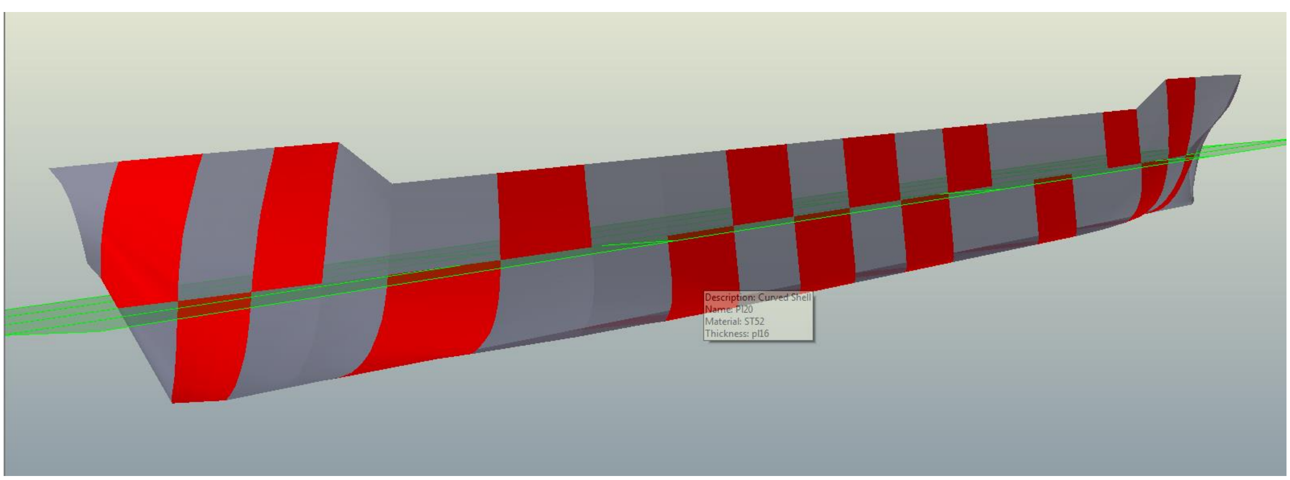
- Next, the PORT hull plates will be divided at the 9.403m waterline
  - This is done in order to establish the ships draft for HydroD
    - Select all of PORT hull plates, RMB|Divide



- In the dialogue box, select divide plates with plane
  - Select 3 corners of the 9.403m guide plane that was just created
  - Click Apply then Cancel



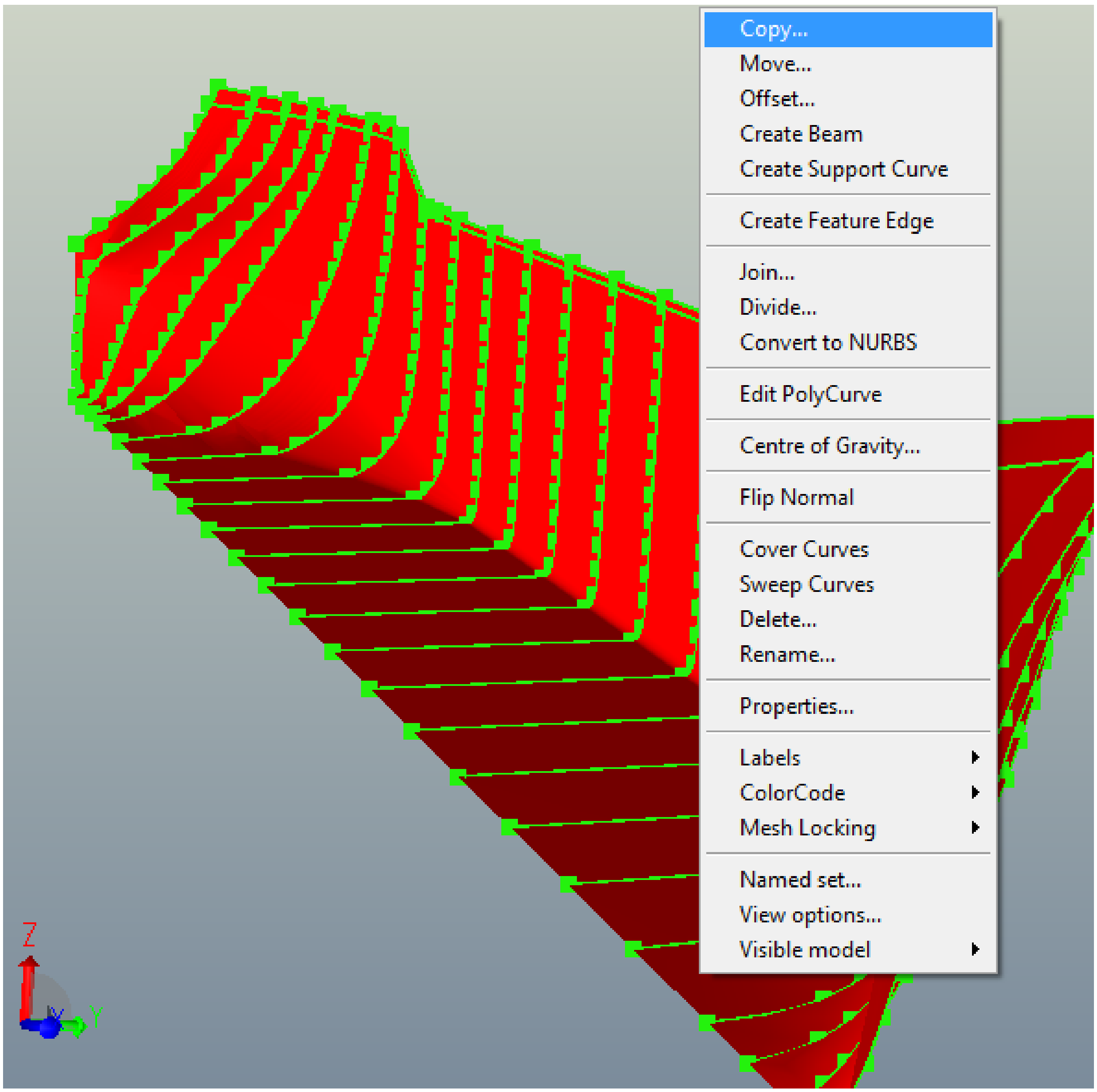
- Now the plates have been divided at a draft of T= 9.403m and should resemble the image below.



Copy/Mirror

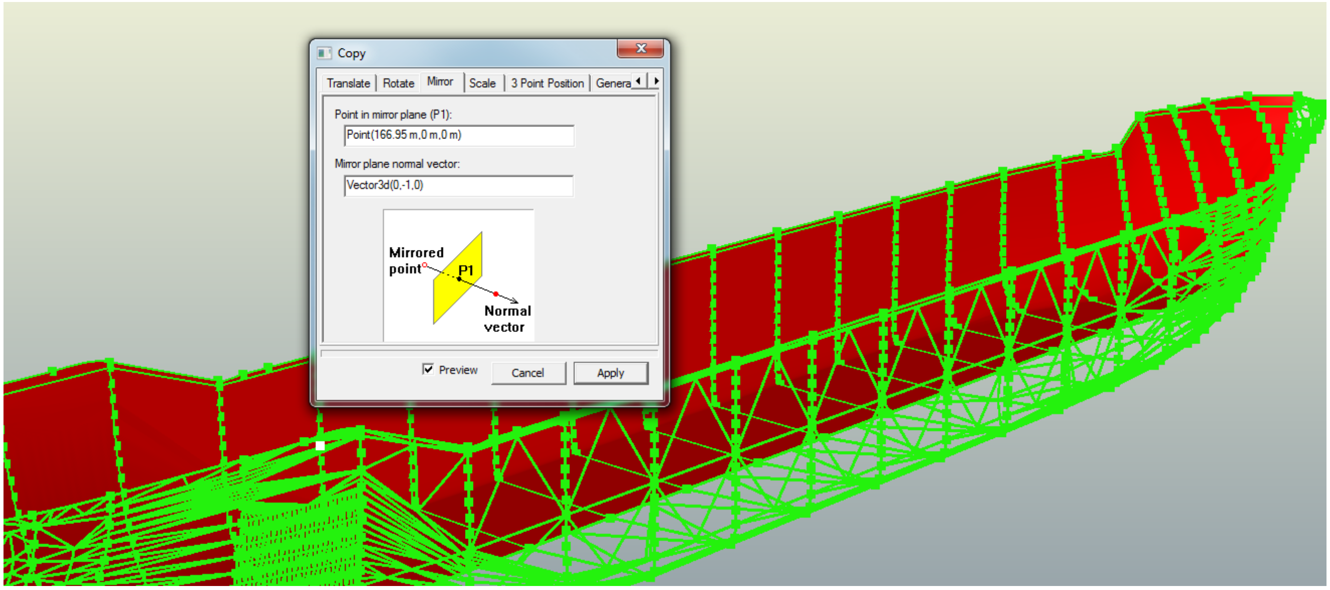
At this point, the PORT panel model is ready to be mirrored.

- Select all items created to this point
- RMB|Copy



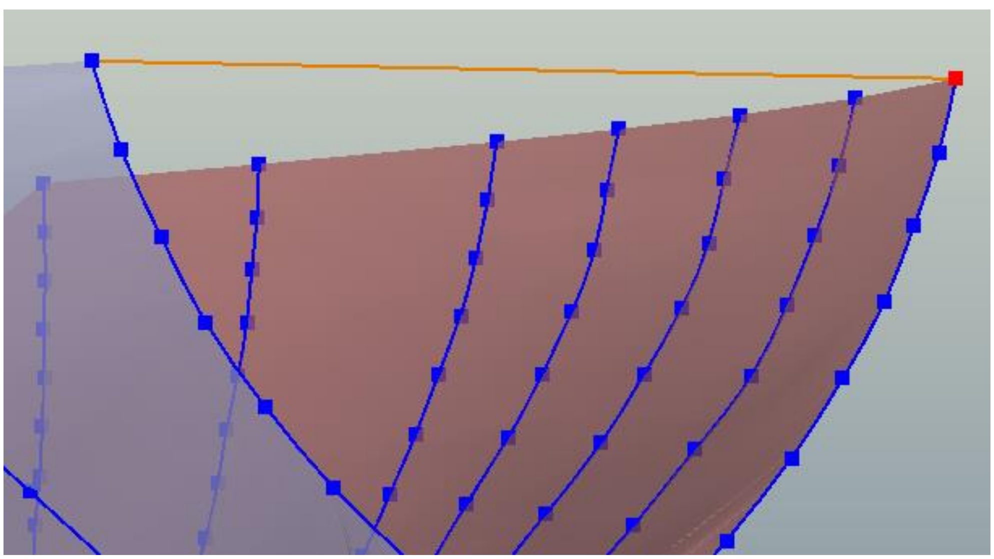
In the Copy dialogue box.

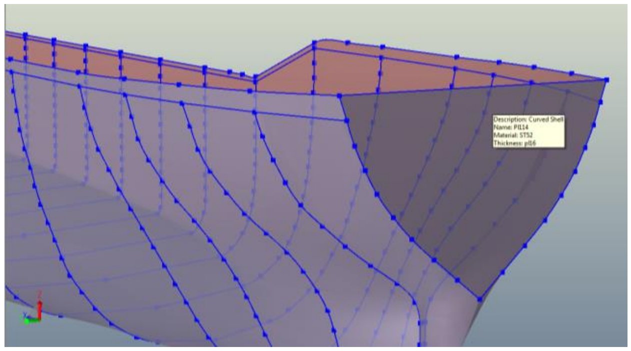
- Select the Mirror tab
- Fill in the values as depicted below
- Select Apply then Cancel



- On the AFT end of the ship, create a line connecting the uppermost points of the PORT & STBD aft most stations

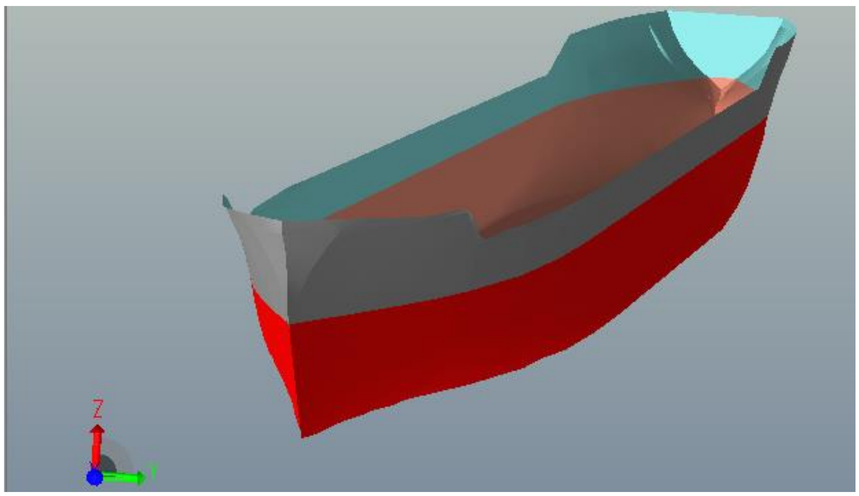
- Select the newly XVERSE line and the PORT & STBD station curves.
  - RMB|Cover Curves



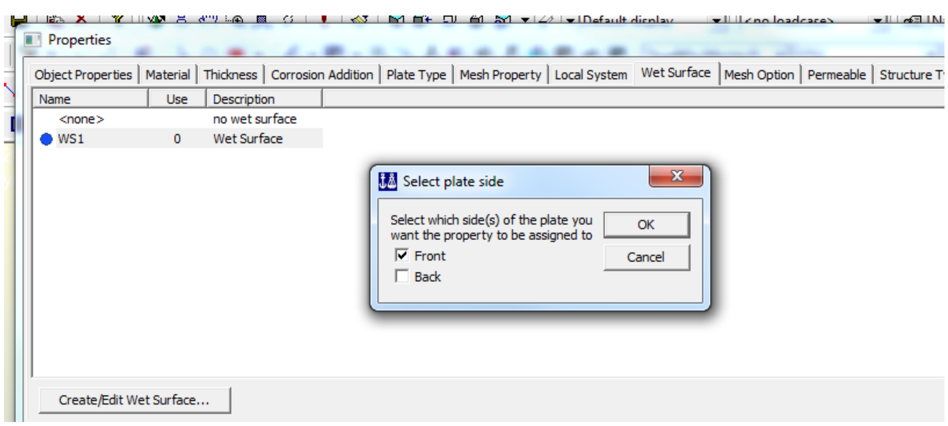


Prepare Panel Model for HydroD

- Select all of the hull plates below the T= 9.403m draft

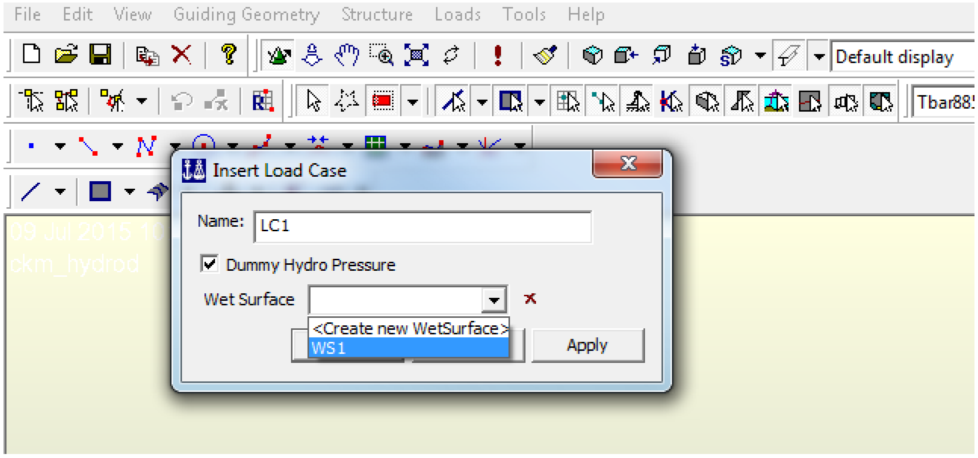


- RMB the highlighted region and select properties
  - Select the Wet Surface tab
  - Select WS1 and click Apply
  - Select the Front box and click OK
  - Click Cancel on the main dialogue box



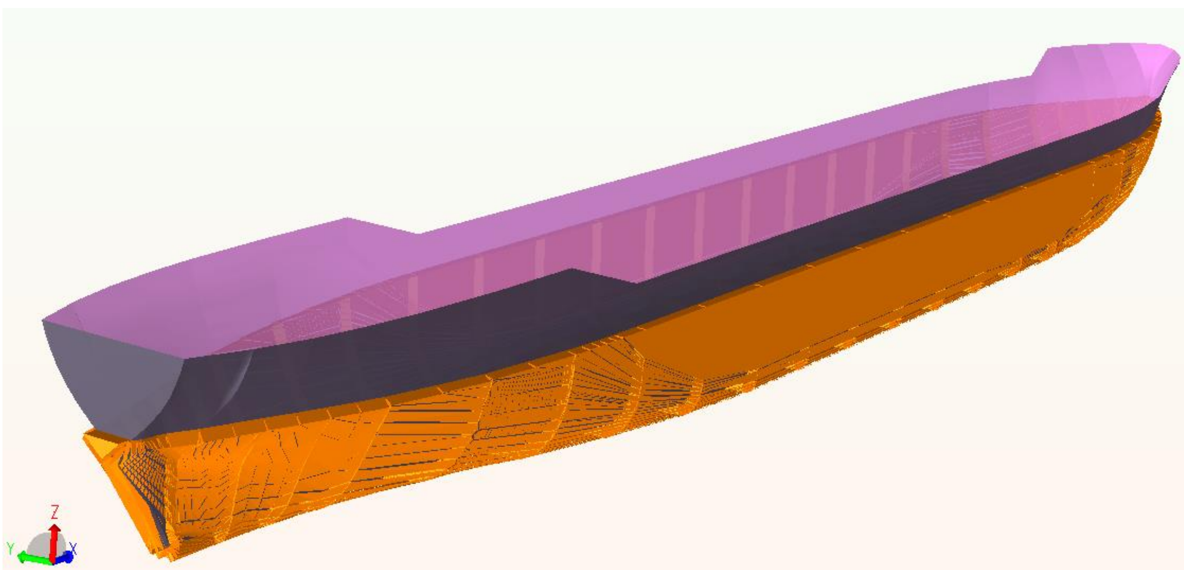
Next, apply the load case

- Under the Load tab, select load case
- Complete the dialogue box as shown and select Apply then Cancel



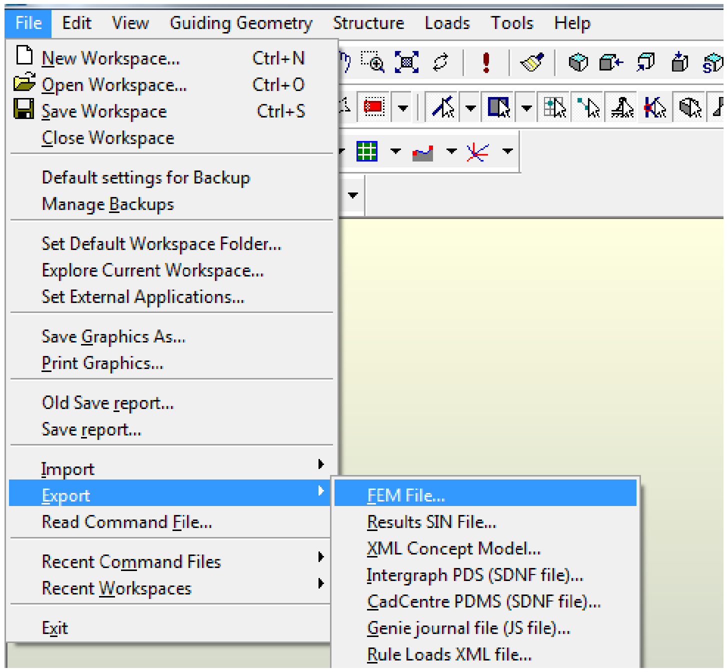
Apply the mesh

- Select the entire model and press Alt-M (this will mesh the model.)



Export the model as a FEM file

- File|Export|FEM File…



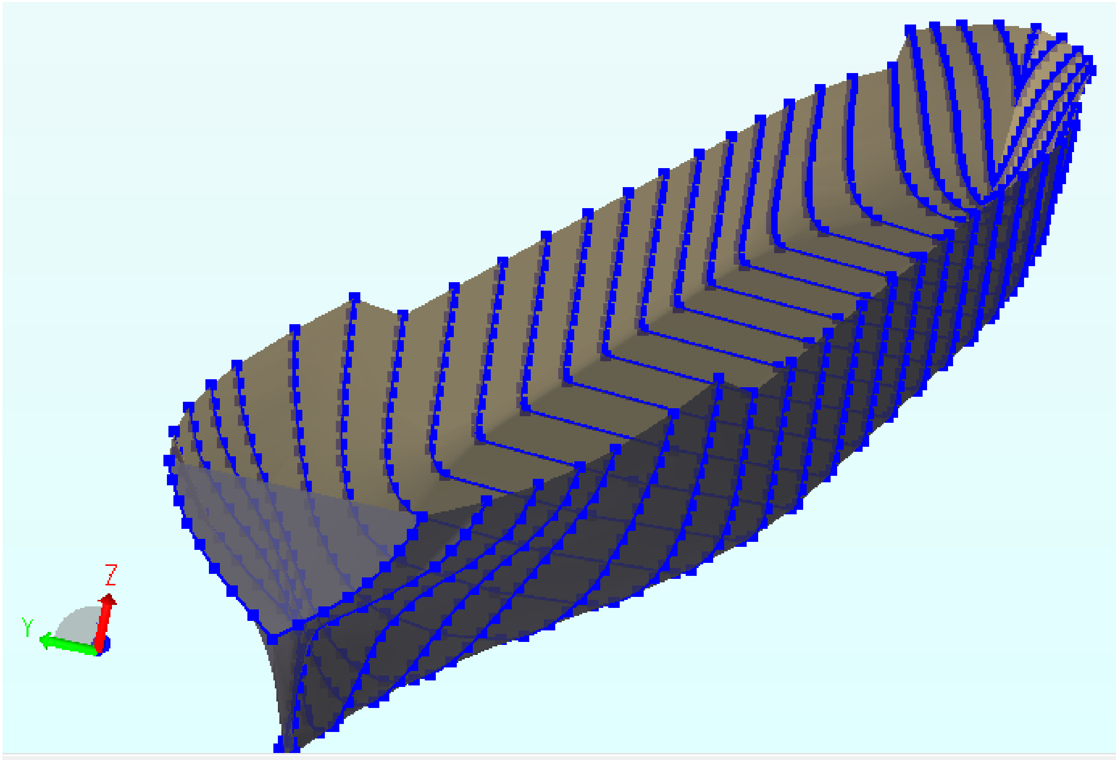
Section 2- Structural Model

This section is written such that the user has the following initial conditions met:

- A panel model T1FEM file has been exported with mesh applied to LC1
- All of the previously defined: member sections, plate thicknesses, material properties and units have been selected and/or defined.
- Identical Mesh properties have been selected, **with the exception of the Super Element type, which should be set to 3 vice 1.**
- The original 25 PORT ship stations and Bow Extra poly-curves have been created with the value listed in Appendix 1.
- A complete and empty hull exists from the completion of the previous section.

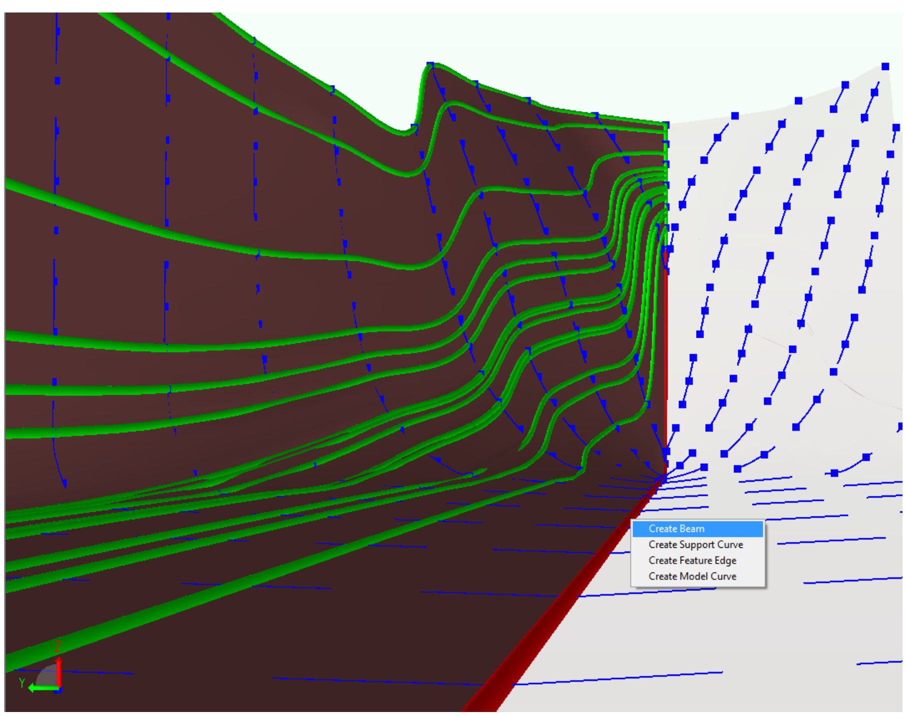
The information needed to establish these initial conditions is provided in the previous section. Additionally, detailed instruction on how to navigate to functions or tools that were explained/demonstrated in the previous section will not be repeated.

In the previous section, the cover curves method was utilized to make panels (plates) that collectively represent the ship's hull. It is at this point that the inner structural members of the ship will be added to the model carried forward from the previous section.

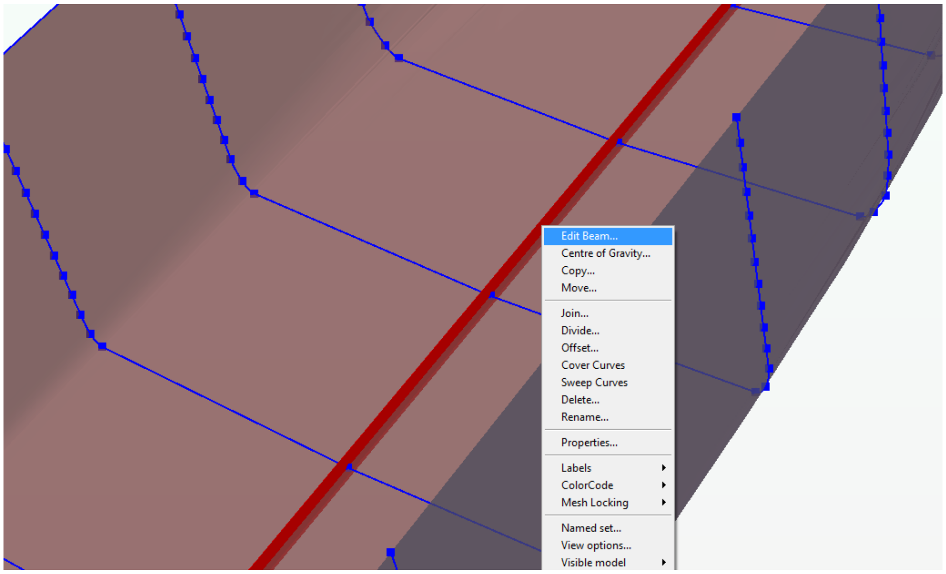


Centerline Girder

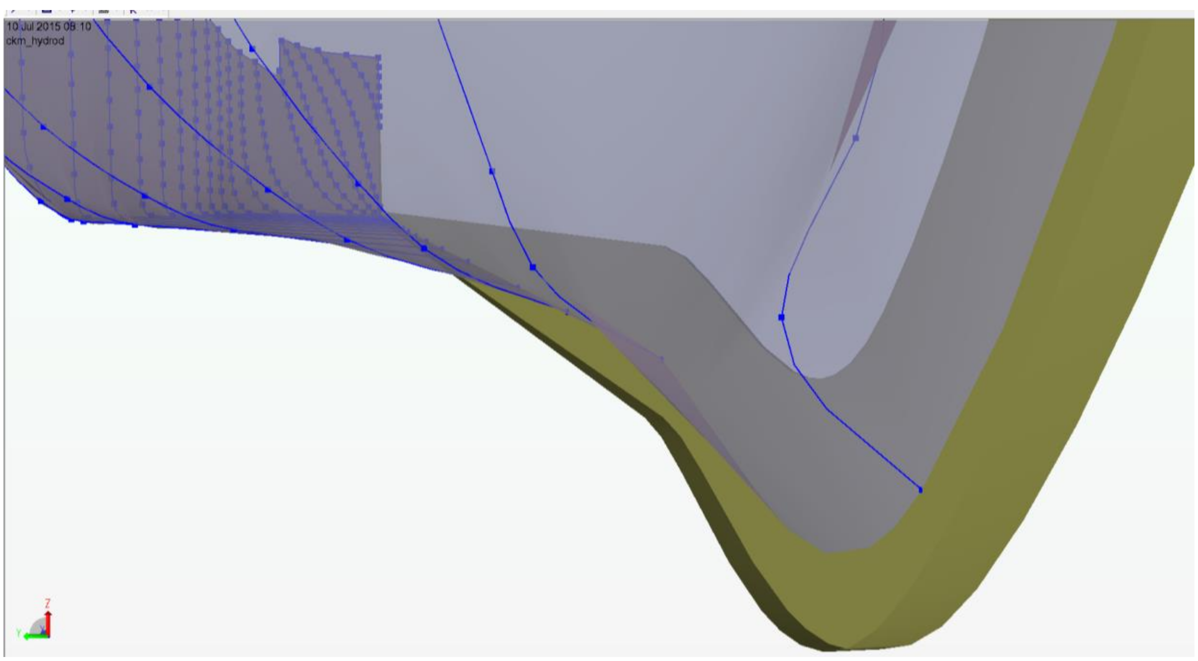
- Double LMB the PORT hull
  - This will cause the model to change to show the topology of the structure to include connection lines
  - Select the centerline connection line
    - RMB|Create Beam



- Double LMB the PORT hull
- Select the beam and RMB|Edit Beam…

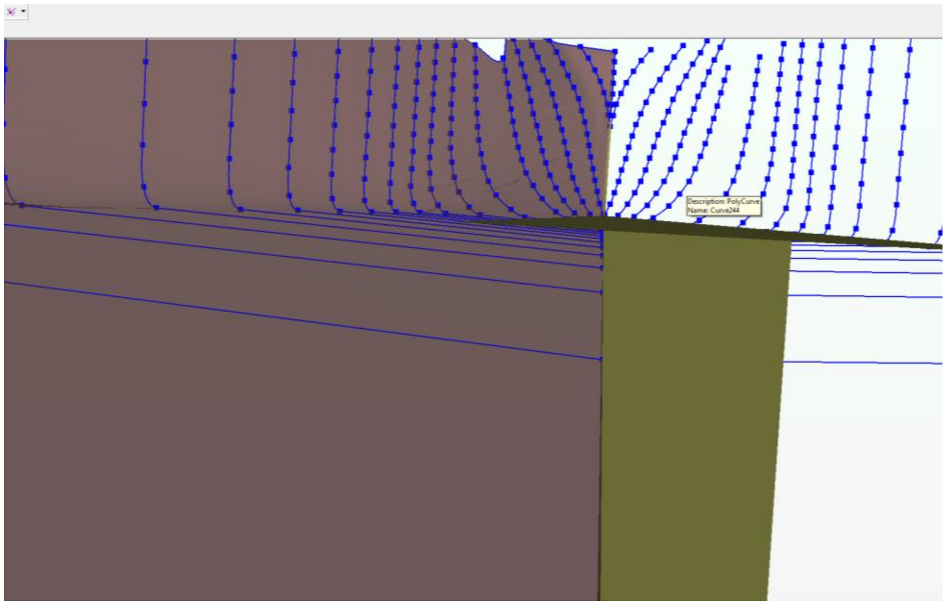


Beam Orientation



The figure above shows that the T-Bar that was just created is upside down and protruding through the hull

- In the Edit Beams Dialogue, select Rotate around local X-axis and enter 180
  - LMB|Apply
  - Select the Offset Vector tab
    - Check the Align Section box and LMB|Apply|OK

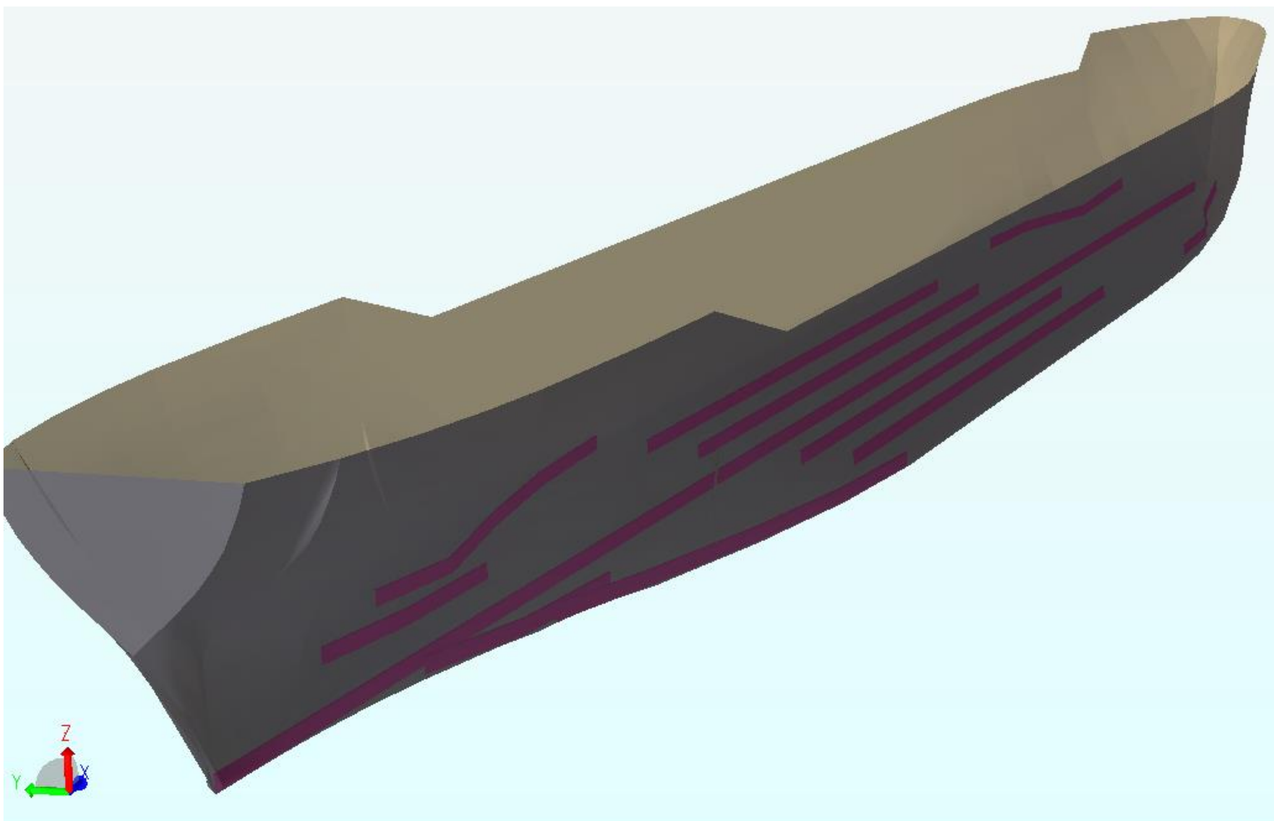


Additional Bottom Longitudinal Beams

- Double LMB the PORT hull
  - This will cause the model to change to show the topology of the structure to include connection lines
  - Select the connection lines adjacent to the centerline between Station 24 – Station 3
    - RMB|Create Beam
  - Double LMB the PORT hull
  - Select the new beam and RMB|Edit Beam…
- In the Edit Beams Dialogue, select Rotate around local X-axis and enter 180
  - LMB|Apply
  - Select the Offset Vector tab
    - Check the Align Section box and LMB|Apply|OK

- Select the Local System tab
    - Check the Relative to plate circle
    - Click inside of the ‘relative to the normal of’ box
    - Click anywhere on the PORT hull
    - LMB|Apply|Cancel

Perform these steps for the next adjacent connection lines until you have attained a longitudinal beam layout similar to the one below.

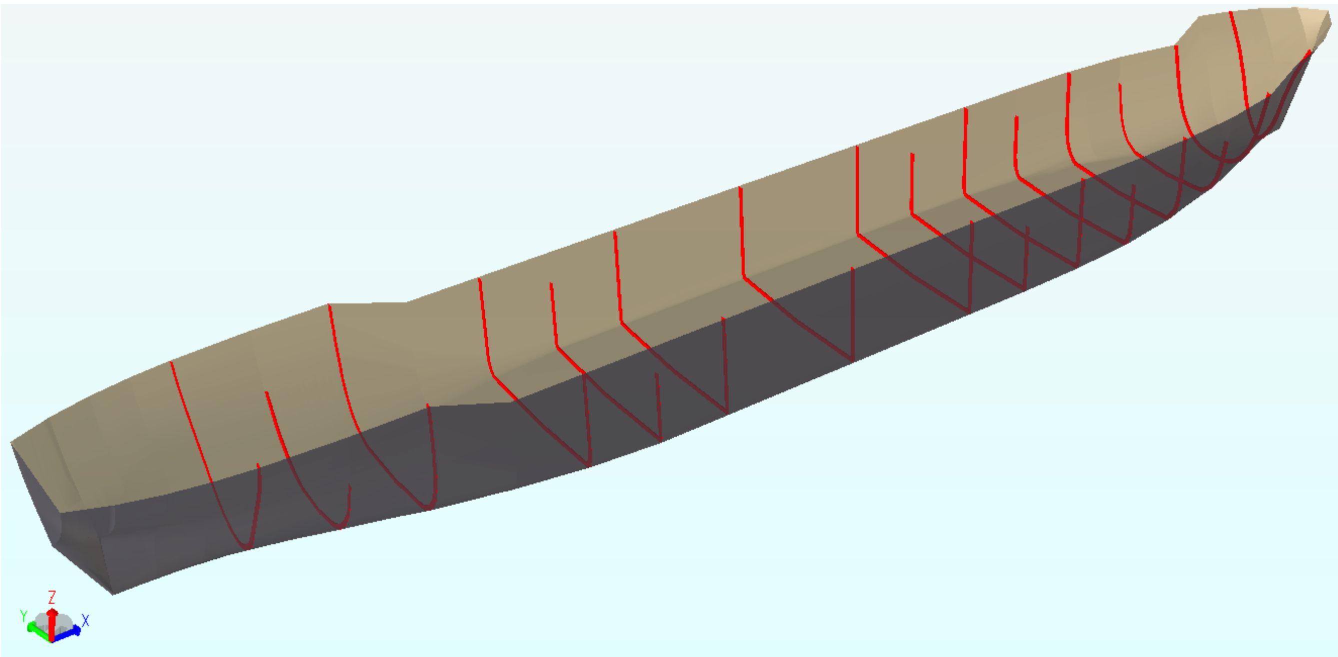


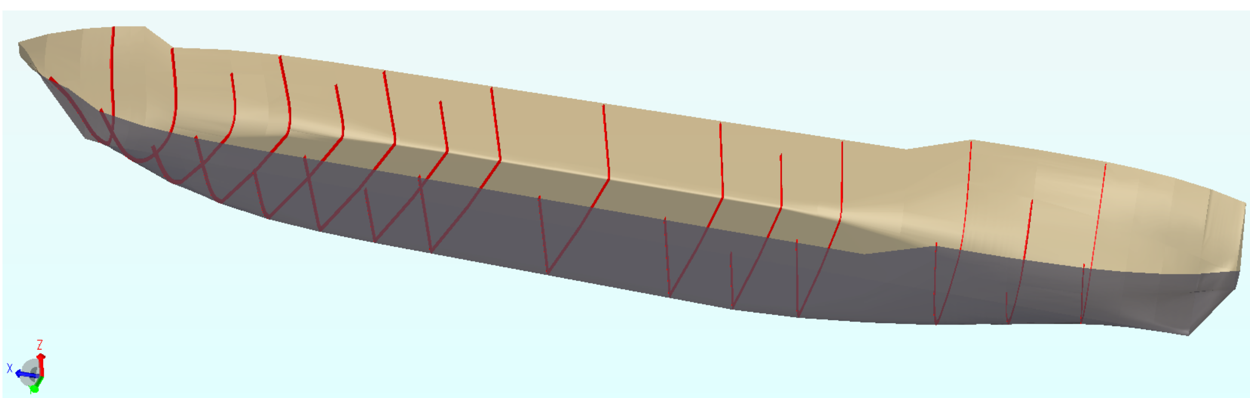
- Now select all thesenewly created beams beams at once
    - RMB|Properties
    - Ensure the Tbar885x200x14x35 section is chosen
    - LMB|Apply|Cancel

Transverse Beams

Create transverse beams on the PORT and STBD station poly-curves.

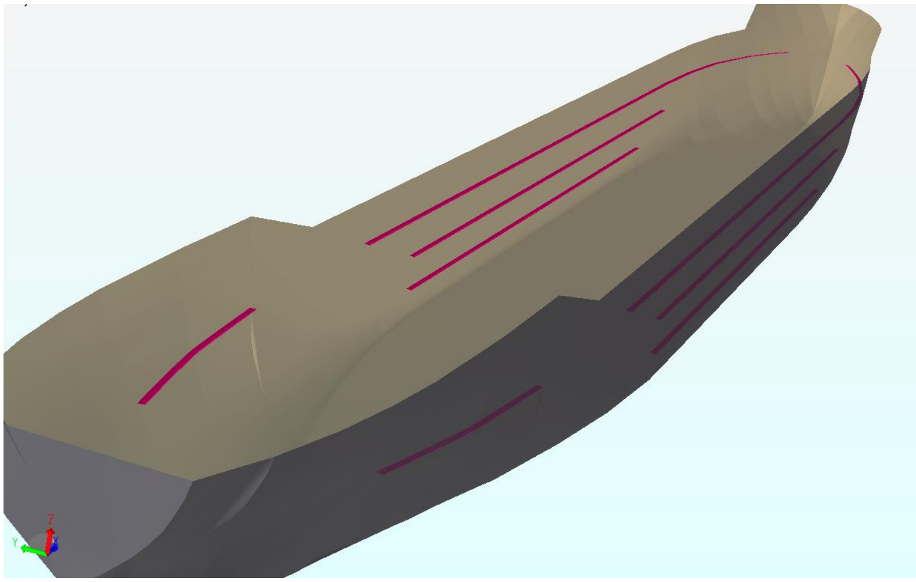
- Select a station line
  - RMB|Create Beam
- Orientate the beam properly using previously utilized methods
- When done, set all of them to be Tbar575x150x12x25 sections
- Perform the same steps to create a layout similar to the one shown below.

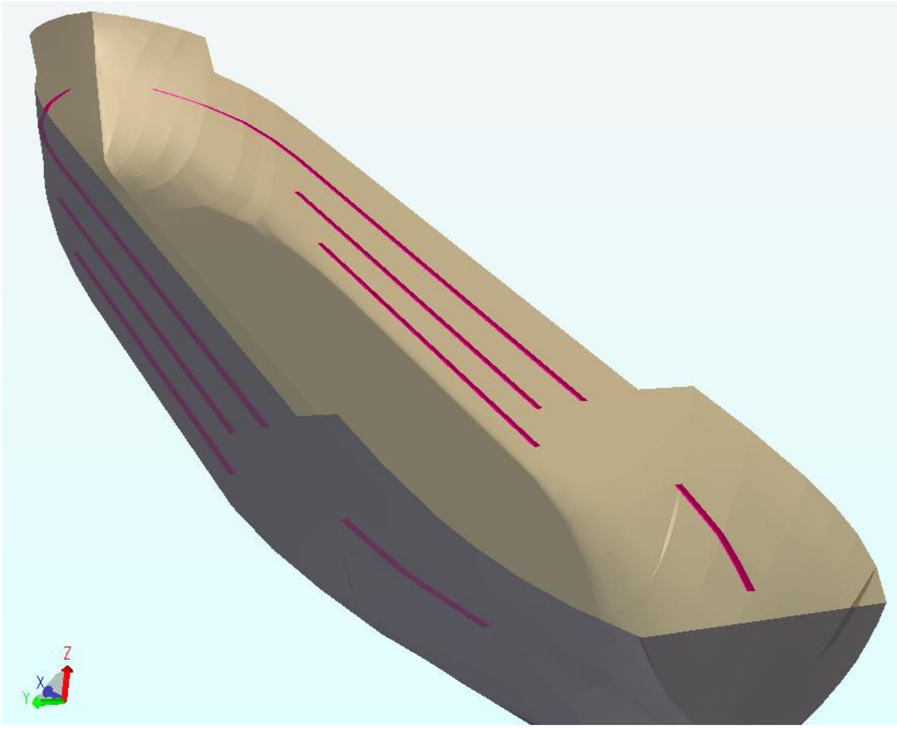




Longitudinal Stiffeners

The longitudinal stiffeners are created by utilizing the same methods utilized to generate the previous beams. They are made up of Tbar425x120x12x25 sections.





Prepare to Export to HydroD

Prior to meshing the model various images of the models structural layout are shown to give the user an opportunity to review their model for accuracy.

Figure 4 is taken from the AFT perpendicular looking forward. The bulk heads are hidden in this view.

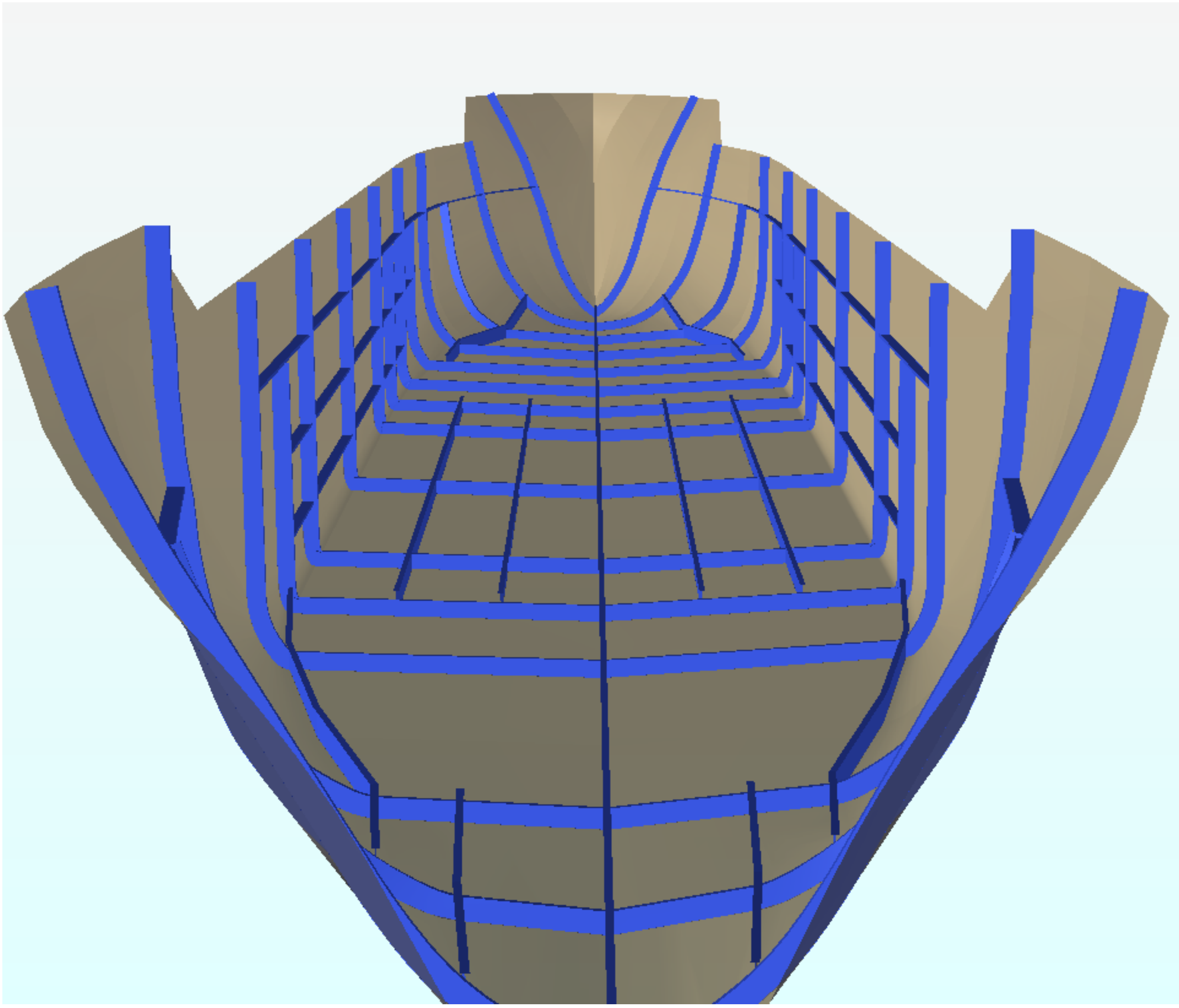
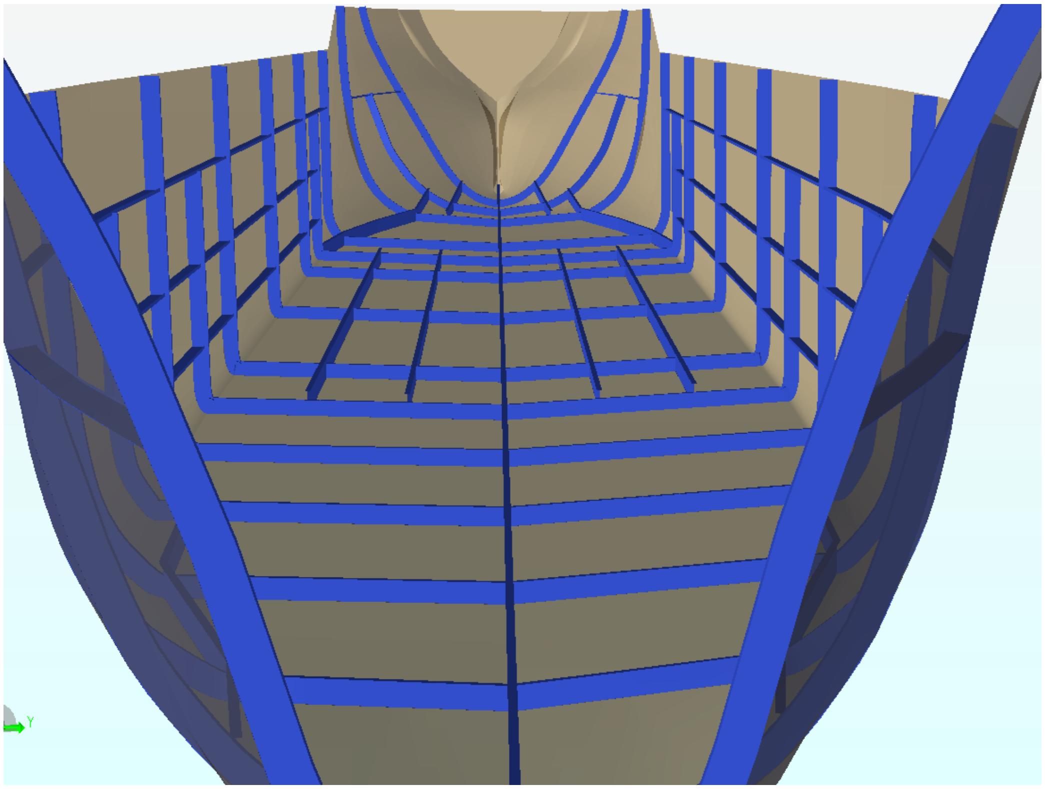
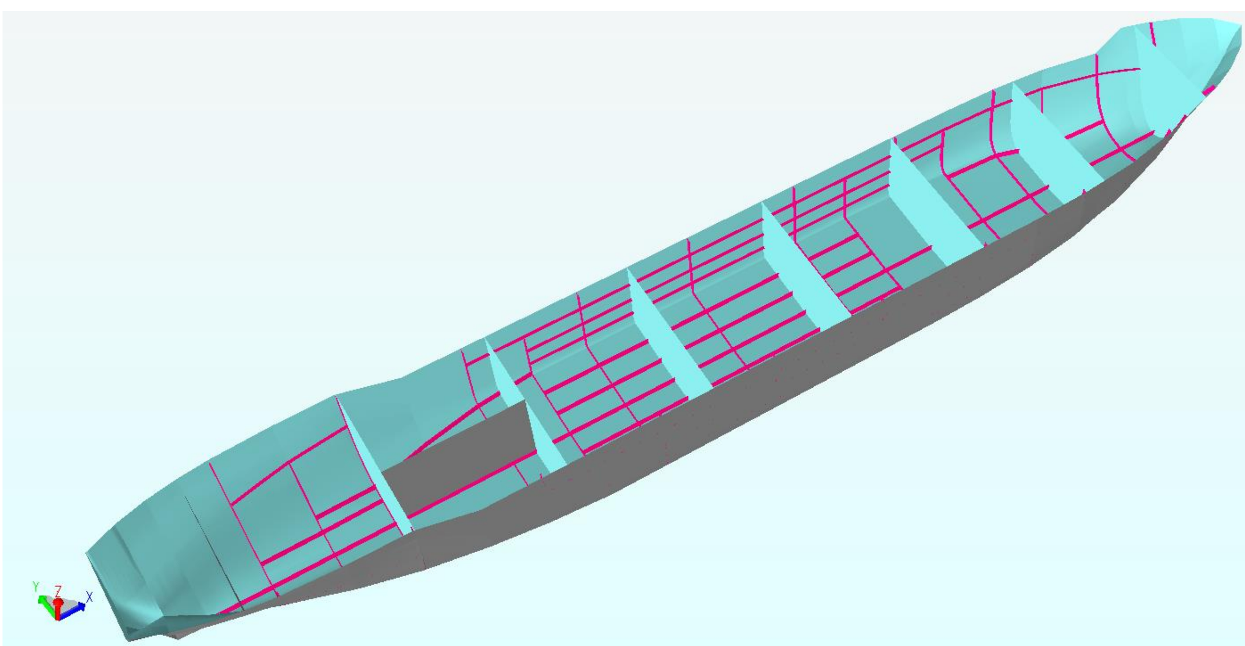


Figure 4: Scantling as Viewed From the Aft Perpendicular Centerline Facing the Bow

The next image is similar to Fig. 4, but it is taken from the FWD perpendicular looking aft.



This image shows the location of the bulk heads. The AP is located on the left.



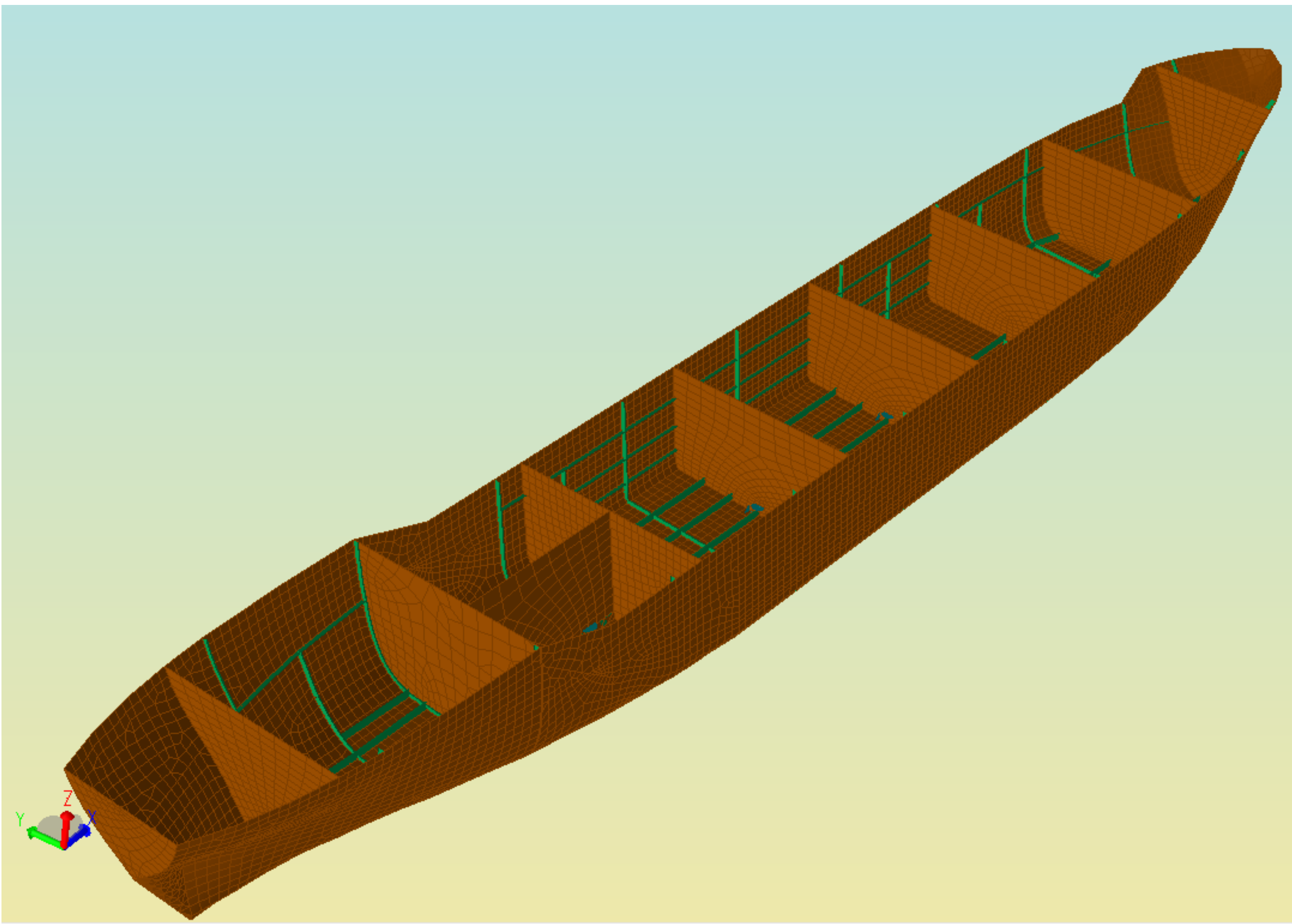
Meshing

The structural model has to be meshed in order for it to be able to be imported into HydroD

- Press Alt-M on the keyboard

Export the model as a FEM file

- File|Export|FEM File…

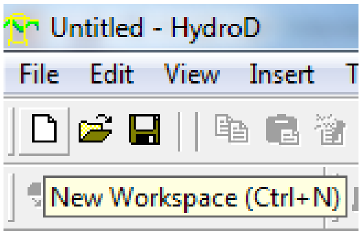


Chapter 4 – HydroD

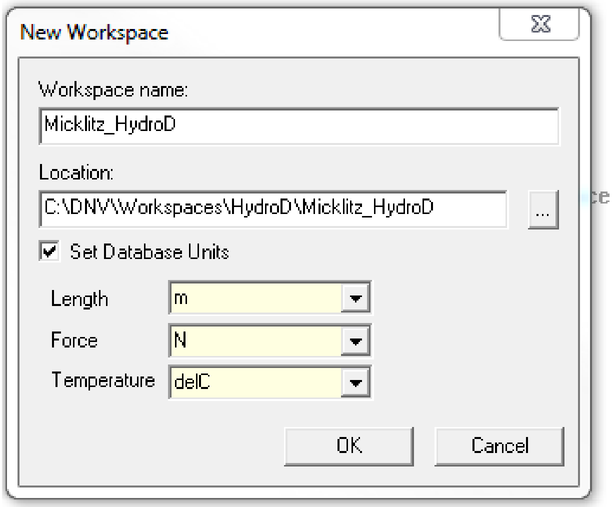
Generally speaking, HydroD is the software module that will be needed whenever a structure or vessels behaviour/response in water is desired. This includes, but is not limited to, static stability, hydrostatic properties, frequency or time-domain vessel response due to wind/waves/current, and select multiple body interactive response to dynamic forces.

HydroD will be used to perform the hydrostatic and stability analysis of the ship by utilizing the two model files that were created and exported in Chapter 3.The Panel and Structural model of the ship are brought together via the Stability Wizard to in order to perform these tasks.

- Start by making a new workspace in HydroD
  - File → New Workspace
  - Or by pressing Ctrl+N

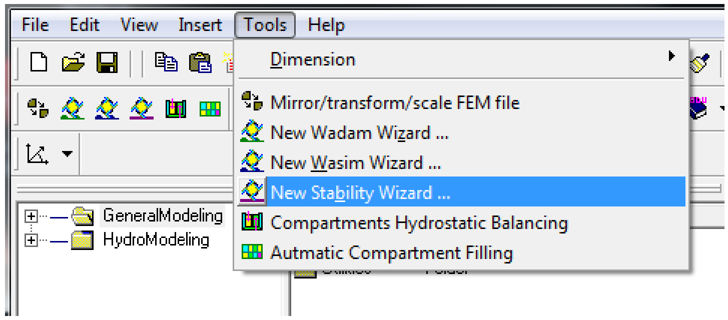


- Name your workspace and press the OK button

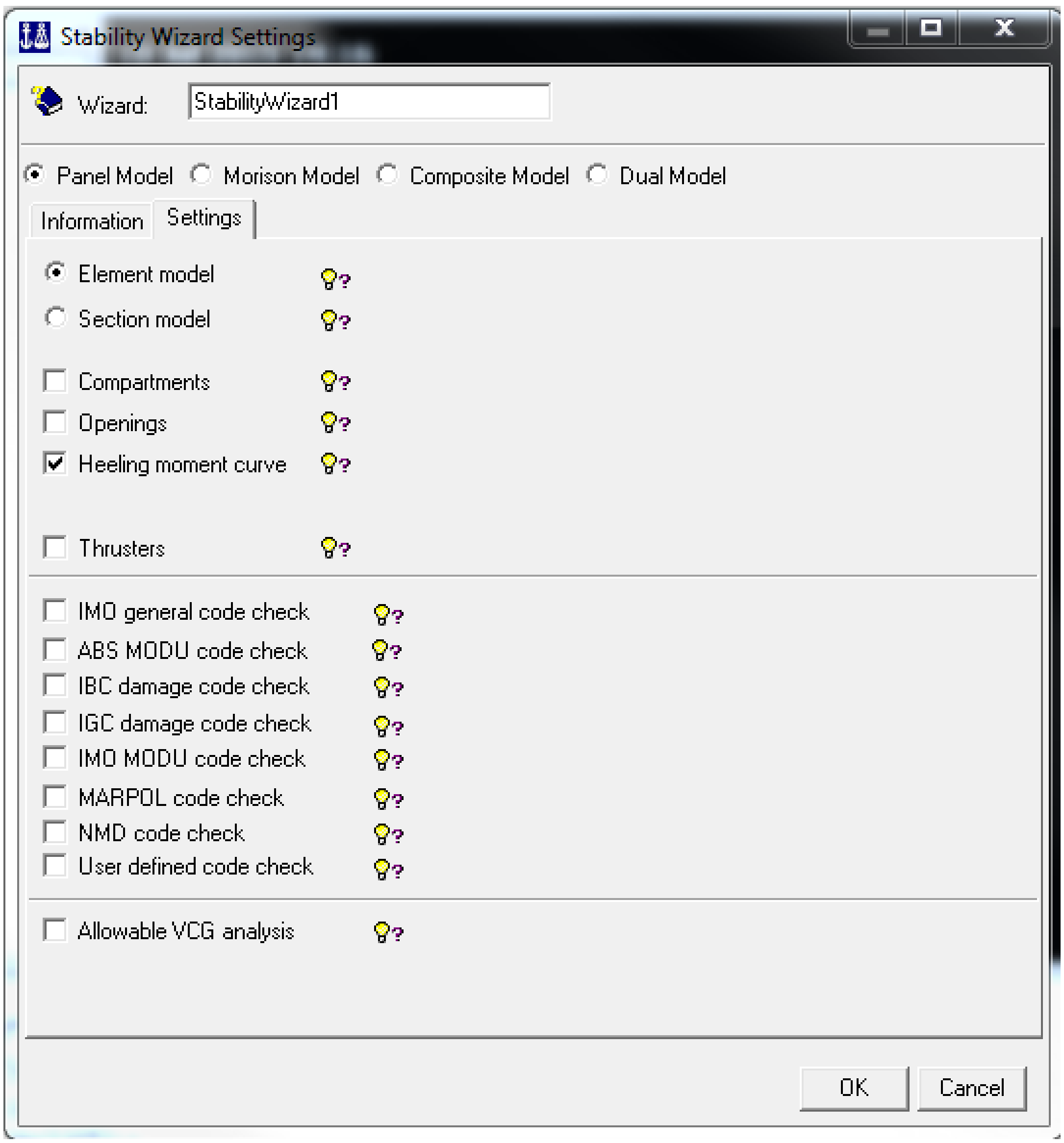


Stability Wizard

- Select Tools| Stability Wizard

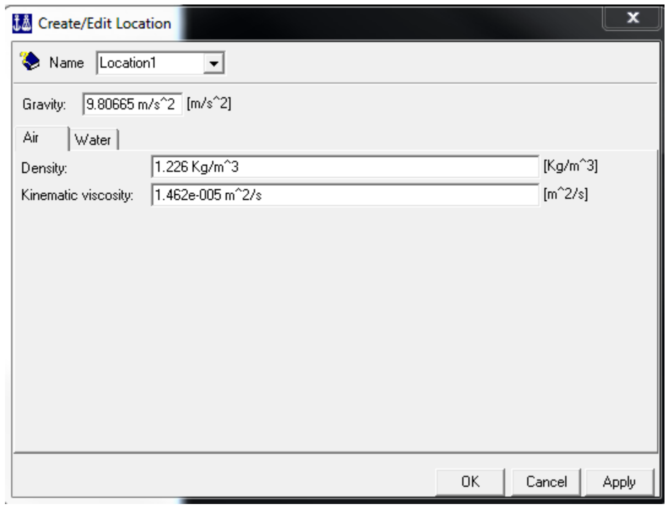


- Set up the settings tab as shown below and click OK



- Click First step on the Stability Wizard

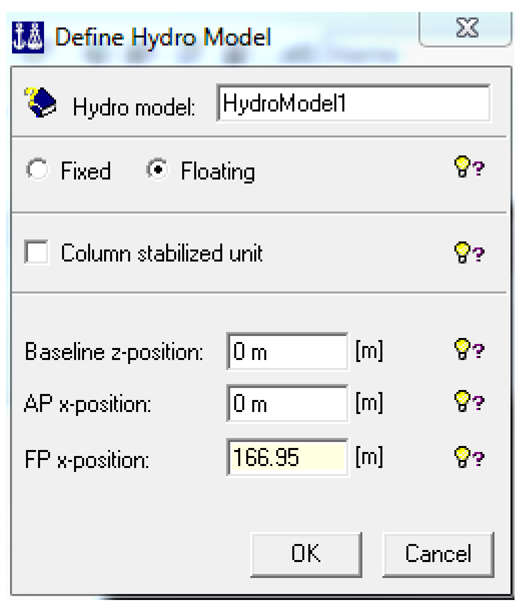
- Click Apply then Cancel



- Click Next step on the Stability Wizard

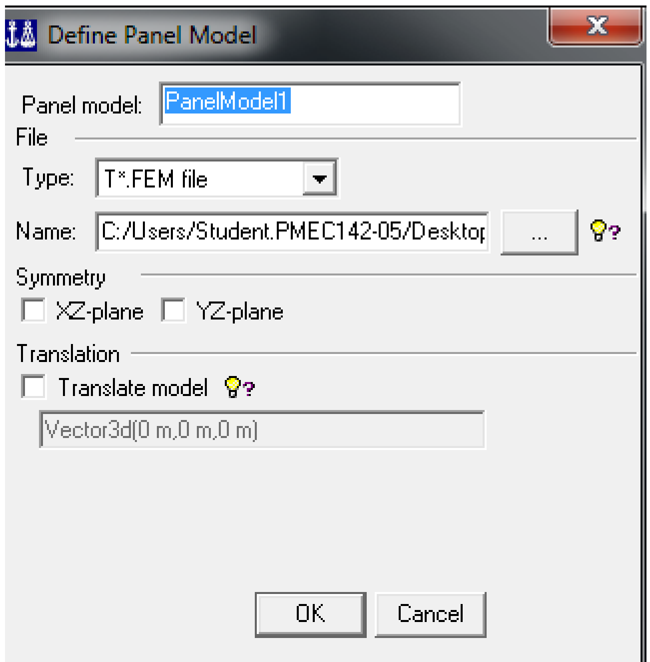
- Change FP position to 166.95 and select OK.

Note that 166.95 m is the length between perpendiculars for the specific ship model used in this guide.

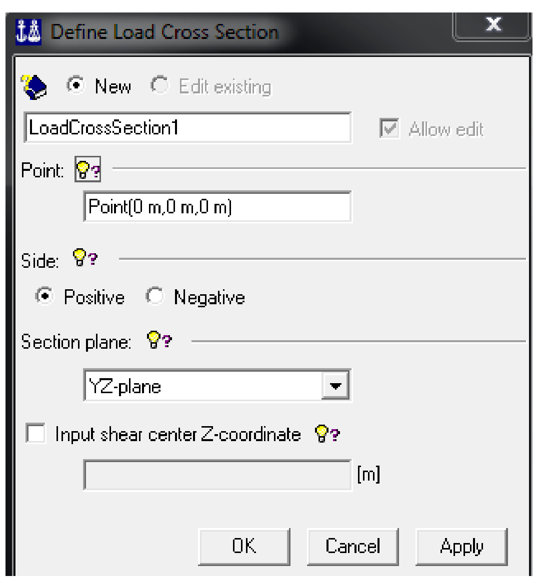


- Click Next step on the Stability Wizard

- Load the Panel model that was created in Chapter 3.1 and click OK

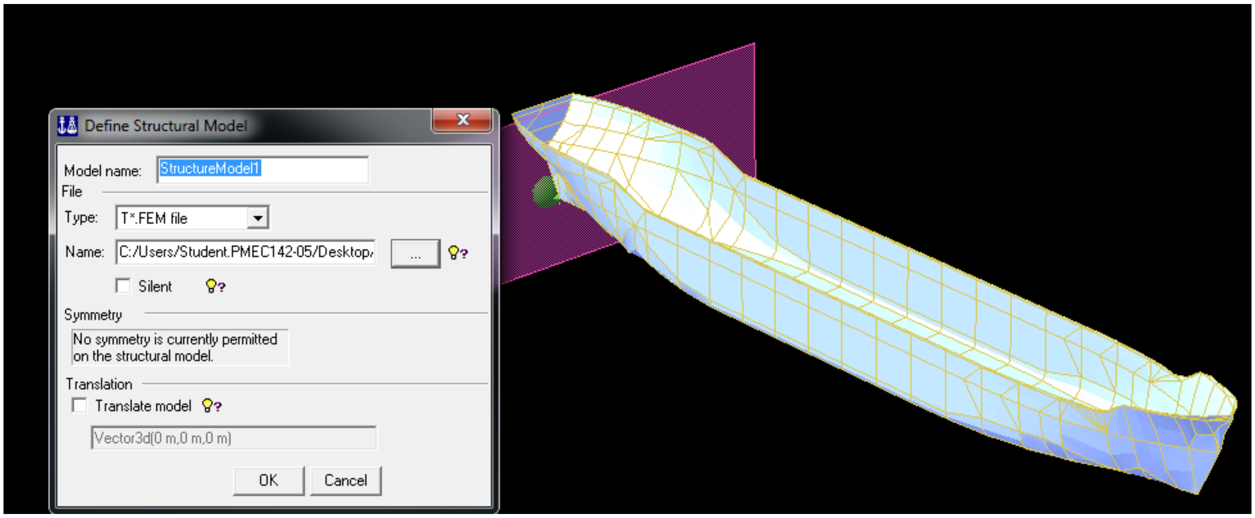


- Click Next step on the Stability Wizard
- Click Apply then Cancel



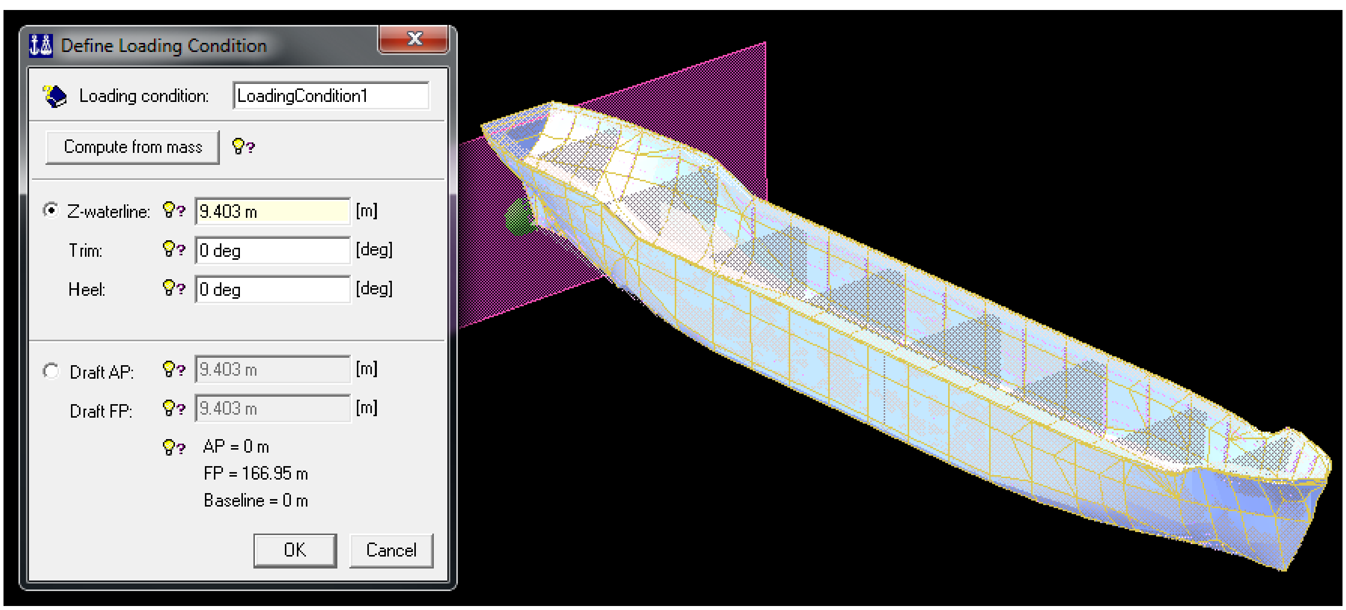
- Click Next step on the Stability Wizard

- Load the Structural Model created in chapter 3.2 and click OK

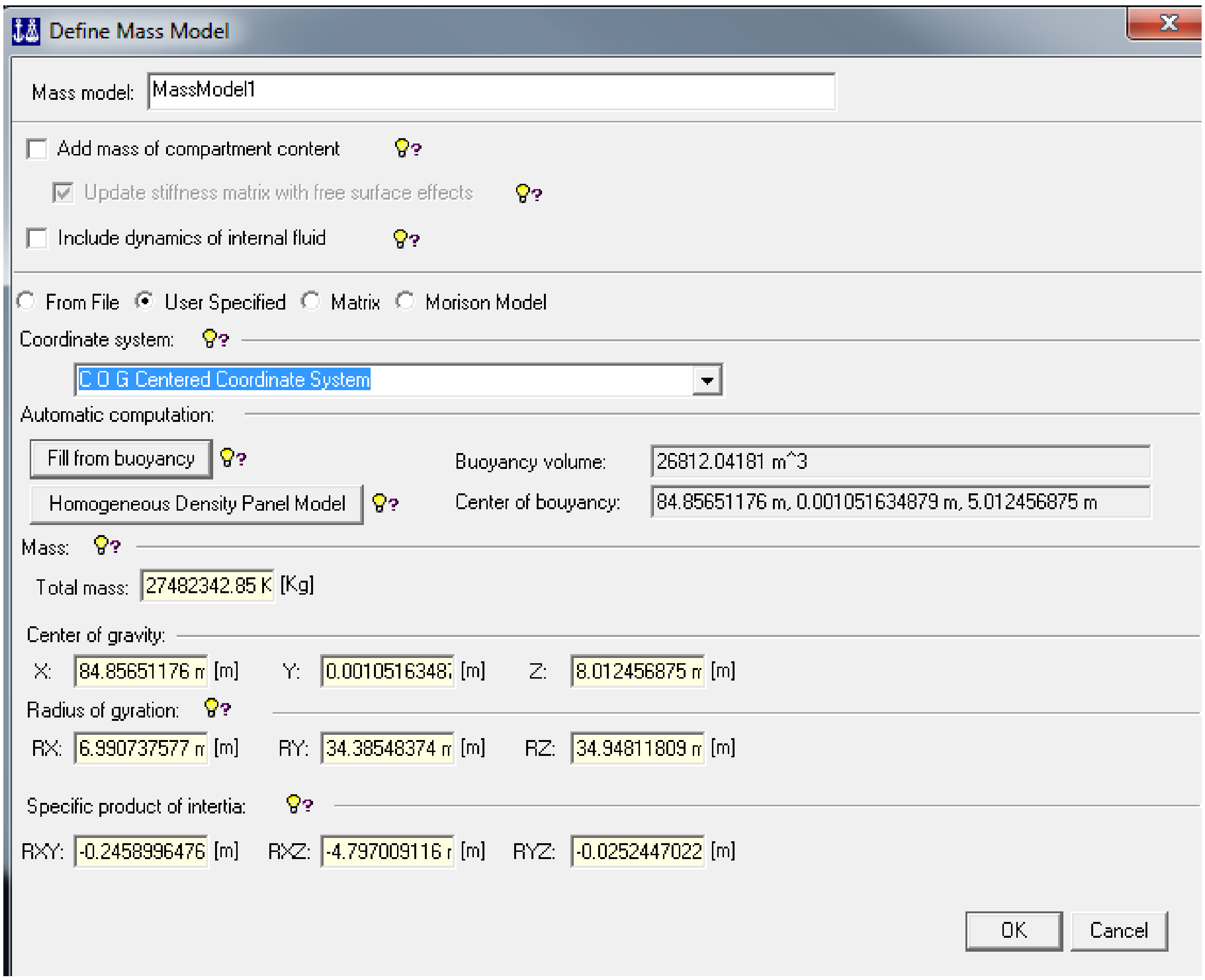


- Click Next step on the Stability Wizard
- Change the Z-waterline value to 9.403 and click OK

Note that 9.403 m is the draft that was chosen for analysis of the specific model considered here.

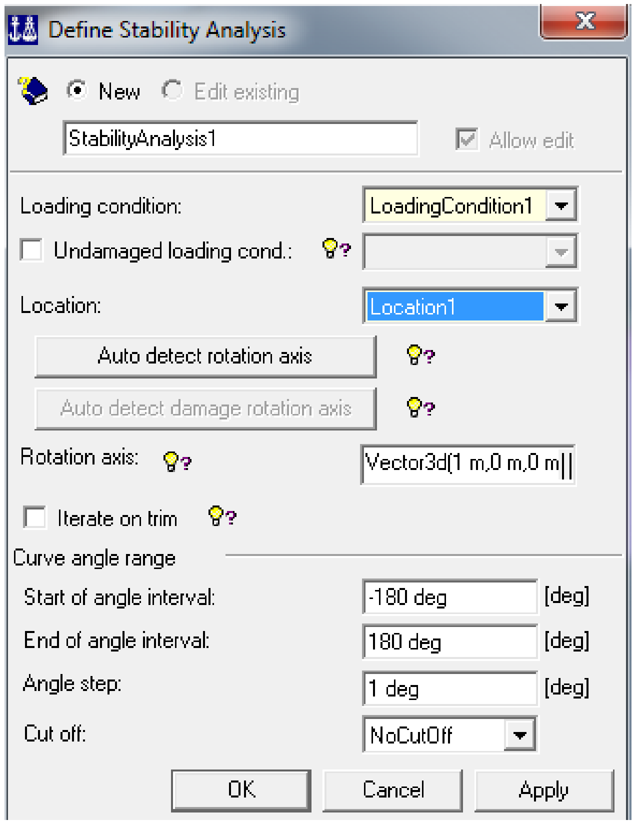


- Click Next step on the Stability Wizard
- Uncheck ‘Add mass of compartment content’
    - Click Homogenous Density Panel Model
        - Click OK
    - Click Fill from buoyancy
        - Click OK
        - Click OK again
    - Click OK

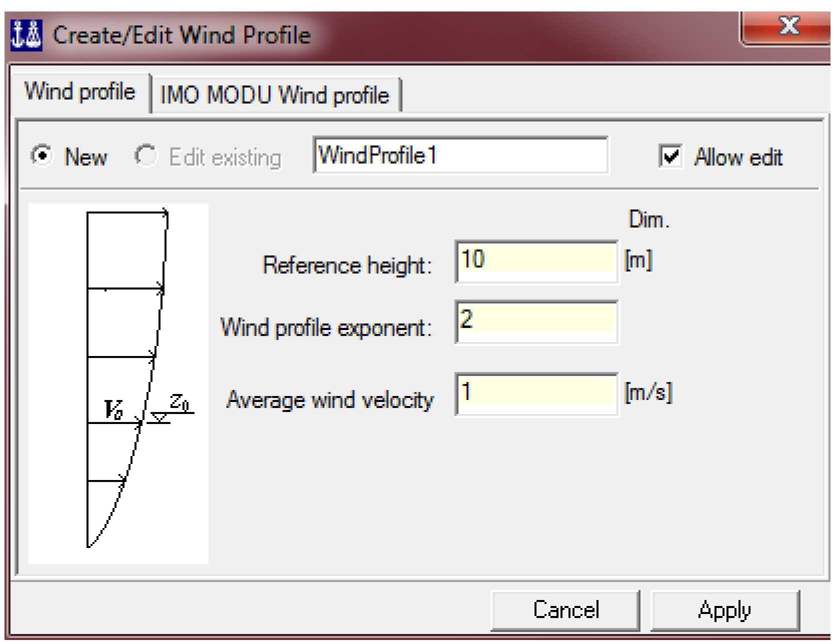


Note that the ‘Add mass of compartment content was deselected, because the ship is analysed absent of contents such as crude oil or iron ore for example. Further information regarding ‘Compartment Contents’ is located in the HydroD_User_Manual, 5.3.16.5 Compartment Contents.

- Click Next step on the Stability Wizard
- Select Loading Condition1 and Location1
  - Click Apply then cancel

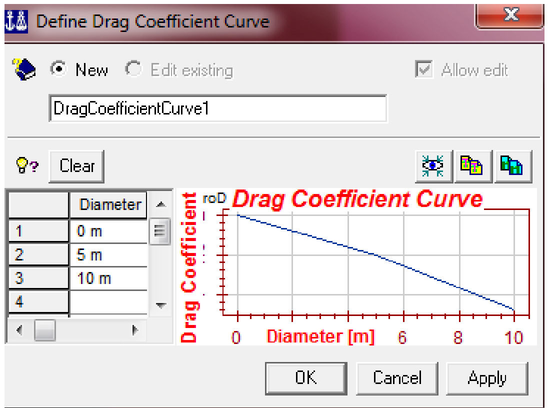


- Click Next step on the Stability Wizard
- Input 10m, 2, and 1 (m/s) as shown
  - Click Apply then Cancel

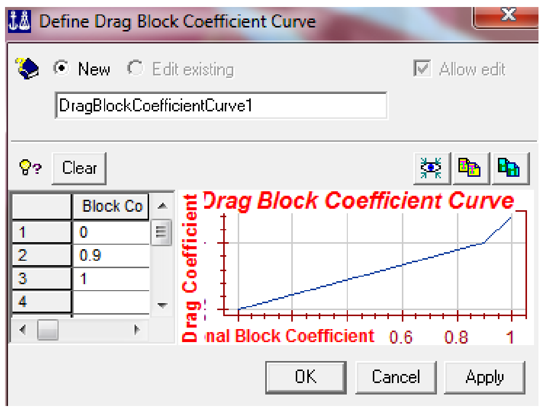


Wind profile information is located in HydroD_User_Manual, 5.2.5.1 Exponential Wind Profile

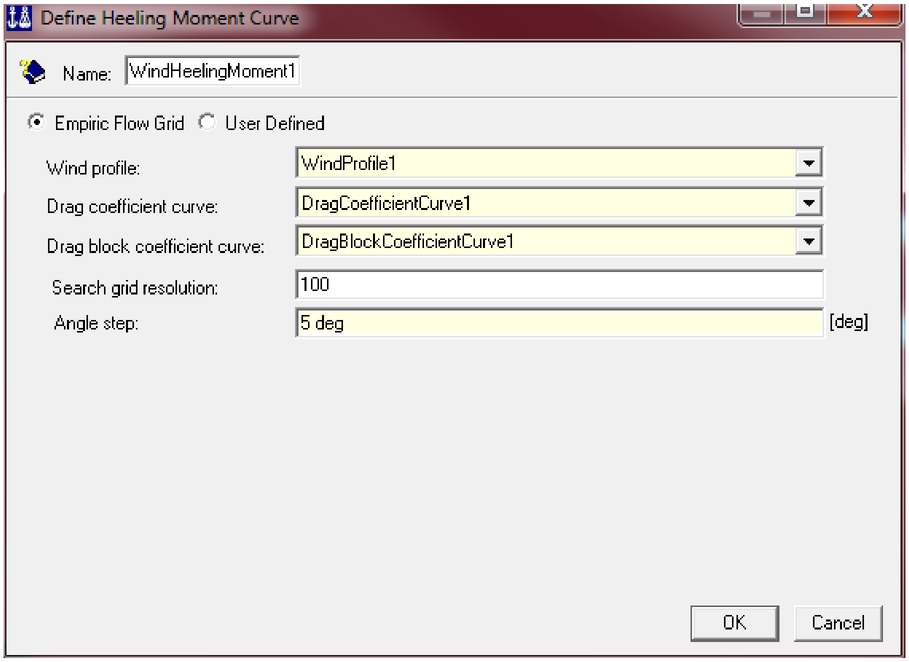
- Click Next step on the Stability Wizard
- Click Apply then Cancel



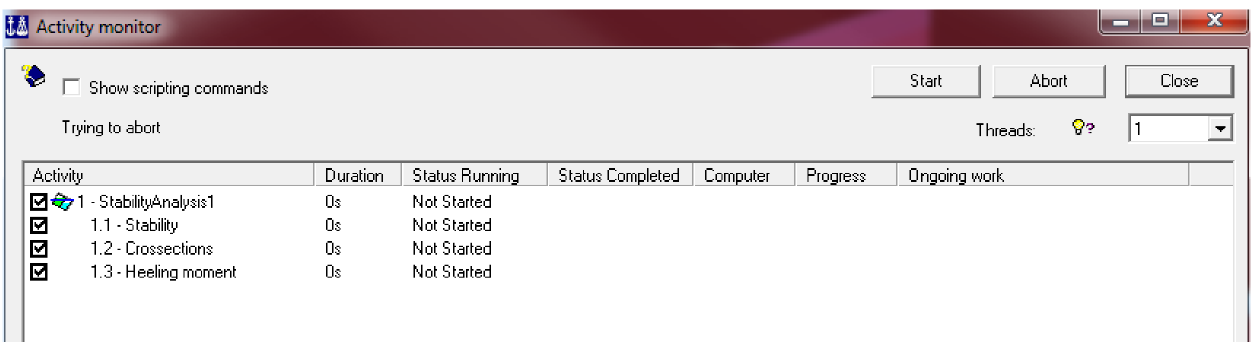
- Click Next step on the Stability Wizard
- Click Apply then Cancel



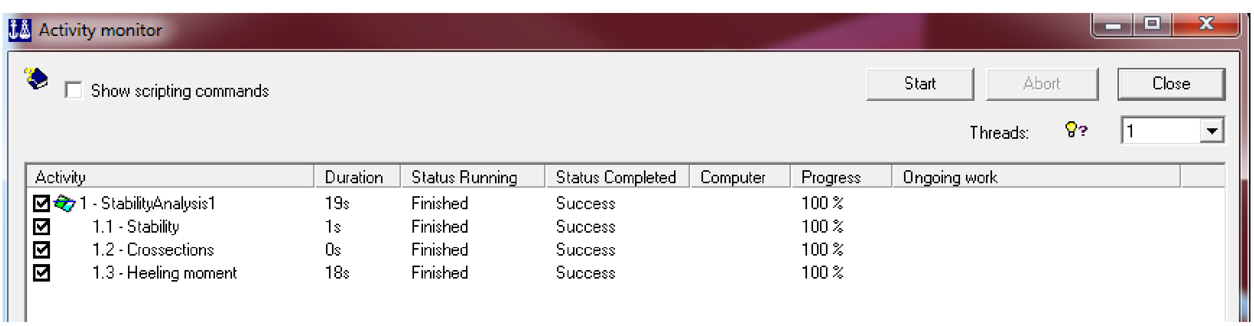
- Click Next step on the Stability Wizard
- Populate the dialogue box as shown
  - Click OK



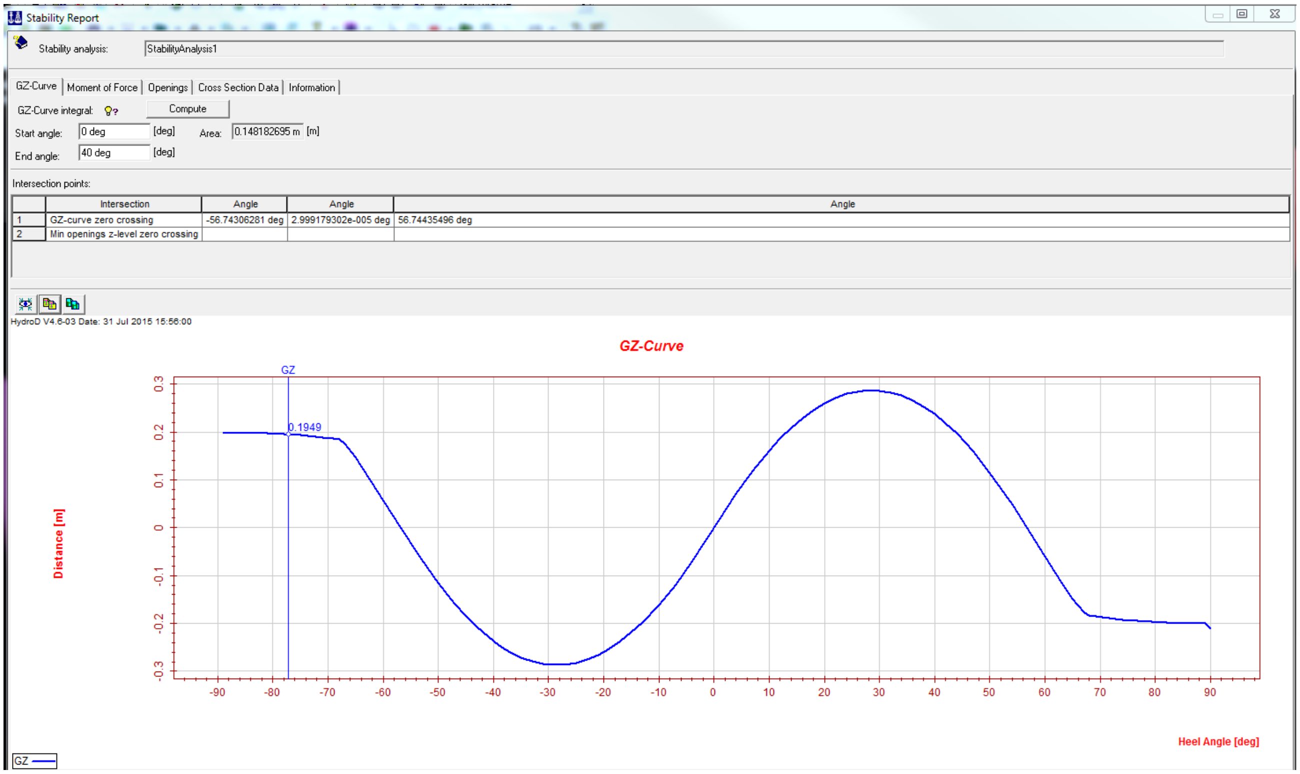
- Click Next step on the Stability Wizard
- Click Start



- Once the file is done running click Close



- Click Last step on the Stability Wizard

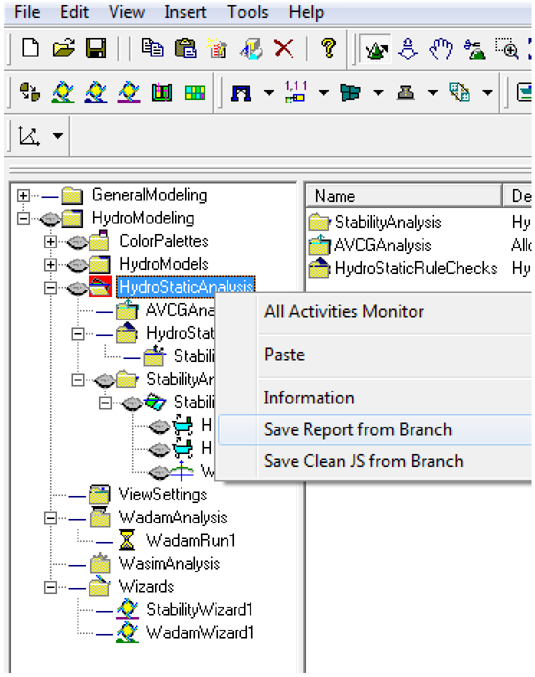


The Stability Wizard is now complete. Further hydrostatic information can be obtained by clicking on tabs of the Stability Report. Some of the basic hydrostatic data that was generated by the Stability Wizard is provided in Appendix 4.

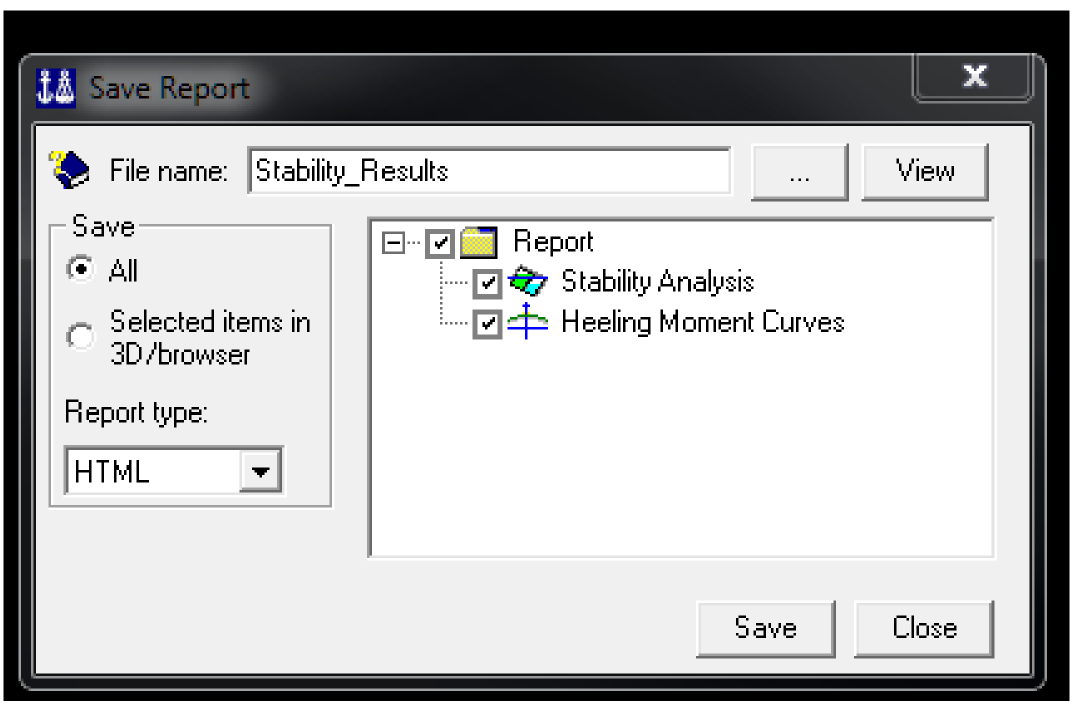
Saving the Stability Analysis

Saving the entire stability report is done in a manner that is notably different than normal methods utilized in DNV Sesam. The report will be saved as an HTML file that will be accessible later with an internet browser.

- RMB HydroStaticAnalysis in the model browser
- Select Save Report from Branch



- Choose a file location and name for the file
- Select HTML as the report type
- Click Save then Close



Chapter 5 – Sestra

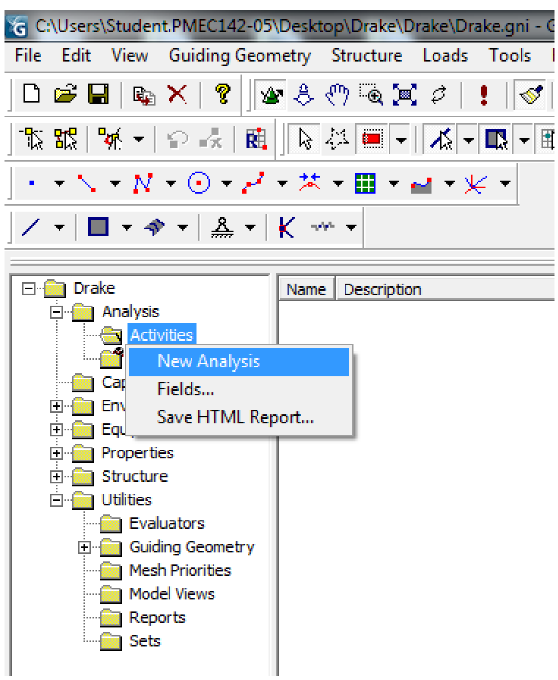
The Superelement Structural Analysis Program (Sestra) functions differently than GeniE and HydroD in that it does not have a its own standalone interface. Sestra is interfaced with various Sesam modules and performs calculations in the background. Real-time executions of these calculations are transparent to the user, and are only visible once Sestra has finished its analysis. At which point they can be viewed in .txt format in Notepad via the Sestra.LIS file.

Sestra is capable of Static, Free vibration, and Dynamic structural analysis of the hull, beam, and solid components that form the structural model of a vessel. Static and free-vibration analyses of the ship in Sesam GeniE are demonstrated below.

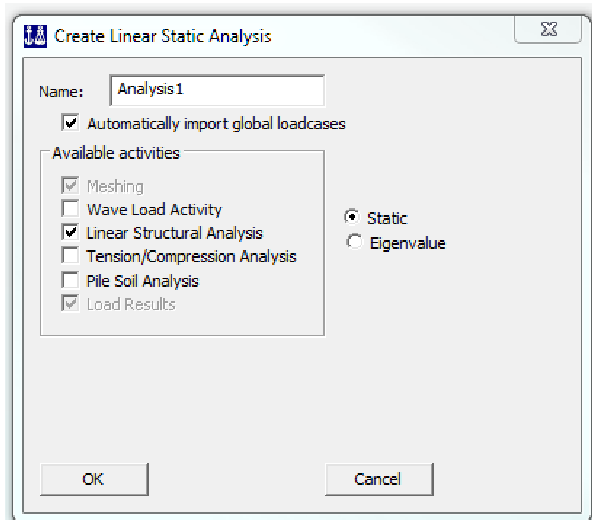
This chapter utilizes GeniE, and begins were chapter 3.2 left off. If the GeniE program was exited, simply re-open the GeniE workspace that was used to create the files that were imported into HydroD. Once this workspace has been opened, begin performing the steps below.

Creating a Load Analysis

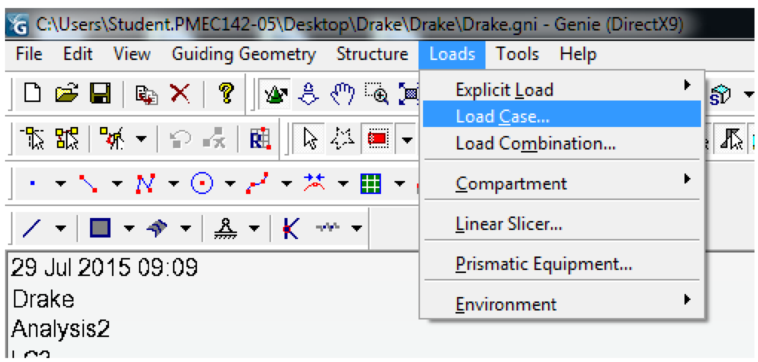
- LMB|Activities
- Select "New Analysis"



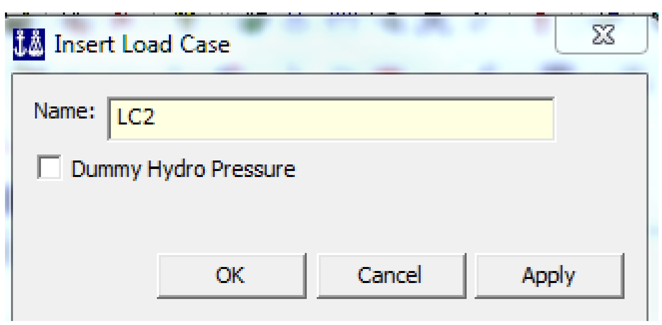
- Select OK



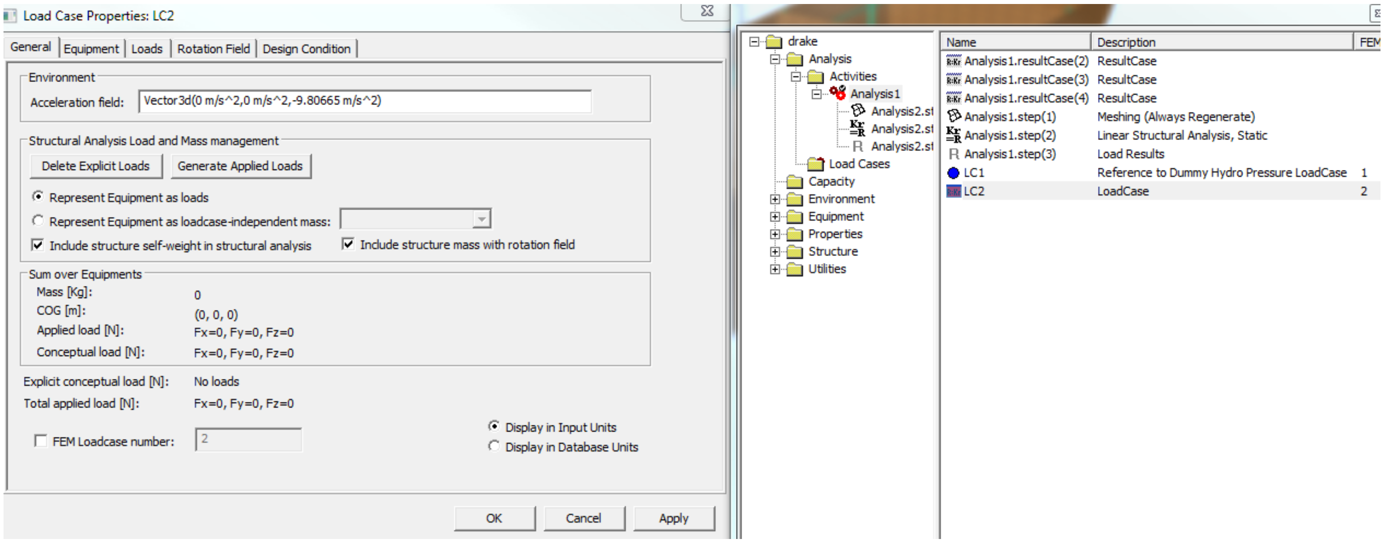
- Now Select Loads | New Loadcase



- Click OK

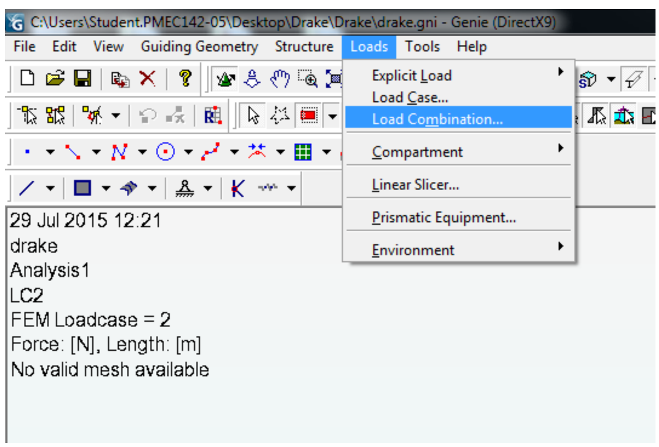


- Double LMB
- Then RMB LC2 and select properties
- Populate the dialogue box as shown
- Click
- Apply|Cancel

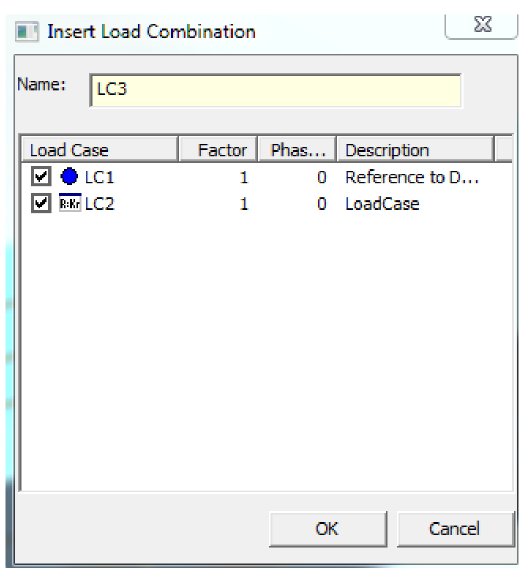


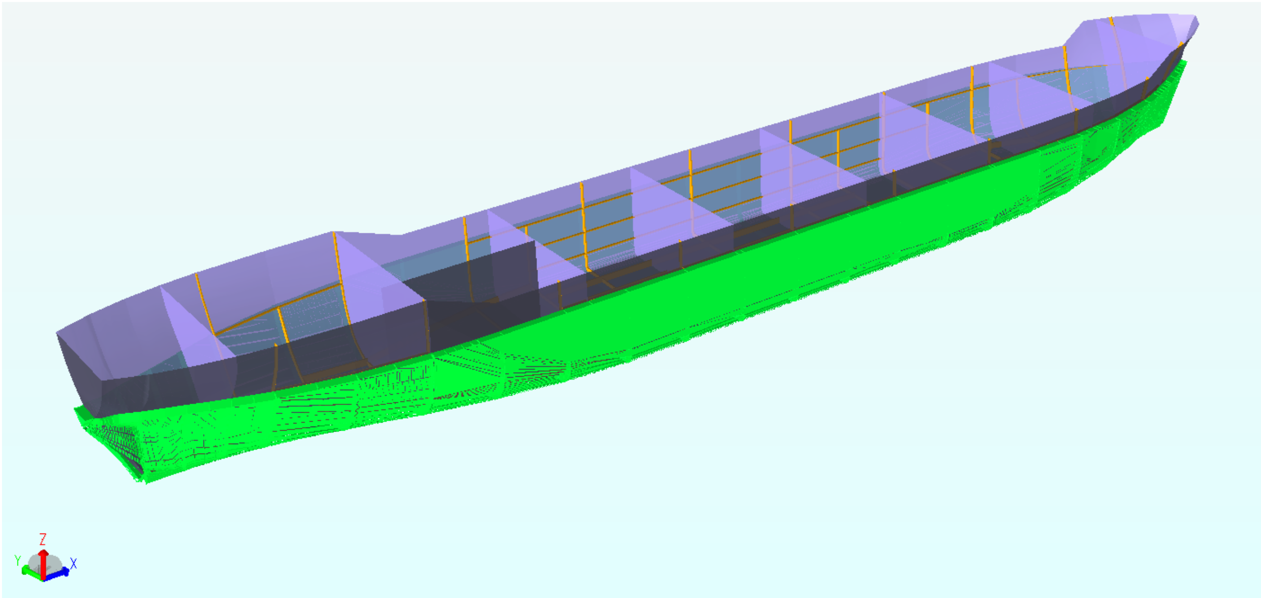
The dummy hydro load ‘LC1’ and the structure self-weight ‘LC2’ need to be combined so that both can be analyzed in one analysis.

- Select Loads| Load Combination



- Click OK

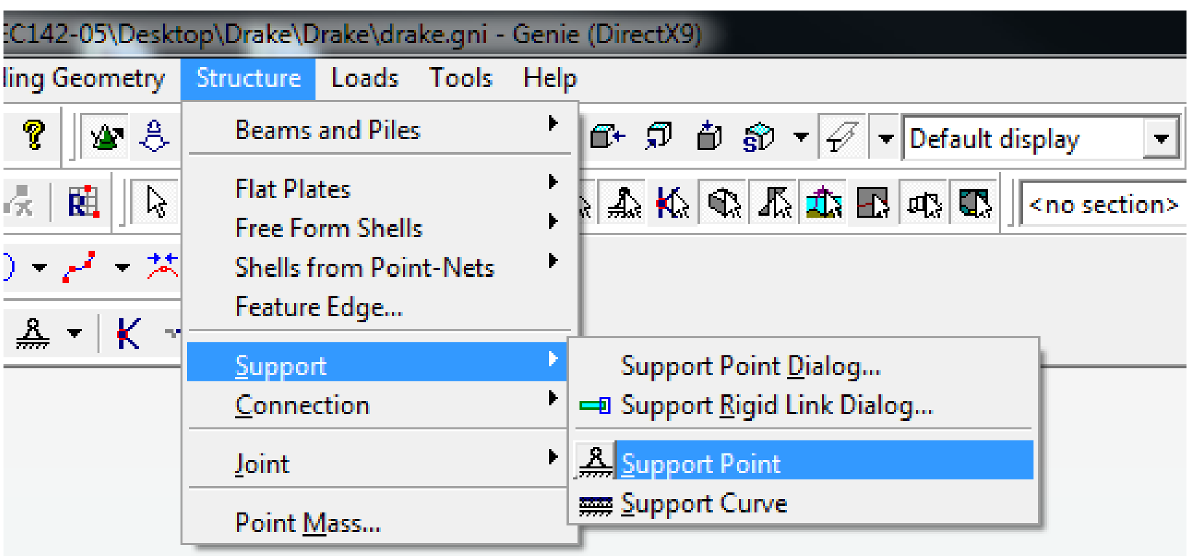




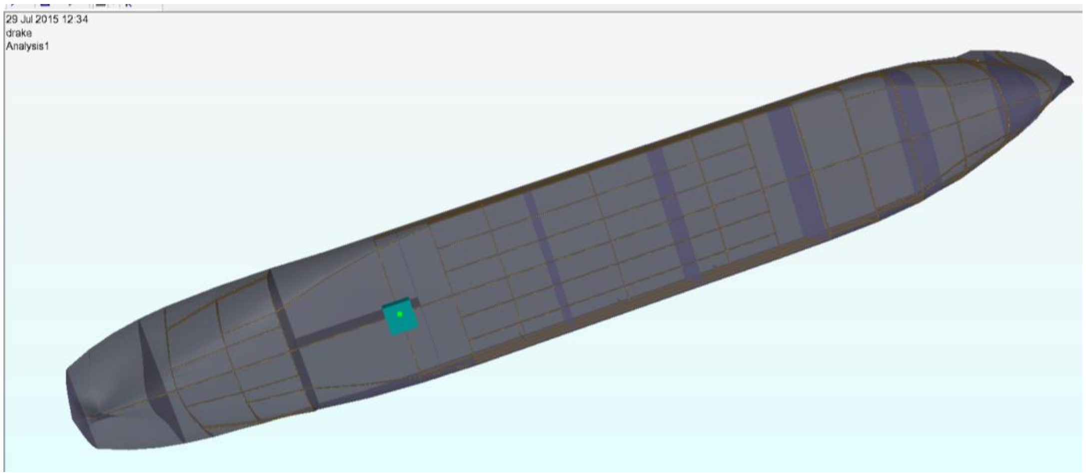
Establish Boundary Conditions

Boundary conditions for the model need to be set for the ship.

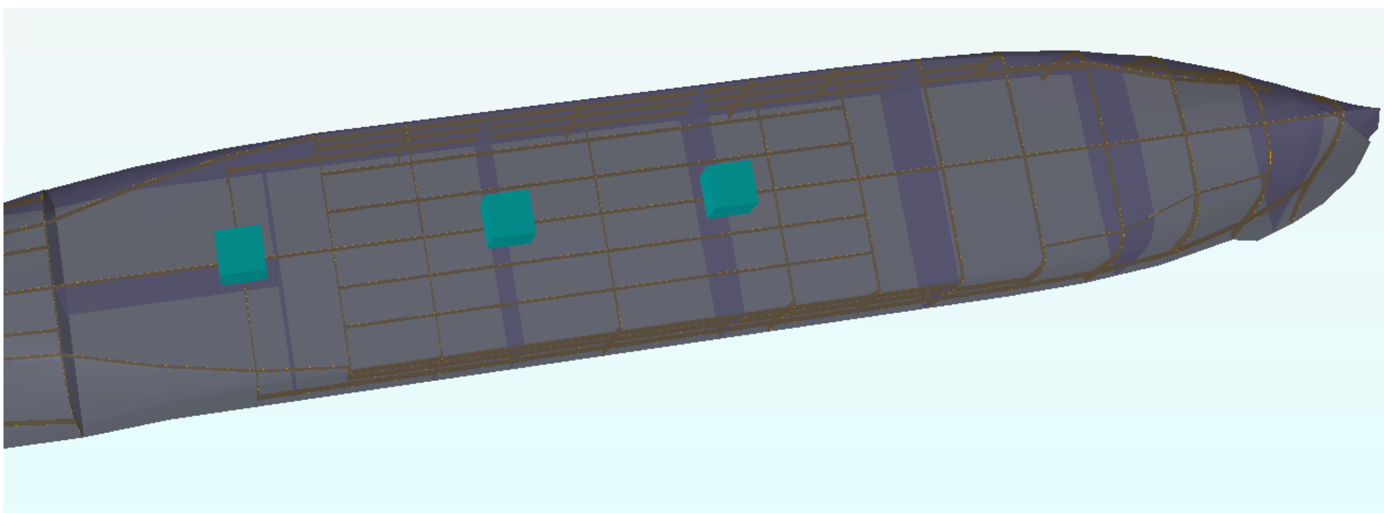
- RMB Structure |Support |Support Point



- Click on the bottom of the hull centerline (longitudinal distance does not matter).

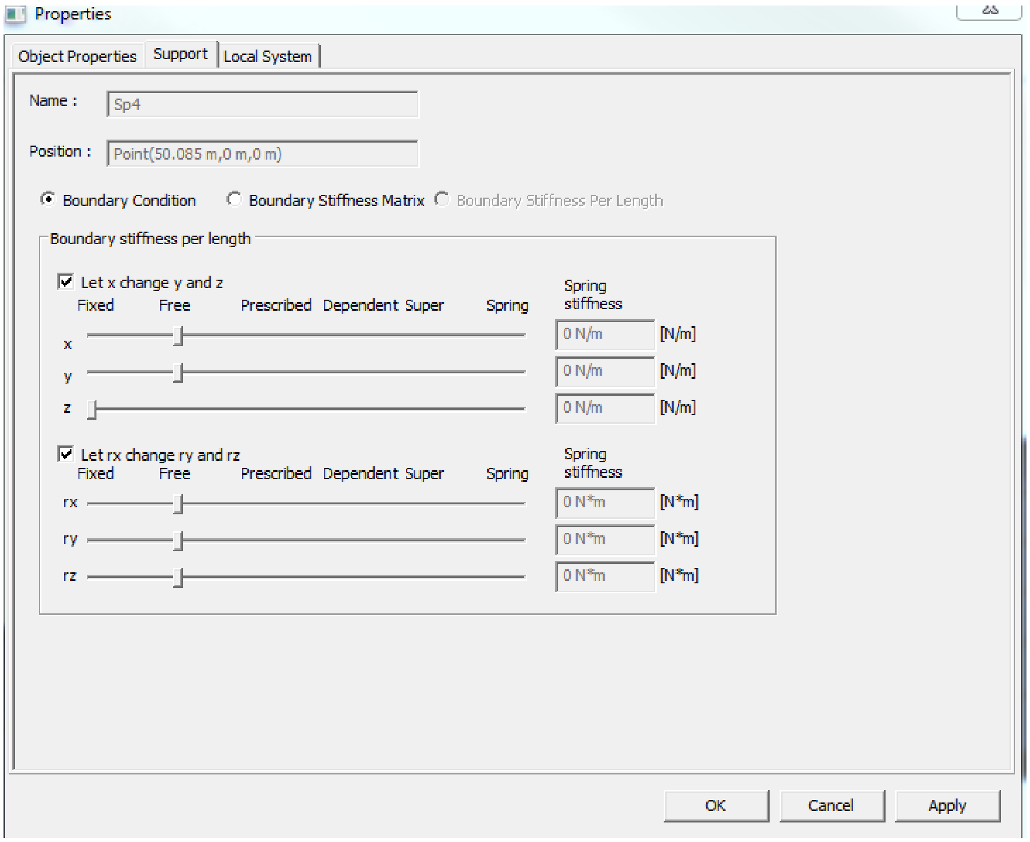


- Do this 2 more times on the bottom of the hull and centerline

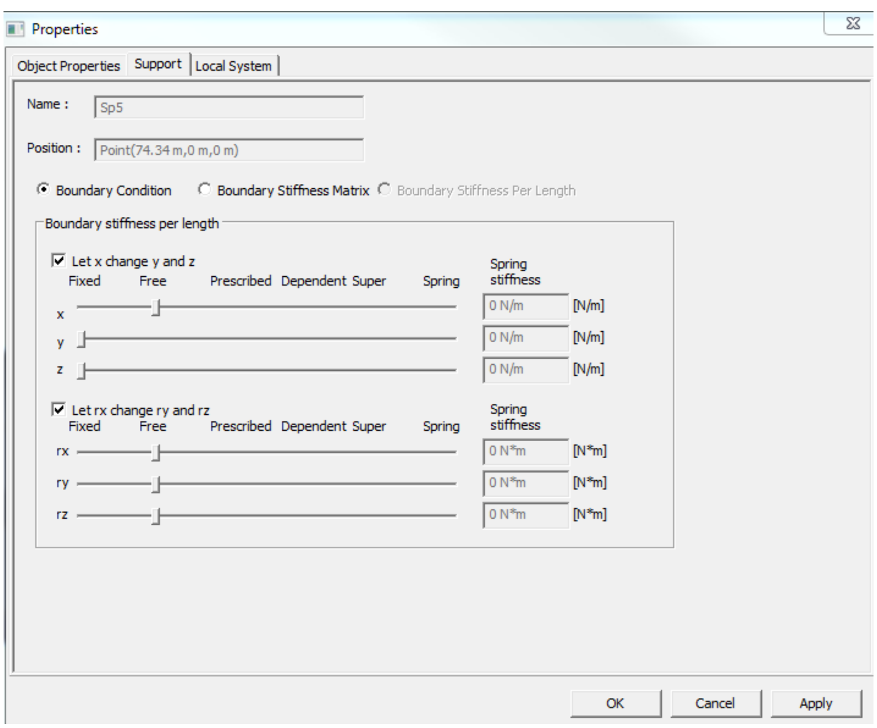


- Exit the Support Curve function
- Select the 1st support point

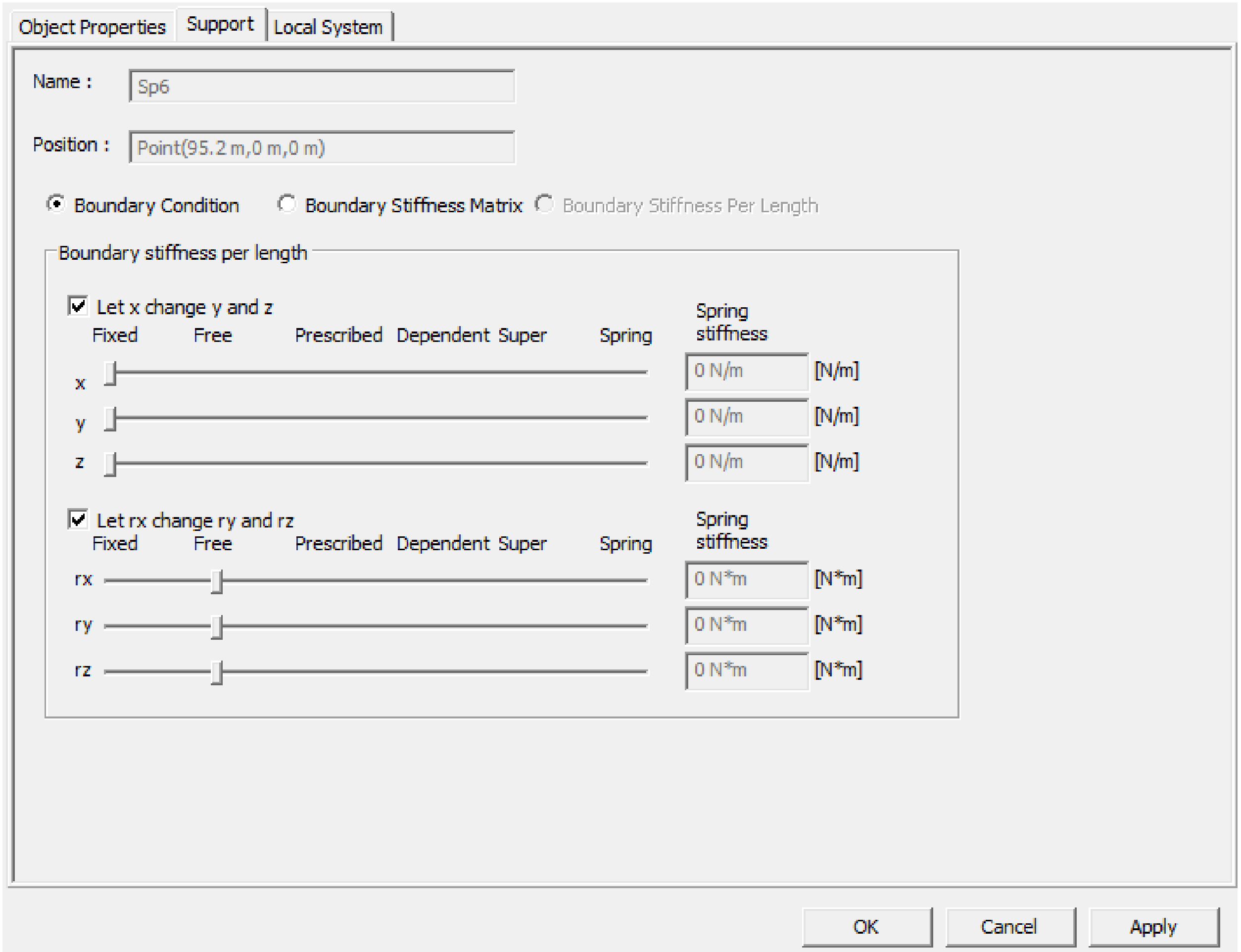
- LMB|Properties
- Adjust the dialogue box to match the image below and click Apply|Cancel (Fix Z)



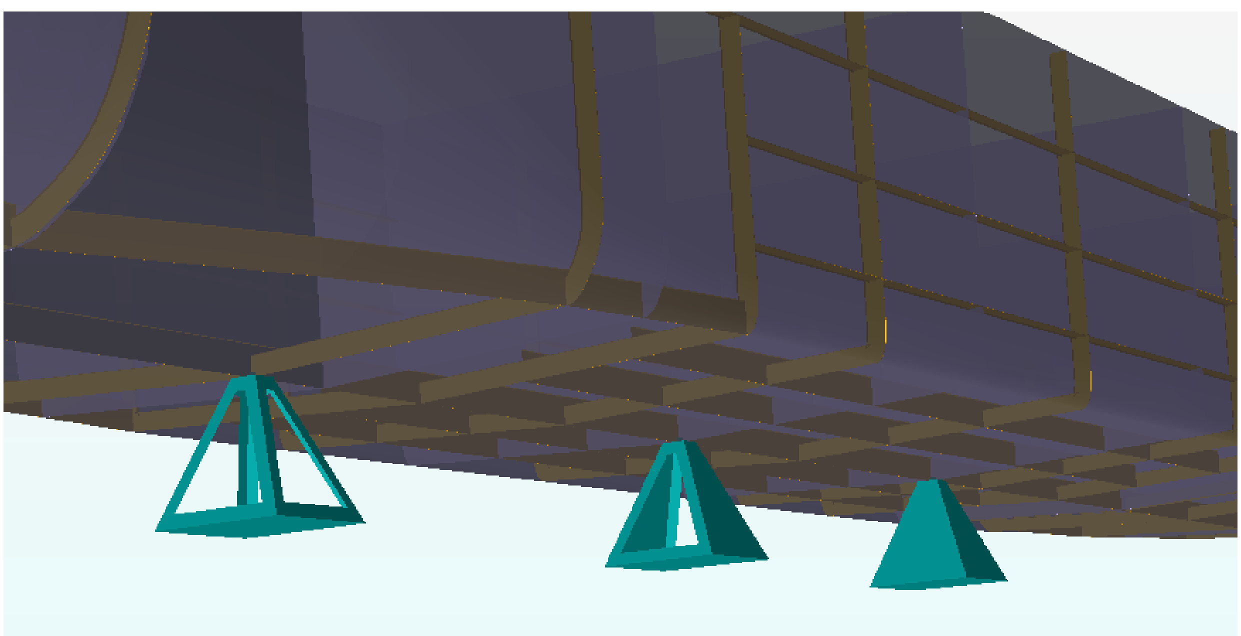
- Adjust the 2nd support point to match the image below and click Apply|Cancel (Fix Y & Z)



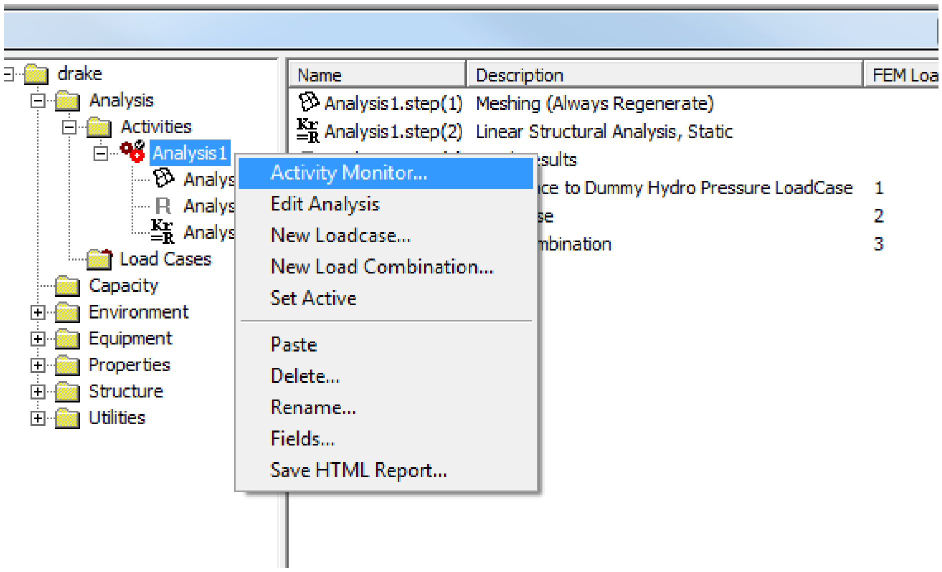
- Adjust the 3rd support point to match the image below and click Apply|Cancel (Fix X, Y & Z)



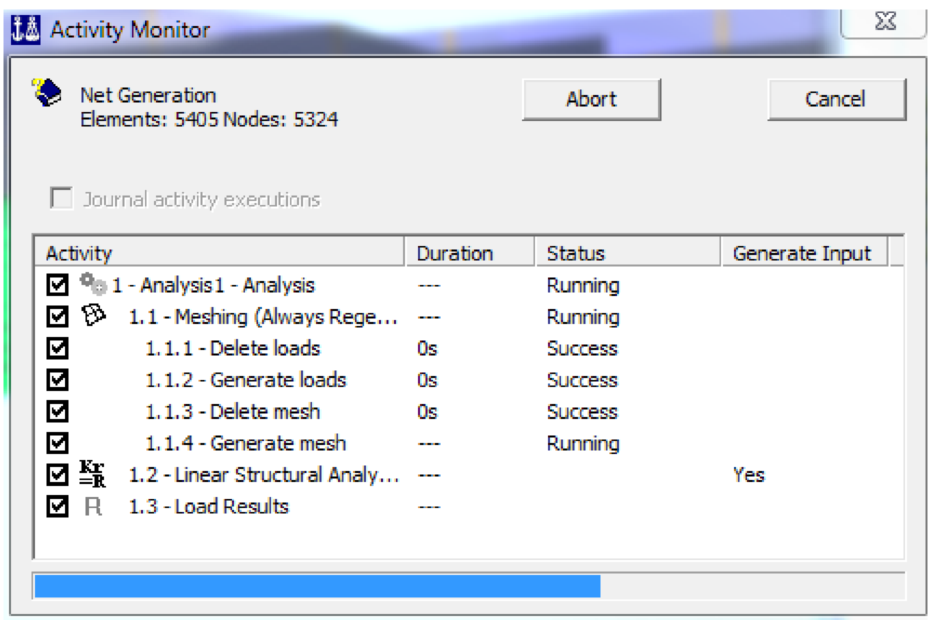
The symbols should now appear similar to the image below. The order that the symbols occur along the centerline is not important.



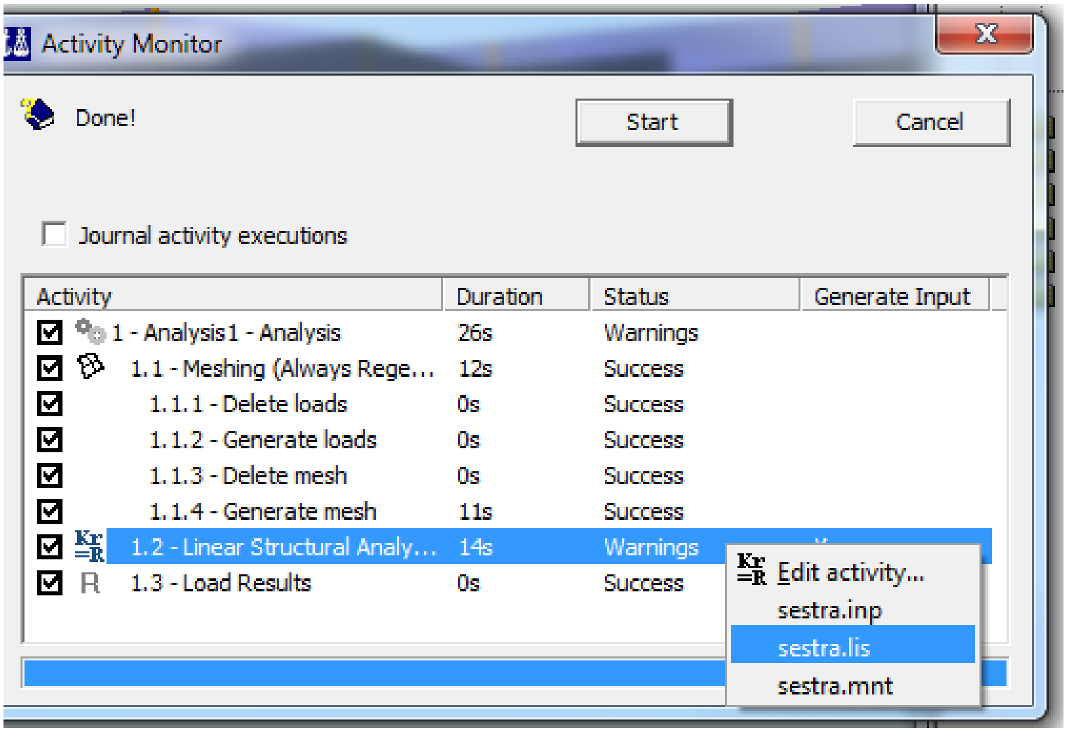
- RMB Analysis 1 and select Activity Monitor



- Click Start

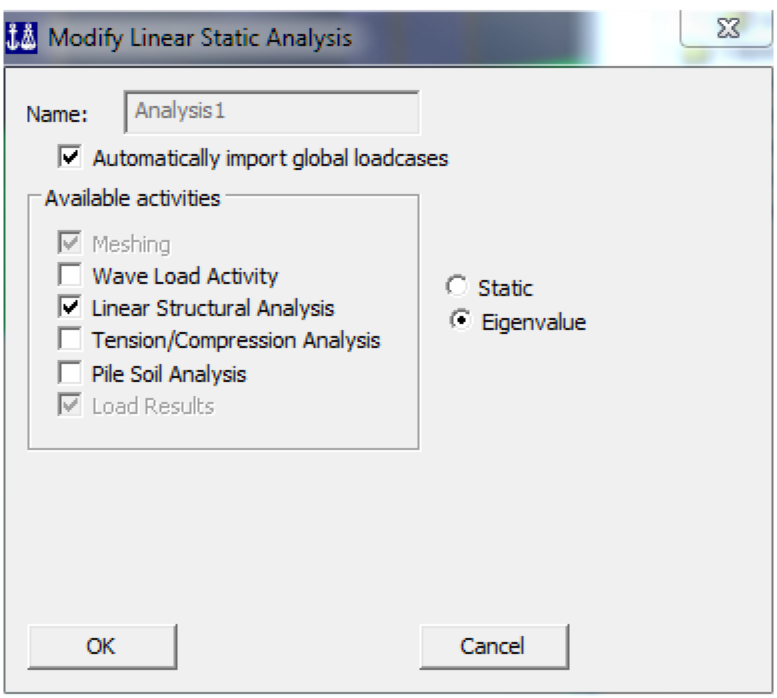


- Once it is finished running, RMB step 1.2
- Select Sestra.LIS (Open file with Notepad)
- Save the file as Sestra_Static.LIS for later viewing



This is a text file and contains the static structural analysis of the ship. Condensed contents of this file are included as Appendix 5.

- RMB Analysis 1
- Select Edit Analysis
- Select the Eigenvalue option then click OK



- RMB Analysis 1 and select Activity Monitor
- Click Start
- Once it is finished running, RMB step 1.2
- Select Sestra.LIS
- Save the file as Sestra_Eigen.LIS for later viewing

This is a text file and contains the Eigenvalue Frequencies of the ship. Condensed contents of this file are included as Appendix 6.

```
***************************
*                         *
*  E I G E N V A L U E S  *
*                         *
*  F R E Q U E N C I E S  *
*                         *
***************************


ALL EIGENVALUES BEING CAL-
CULATED ARE PRINTED TOGE-
THER WITH THE CORRESPONDING
FREQUENCIES AND PERIODS.
FREQ = SQRT(EIGENV)/(2.*PI)
PERI = 1./FREQ
```

NO.	EIGENVALUE UNIT: (SEC)-2	FREQUENCY UNIT: HERTZ	PERIOD UNIT: SEC
1	0.7362911E-05	0.000	2315.55493
2	0.2850339E+01	0.269	3.72162
3	0.2859708E+01	0.269	3.71552
4	0.3059905E+01	0.278	3.59191
5	0.3460258E+01	0.296	3.37774
6	0.3503785E+01	0.298	3.35669
7	0.5178583E+01	0.362	2.76105
8	0.7079450E+01	0.423	2.36146
9	0.1366105E+02	0.588	1.69996
10	0.1415003E+02	0.599	1.67033

```
DATE: 29-JUL-2015 TIME: 13:08:50   ***************  SESTRA  ***************          PAGE:    12

                          DYNAMIC ANALYSIS OF STRUCTURE
                                                                                  SUB PAGE:   3
```

Chapter 6 – Suggestions/Common Errors

- Organizing model elements using 'Named Sets' will allow the user to more effectively navigate a complex model

- File naming convention dictates that the file must begin with a Letter and the string cannot contain any spaces.

- It is important that the user remembers to close dialogue boxes when done. This often means clicking cancel. If a dialogue box is left open and the user proceeds to open other unrelated dialogue boxes, program crash is likely.

- Often times the software will display the 'Not Responding' caption in the header. More often than not, the program has not crashed. Simply doing nothing until the message clears is the recommended approach to this error.

- If the material/section library is located in a drive that the user doesn't have write access to, the library will not import as shown in this guide as well as the guides provided by DNV.
  - The user must Copy|Paste the desired library to a location on the computer where they possess write privileges. Then import the library from its new location.

- When working with larger models, like the ship in this guide, increasing the zoom gain can have a dramatic positive affect on the user's ability to efficiently navigate the model

- The GeniE user manual mentions that the ship's hull is generally modelled in software outside of the Sesam suite. There are various help files that explain imported outside generated hulls from: Rhino, Sacs, and general Parametric software programs

Bibliography

American Bureau of Shipping (ABS)—ABS Plaza, 16855 Northchase Drive, Houston, TX 77060
ABS Rules for Building and Classing Steel Vessels 2009

SESAM User Course in Curved Structure Modelling Genie Workshop: Modelling pontoon and lower column
C:\Program Files (x86)\DNVS\GeniE V6.4-08\Examples\A2_Semisub_Pontoon

SESAM User Manual GENIE VOL. III MODELLING OF PLATE/SHELL STRUCTURES
C:\Program Files (x86)\DNVS\GeniE V6.4-08\Help\pdf\GeniE_UM_Vol3

SESAM User Manual HydroD
C:\Program Files (x86)\DNVS\HydroD V4.6-03\User Documentation\pdf\HydroD_UM

SESAM User Manual Sestra
C:\Program Files (x86)\DNVS\Sestra V8.5-01\Doc\Sestra_UM

Appendices

Appendix 1: Table of Offsets

Table of Offsets

Station Number	Station Longitude (m)	Waterlines												DECK	
		0.0 (m)	0.5005 (m)	1.001 (m)	2.002 (m)	3.003 (m)	4.004 (m)	6.006 (m)	8.008 (m)	10.01 (m)	12.012 (m)	14.014 (m)	16.016 (m)	Half Breadth (m)	Height (m)
A.P.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.38	4.41	5.74	6.58	6.93	17.01
0.25	4.17	0.00	0.42	0.21	0.14	0.07	0.07	0.14	1.40	4.06	6.23	7.49	8.33	8.54	16.87
0.5	8.35	0.00	0.70	0.91	1.26	1.54	1.82	2.45	3.71	5.60	7.49	8.82	9.52	9.66	16.80
0.75	12.52	0.00	1.12	1.61	2.38	2.94	3.43	4.41	5.60	7.07	8.61	9.73	10.29	10.43	16.73
1	16.70	0.00	1.75	2.52	3.64	4.41	5.04	6.16	7.28	8.40	9.45	10.29	10.78	10.85	16.66
1.5	25.04	0.00	3.50	4.76	6.16	7.07	7.77	8.82	9.52	10.15	10.64	10.99	11.20	11.27	16.45
2	33.39	0.00	6.02	7.28	8.61	9.38	9.87	10.50	10.85	11.06	11.20	11.27	11.27	11.27	16.38
3	50.09	0.00	10.01	10.64	11.13	11.27	11.27	11.27	11.27	11.27	11.27			11.27	13.37
4	66.78	0.00	10.85	11.27	11.27	11.27	11.27	11.27	11.27	11.27	11.27			11.27	13.37
5	83.48	0.00	10.85	11.27	11.27	11.27	11.27	11.27	11.27	11.27	11.27			11.27	13.37
6	100.17	0.00	10.85	11.27	11.27	11.27	11.27	11.27	11.27	11.27	11.27			11.27	13.37
7	116.87	0.00	10.64	11.06	11.27	11.27	11.27	11.27	11.27	11.27	11.27			11.27	13.37
8	133.56	0.00	8.54	9.31	10.08	10.50	10.71	10.92	10.99	10.99	10.99			11.06	13.44
8.5	141.91	0.00	5.88	6.93	8.12	8.75	9.17	9.66	9.94	10.15	10.29			10.36	13.44
9	150.26	0.00	2.87	3.85	5.04	5.81	6.44	7.21	7.77	8.19	8.61			8.96	13.51
9.25	154.43	0.00	1.68	2.45	3.43	4.13	4.69	5.46	6.02	6.65	7.28	7.98	8.82	7.84	16.03
9.5	158.60	0.00	0.70	1.19	1.89	2.45	2.87	3.50	4.06	4.76	5.53	6.51	7.56	7.77	16.38
9.75	162.78	0.00	0.00	0.07	0.49	0.77	1.05	1.54	1.96	2.59	3.43	4.55	5.81	6.30	16.66
F.P.	166.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.77	1.75	3.15	3.92	17.01

Appendix 2: Ships Stations

FULL SCALE DIMENSIONS (meters)

Station_AP			Station_2			Station 3			Station 4			Station 5		
0	0	8.008	4.172	0	0	8.351	0	0	12.523	0	0	16.695	0	0
0	1.19	9.009	4.172	0.42	0.5005	8.351	0.7	0.5005	12.523	1.12	0.5005	16.695	1.75	0.5005
0	2.38	10.01	4.172	0.21	1.001	8.351	0.91	1.001	12.523	1.61	1.001	16.695	2.52	1.001
0	3.5	11.011	4.172	0.14	2.002	8.351	1.26	2.002	12.523	2.38	2.002	16.695	3.64	2.002
0	4.41	12.012	4.172	0.07	3.003	8.351	1.54	3.003	12.523	2.94	3.003	16.695	4.41	3.003
0	5.18	13.013	4.172	0.07	4.004	8.351	1.82	4.004	12.523	3.43	4.004	16.695	5.04	4.004
0	5.74	14.014	4.172	0.14	5.005	8.351	2.1	5.005	12.523	3.92	5.005	16.695	5.6	5.005
0	6.23	15.015	4.172	0.14	6.006	8.351	2.45	6.006	12.523	4.41	6.006	16.695	6.16	6.006
0	6.58	16.016	4.172	0.42	7.007	8.351	3.01	7.007	12.523	4.97	7.007	16.695	6.72	7.007
			4.172	1.4	8.008	8.351	3.71	8.008	12.523	5.6	8.008	16.695	7.28	8.008
			4.172	2.8	9.009	8.351	4.55	9.009	12.523	6.3	9.009	16.695	7.84	9.009
			4.172	4.06	10.01	8.351	5.6	10.01	12.523	7.07	10.01	16.695	8.4	10.01
			4.172	5.18	11.011	8.351	6.65	11.011	12.523	7.91	11.011	16.695	8.96	11.011
			4.172	6.23	12.012	8.351	7.49	12.012	12.523	8.61	12.012	16.695	9.45	12.012
			4.172	6.93	13.013	8.351	8.26	13.013	12.523	9.24	13.013	16.695	9.94	13.013
			4.172	7.49	14.014	8.351	8.82	14.014	12.523	9.73	14.014	16.695	10.29	14.014
			4.172	7.98	15.015	8.351	9.17	15.015	12.523	10.01	15.015	16.695	10.57	15.015
			4.172	8.33	16.016	8.351	9.52	16.016	12.523	10.29	16.016	16.695	10.78	16.016

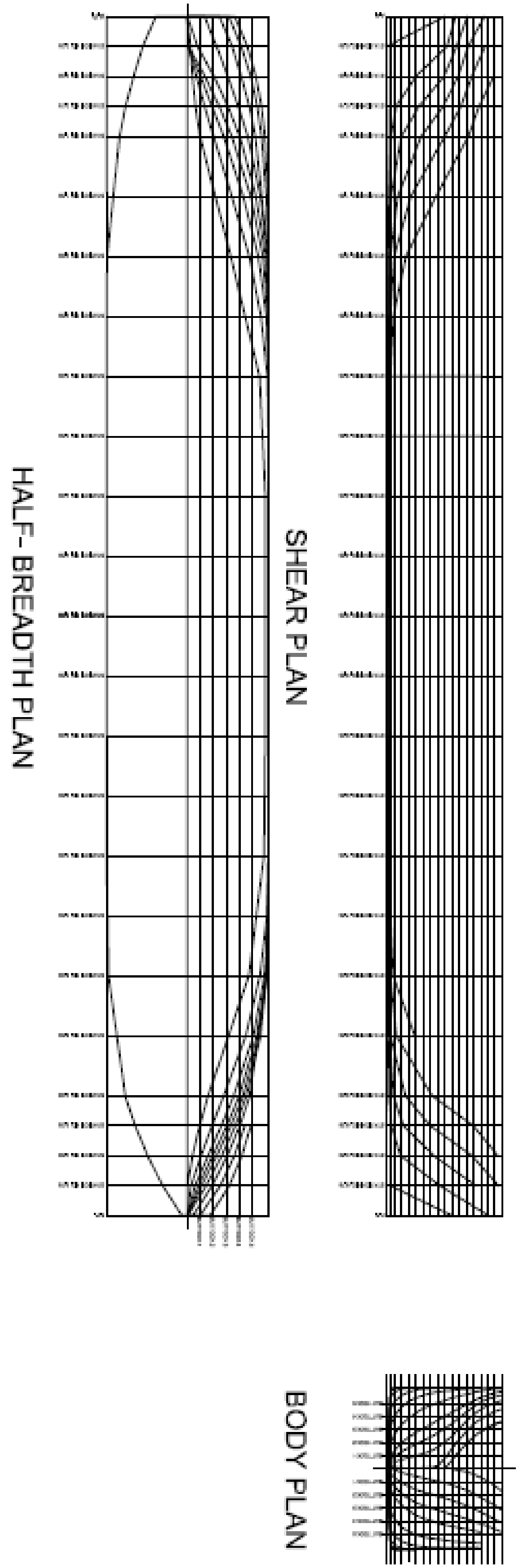
Station 6			Station 7			Station 8			Station 9			Station 10		
25.046	0	0	33.39	0	0	41.741	0	0	50.085	0	0	58.436	0	0
25.046	3.5	0.5005	33.39	6.02	0.5005	41.741	8.33	0.5005	50.085	10.01	0.5005	58.436	10.85	0.5005
25.046	4.76	1.001	33.39	7.28	1.001	41.741	9.31	1.001	50.085	10.64	1.001	58.436	11.2	1.001
25.046	6.16	2.002	33.39	8.61	2.002	41.741	10.22	2.002	50.085	11.13	2.002	58.436	11.27	2.002
25.046	7.07	3.003	33.39	9.38	3.003	41.741	10.71	3.003	50.085	11.27	3.003	58.436	11.27	3.003
25.046	7.77	4.004	33.39	9.87	4.004	41.741	10.99	4.004	50.085	11.27	4.004	58.436	11.27	4.004
25.046	8.4	5.005	33.39	10.22	5.005	41.741	11.13	5.005	50.085	11.27	5.005	58.436	11.27	5.005
25.046	8.82	6.006	33.39	10.5	6.006	41.741	11.2	6.006	50.085	11.27	6.006	58.436	11.27	6.006
25.046	9.17	7.007	33.39	10.71	7.007	41.741	11.27	7.007	50.085	11.27	7.007	58.436	11.27	7.007
25.046	9.52	8.008	33.39	10.85	8.008	41.741	11.27	8.008	50.085	11.27	8.008	58.436	11.27	8.008
25.046	9.87	9.009	33.39	10.92	9.009	41.741	11.27	9.009	50.085	11.27	9.009	58.436	11.27	9.009
25.046	10.15	10.01	33.39	11.06	10.01	41.741	11.27	10.01	50.085	11.27	10.01	58.436	11.27	10.01
25.046	10.36	11.011	33.39	11.13	11.011	41.741	11.27	11.011	50.085	11.27	11.011	58.436	11.27	11.011
25.046	10.64	12.012	33.39	11.2	12.012	41.741	11.27	12.012	50.085	11.27	12.012	58.436	11.27	12.012
25.046	10.85	13.013	33.39	11.2	13.013	41.741	11.27	13.013	50.085	11.27	13.013	58.436	11.27	13.013
25.046	10.99	14.014	33.39	11.27	14.014	41.741	0	14.014	50.085	0	14.014	58.436	0	14.014
25.046	11.13	15.015	33.39	11.27	15.015	41.741	0	15.015	50.085	0	15.015	58.436	0	15.015
25.046	11.2	16.016	33.39	11.27	16.016	41.741	0	16.016	50.085	0	16.016	58.436	0	16.016

Station 11			Station 12			Station 13			Station 14			Station 15		
66.78	0	0	75.131	0	0	83.475	0	0	91.826	0	0	100.17	0	0
66.78	10.85	0.5005	75.131	10.85	0.5005	83.475	10.85	0.5005	91.826	10.85	0.5005	100.17	10.85	0.5005
66.78	11.2	1.001	75.131	11.2	1.001	83.475	11.2	1.001	91.826	11.2	1.001	100.17	11.2	1.001
66.78	11.27	2.002	75.131	11.27	2.002	83.475	11.27	2.002	91.826	11.27	2.002	100.17	11.27	2.002
66.78	11.27	3.003	75.131	11.27	3.003	83.475	11.27	3.003	91.826	11.27	3.003	100.17	11.27	3.003
66.78	11.27	4.004	75.131	11.27	4.004	83.475	11.27	4.004	91.826	11.27	4.004	100.17	11.27	4.004
66.78	11.27	5.005	75.131	11.27	5.005	83.475	11.27	5.005	91.826	11.27	5.005	100.17	11.27	5.005
66.78	11.27	6.006	75.131	11.27	6.006	83.475	11.27	6.006	91.826	11.27	6.006	100.17	11.27	6.006
66.78	11.27	7.007	75.131	11.27	7.007	83.475	11.27	7.007	91.826	11.27	7.007	100.17	11.27	7.007
66.78	11.27	8.008	75.131	11.27	8.008	83.475	11.27	8.008	91.826	11.27	8.008	100.17	11.27	8.008
66.78	11.27	9.009	75.131	11.27	9.009	83.475	11.27	9.009	91.826	11.27	9.009	100.17	11.27	9.009
66.78	11.27	10.01	75.131	11.27	10.01	83.475	11.27	10.01	91.826	11.27	10.01	100.17	11.27	10.01
66.78	11.27	11.011	75.131	11.27	11.011	83.475	11.27	11.011	91.826	11.27	11.011	100.17	11.27	11.011
66.78	11.27	12.012	75.131	11.27	12.012	83.475	11.27	12.012	91.826	11.27	12.012	100.17	11.27	12.012
66.78	11.27	13.013	75.131	11.27	13.013	83.475	11.27	13.013	91.826	11.27	13.013	100.17	11.27	13.013

Station 16			Station 17			Station 18			Station 19			Station 20		
108.521	0	0	116.865	0	0	125.216	0	0	133.56	0	0	141.911	0	0
108.521	10.85	0.5005	116.865	10.64	0.5005	125.216	10.01	0.5005	133.56	8.54	0.5005	141.911	5.88	0.5005
108.521	11.2	1.001	116.865	11.06	1.001	125.216	10.57	1.001	133.56	9.31	1.001	141.911	6.93	1.001
108.521	11.27	2.002	116.865	11.27	2.002	125.216	11.06	2.002	133.56	10.08	2.002	141.911	8.12	2.002
108.521	11.27	3.003	116.865	11.27	3.003	125.216	11.2	3.003	133.56	10.5	3.003	141.911	8.75	3.003
108.521	11.27	4.004	116.865	11.27	4.004	125.216	11.27	4.004	133.56	10.71	4.004	141.911	9.17	4.004
108.521	11.27	5.005	116.865	11.27	5.005	125.216	11.27	5.005	133.56	10.85	5.005	141.911	9.45	5.005
108.521	11.27	6.006	116.865	11.27	6.006	125.216	11.27	6.006	133.56	10.92	6.006	141.911	9.66	6.006
108.521	11.27	7.007	116.865	11.27	7.007	125.216	11.27	7.007	133.56	10.92	7.007	141.911	9.8	7.007
108.521	11.27	8.008	116.865	11.27	8.008	125.216	11.27	8.008	133.56	10.99	8.008	141.911	9.94	8.008
108.521	11.27	9.009	116.865	11.27	9.009	125.216	11.27	9.009	133.56	10.99	9.009	141.911	10.08	9.009
108.521	11.27	10.01	116.865	11.27	10.01	125.216	11.27	10.01	133.56	10.99	10.01	141.911	10.15	10.01
108.521	11.27	11.011	116.865	11.27	11.011	125.216	11.27	11.011	133.56	10.99	11.011	141.911	10.22	11.011
108.521	11.27	12.012	116.865	11.27	12.012	125.216	11.27	12.012	133.56	10.99	12.012	141.911	10.29	12.012
108.521	11.27	13.013	116.865	11.27	13.013	125.216	11.27	13.013	133.56	11.06	13.013	141.911	10.36	13.013

Station 21			Station 22			Station 23			Station 24			Station_FP		
150.255	0	0	154.427	0	0	158.606	0	0	162.778	0	0	166.95	0	9.009
150.255	2.87	0.5005	154.427	1.68	0.5005	158.606	0.7	0.5005	162.778	0	0.5005	166.95	0.21	10.01
150.255	3.85	1.001	154.427	2.45	1.001	158.606	1.19	1.001	162.778	0.07	1.001	166.95	0.42	11.011
150.255	5.04	2.002	154.427	3.43	2.002	158.606	1.89	2.002	162.778	0.49	2.002	166.95	0.77	12.012
150.255	5.81	3.003	154.427	4.13	3.003	158.606	2.45	3.003	162.778	0.77	3.003	166.95	1.19	13.013
150.255	6.44	4.004	154.427	4.69	4.004	158.606	2.87	4.004	162.778	1.05	4.004	166.95	1.75	14.014
150.255	6.86	5.005	154.427	5.11	5.005	158.606	3.22	5.005	162.778	1.26	5.005	166.95	2.38	15.015
150.255	7.21	6.006	154.427	5.46	6.006	158.606	3.5	6.006	162.778	1.54	6.006	166.95	3.15	16.016
150.255	7.49	7.007	154.427	5.74	7.007	158.606	3.78	7.007	162.778	1.75	7.007			
150.255	7.77	8.008	154.427	6.02	8.008	158.606	4.06	8.008	162.778	1.96	8.008			
150.255	7.98	9.009	154.427	6.37	9.009	158.606	4.41	9.009	162.778	2.24	9.009	BOW Extra		
150.255	8.19	10.01	154.427	6.65	10.01	158.606	4.76	10.01	162.778	2.59	10.01	167.4	0	10.01
150.255	8.4	11.011	154.427	6.93	11.011	158.606	5.11	11.011	162.778	2.94	11.011	167.65	0	11.011
150.255	8.61	12.012	154.427	7.28	12.012	158.606	5.53	12.012	162.778	3.43	12.012	167.9	0	12.012
150.255	8.82	13.013	154.427	7.63	13.013	158.606	6.02	13.013	162.778	3.99	13.013	168.14	0	13.013
150.255	0	14.014	154.427	7.98	14.014	158.606	6.51	14.014	162.778	4.55	14.014	168.48	0	14.014
150.255	0	15.015	154.427	8.4	15.015	158.606	7.07	15.015	162.778	5.11	15.015	168.9215	0	15.015
150.255	0	16.016	154.427	8.82	16.016	158.606	7.56	16.016	162.778	5.81	16.016	169.6832	0	16.016

Appendix 3: Hull Lines

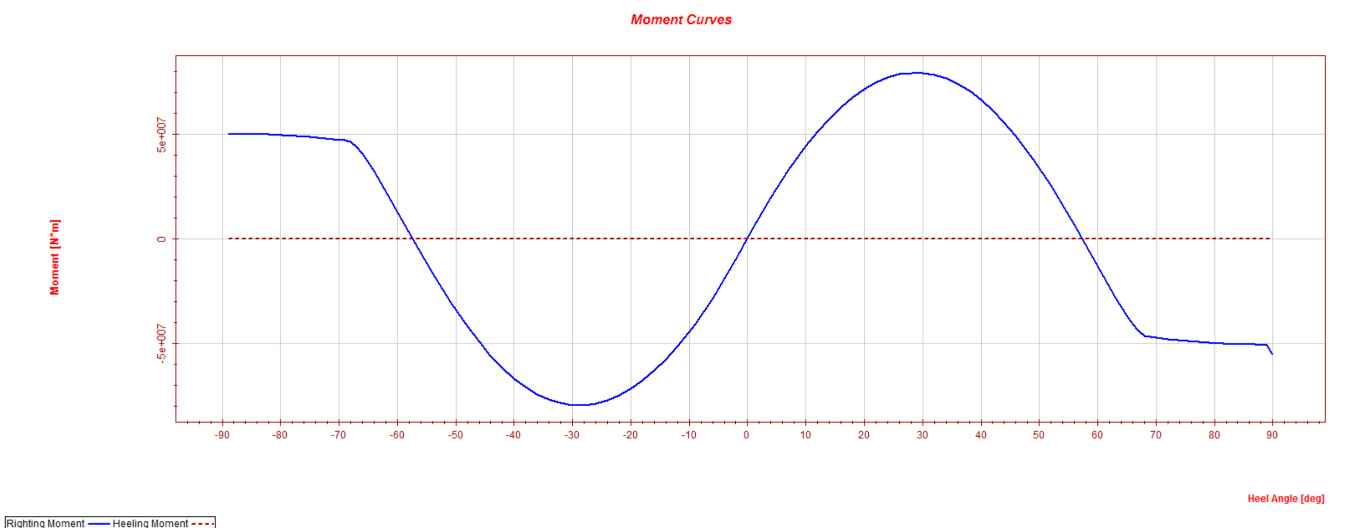


Appendix 4: Stability Report

	Result Variable	Value (X)	Y	Z
1	Metacentric Height GM (wet)	1.100871913 m		
2	Metacentric Height GM (dry)	1.100871913 m		
3	Free surface correction FSC	0 m		
4	Total mass (wet) (including compartment contents)	1.797693135e+308 Kg		
5	Total mass (without compartment contents)	1.797693135e+308 Kg		
6	Center of gravity (wet)	1.797693135e+308 m	1.797693135e+308 m	1.797693135e+308 m
7	Center of gravity (without compartment contents)	1.797693135e+308 m	1.797693135e+308 m	1.797693135e+308 m
8	Center of gravity (with compartment contents in metacenter)	1.797693135e+308 m	1.797693135e+308 m	1.797693135e+308 m
9	Buoyancy volume	+Infinity		
10	Buoyancy mass	+Infinity		
11	Center of buoyancy	1.797693135e+308 m	1.797693135e+308 m	1.797693135e+308 m
12	Center of flotation	1.797693135e+308 m	1.797693135e+308 m	1.797693135e+308 m
13	Trim moment	1.797693135e+308 N*m		
14	Panel model block coefficient	1.797693135e+308		
15	Projected XZ area above waterline	305.5958295 m^2		
16	Center projected XZ area above waterline	69.16595658 m		3.82323368 m
17	Projected XZ area below waterline	572.16347 m^2		
18	Center projected XZ area below waterline	80.19379193 m		-2.953307962 m
19	Deck immersion heel angle negative side	-89 deg		
20	Deck immersion heel angle positive side	90 deg		

	Intersection	Angle	Angle	Angle
1	Righting moment zero crossing	-57.37768111 deg	4.982879857e-007 deg	57.38997618 deg
2	Heeling/righting moment intercept	-57.3777244 deg	0.0001212623558 deg	57.38992921 deg

HydroD V4.6-03 Date: 15 Jul 2015 10:05:27



Appendix 5: Condensed Static Sestra Results

Input from CMAS Command :

ANTYP = 1   Static Analysis
MSUM > 0   Calculation of Sum of Masses and Centroid

The singularity constant for membrane and shell elements
CSING = 1.0000E-08

Lowest accepted condition number in reduction
EPSSOL= 1.1102E-14

Input from RSEL Command :

Data types selected for storing on Results File :
- Input Interface File Records,
- displacements, sequence:
  all nodes for the first resultcase, all nodes for the second resultcase, etc.
- forces and moments for beam, spring and layered shell elements, sequence:
  all elements for the first resultcase, all elements for the second resultcase, etc.
- stresses (not for beam or spring elements), sequence:
  all elements for the first resultcase, all elements for the second resultcase, etc.

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*** SUMMARY OF DATA FROM INPUT AND LOAD INTERFACE FILES ***
FOR SUPERELEMENT TYPE   1 ON LEVEL 1

The superelement has

13209 subelements
11311 nodes
6 specified (fixed) degrees of freedom
67860 internal (free) degrees of freedom
totally
67866 degrees of freedom

2 loadcases

Side information for hydropressure is given

The following kinds of loads are given:
gravitational load

The following basic elements are given:
1797 2 node beam elements   BEAS
11128 4 node flat shell elements   FQUS
284 3 node flat shell elements   FTRS

Eccentricities are given

DATE: 31-JUL-2015 TIME: 12:12:22   *************** SESTRA ***************   PAGE: 6

DATAGENERATION - SUPERELEMENT TYPE   1
SUB PAGE: 6

*** SUM OF LOADS AND MOMENTS FOR SUPERELEMENT TYPE   1 ON LEVEL 1 ***

X-LOAD = SUM OF GIVEN LOADS IN GLOBAL X-DIRECTION
Y-LOAD = SUM OF GIVEN LOADS IN GLOBAL Y-DIRECTION
Z-LOAD = SUM OF GIVEN LOADS IN GLOBAL Z-DIRECTION
X-MOM = SUM OF LOCAL MOMENTS ABOUT GLOBAL X-AXIS
Y-MOM = SUM OF LOCAL MOMENTS ABOUT GLOBAL Y-AXIS
Z-MOM = SUM OF LOCAL MOMENTS ABOUT GLOBAL Z-AXIS
X-RMOM = SUM OF MOMENTS ABOUT GLOBAL X-AXIS FROM GIVEN LOADS AND MOMENTS
Y-RMOM = SUM OF MOMENTS ABOUT GLOBAL Y-AXIS FROM GIVEN LOADS AND MOMENTS
Z-RMOM = SUM OF MOMENTS ABOUT GLOBAL Z-AXIS FROM GIVEN LOADS AND MOMENTS

LOADCASE	X-LOAD	Y-LOAD	Z-LOAD	X-MOM	Y-MOM	Z-MOM	X-RMOM	Y-RMOM	Z-RMOM
1	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
2	5.6245E-13	-7.2831E-14	-1.4419E+07	-6.7387E+01	-3.5514E+02	-5.3707E-14	1.1082E+02	1.1732E+09	-4.8588E-12

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DATAGENERATION - SUPERELEMENT TYPE 1
SUB PAGE: 7

Appendix 5: Condensed Static Sestra Results (continued)

*** SUM OF MASSES AND CENTROID FOR SUPERELEMENT TYPE 1 ON LEVEL 1 ***

MASS MATRIX IN GLOBAL COORDINATE SYSTEM (OF THE SUPERELEMENT):

1.47032E+06	0.00000E+00	0.00000E+00	0.00000E+00	7.92487E+06	4.56943E+01
0.00000E+00	1.47032E+06	0.00000E+00	-7.92496E+06	0.00000E+00	1.19631E+08
0.00000E+00	0.00000E+00	1.47032E+06	-1.81717E+01	-1.19631E+08	0.00000E+00
0.00000E+00	-7.92496E+06	-1.81717E+01	1.62273E+08	-4.86859E+02	-6.20397E+08
7.92487E+06	0.00000E+00	-1.19631E+08	-4.86859E+02	1.27987E+10	-1.89948E+02
4.56943E+01	1.19631E+08	0.00000E+00	-6.20397E+08	-1.89948E+02	1.28108E+10

COORDINATES OF CENTROID:

8.1364E+01 -2.1718E-05 5.3899E+00

MASS MATRIX AT CENTROID:

1.47032E+06	0.00000E+00	0.00000E+00	0.00000E+00	-4.18065E+01	1.37613E+01
0.00000E+00	1.47032E+06	0.00000E+00	-4.18065E+01	0.00000E+00	1.42121E+01
0.00000E+00	0.00000E+00	1.47032E+06	1.37613E+01	1.42121E+01	0.00000E+00
0.00000E+00	-4.18065E+01	1.37613E+01	1.19557E+08	-1.96539E+03	2.44104E+07
-4.18065E+01	0.00000E+00	1.42121E+01	-1.96539E+03	3.02224E+09	-4.36237E+02
1.37613E+01	1.42121E+01	0.00000E+00	2.44104E+07	-4.36237E+02	3.07705E+09

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DATAGENERATION - SUPERELEMENT TYPE 1

There are 6 3-noded shell or membrane elements with bad element shape.
The ratio of the largest edge to the smallest height is 4.0 or larger.

- COMPUTATION IS CONTINUED.

*** Estimated size of stiffness matrix for superelement 1: 12140874 variables

*** Estimate of total size of stiffness matrices for new superelements: 12140874 variables

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REDUCTION MODULE - SUPERELEMENT TYPE 1

- STIFFNESS FACTORIZATION PERFORMED BY MULTIFRONT EQUATION SOLVER -

- LOAD SUBSTITUTION PERFORMED BY MULTIFRONT EQUATION SOLVER -

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STATIC ANALYSIS OF STRUCTURE

Results file name: 20150731_121201_R1.SIN DATE: 31-JUL-2015 TIME: 12:12:25 *************** SESTRA ***************
PAGE: 11

RETRACKING MODULE - SUPERELEMENT TYPE 1
THE STRUCTURE SUB PAGE: 2

REACTION FORCES IN NODES WITH SPECIFIED (FIXED) DEGREES OF FREEDOM.
NODES MARKED WITH AN ASTERISK (*) TO THE RIGHT HAVE A LOCAL COORDINATE SYSTEM.
****

LOADCASE (INDEX)	NODE NO.	X	Y	Z	RX	RY	RZ
1	2659			0.00000E+00			
	4782		0.00000E+00	0.00000E+00			
	6487	0.00000E+00	0.00000E+00	0.00000E+00			

```
  2        2659                   5.35821E+06
          4782           -8.70852E+00  -2.02488E+06
          6487  3.42754E-04  8.70869E+00  1.10856E+07

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                    RETRACKING MODULE - SUPERELEMENT TYPE    1
                    THE STRUCTURE                                          SUB PAGE:    3

 SUM OF REACTION FORCES FROM SPECIFIED DEGREES OF FREEDOM.
 THE FORCES AND MOMENTS ARE REFFERED TO THE COORDINATE SYSTEM OF THE ACTUAL SUPERELEMENT.
```

Appendix 5: Condensed Static Sestra Results (continued)

```
 ****************************************************************************************

 LOADCASE (INDEX)      X          Y          Z          RX         RY         RZ

   1         0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
   2         3.4275E-04   1.7241E-04   1.4419E+07  -4.3453E-08  -1.1732E+09   1.8168E+02



SUPERELEMENT TYPE:    1 ACTUAL ELEMENT:    1
HAS BEEN STORED ON RESULT FILE
                                          SUB PAGE:    1

 SUM OF GLOBAL LOADS AND MOMENTS
 *******************************


 LOADCASE (INDEX)      X          Y          Z          RX         RY         RZ

   1         0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
   2         5.6245E-13  -7.2831E-14  -1.4419E+07   1.1082E+02   1.1732E+09  -4.8588E-12

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                      RETRACKING MODULE - GLOBAL DATA
                                                              SUB PAGE:    2

 SUM OF REACTION FORCES AND MOMENTS
 **********************************
 GIVEN IN THE GLOBAL COORDINATE SYSTEM OF THE TOP LEVEL SUPERELEMENT

 LOADCASE (INDEX)      X          Y          Z          RX         RY         RZ

   1         0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00   0.0000E+00
   2         3.4275E-04   1.7241E-04   1.4419E+07  -4.3453E-08  -1.1732E+09   1.8168E+02

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                      RETRACKING MODULE - GLOBAL DATA
                                                              SUB PAGE:    3

 DIFFERENCES BETWEEN SUMMED LOADS AND REACTION FORCES
 ****************************************************
 LARGER THAN   0.00E+00 FOR TRANSLATIONAL COMPONENTS AND LARGER THAN   0.00E+00 FOR ROTATIONAL COMPONENTS

 LOADCASE (INDEX)      X          Y          Z          RX         RY         RZ

   2         3.4275E-04   1.7241E-04   3.7532E-05   1.1082E+02  -6.4972E+02   1.8168E+02

 TOTAL TIME CONSUMED IN SESTRA              CPU TIME:     8.38  CLOCK TIME:     5.16  CHANNEL TIME:     0.00
```

Appendix 6: Condensed Eigenvalue Sestra Results

Type of Analysis :

Eigenvalue Solution by Lanczos Method
Retracking
Input from CMAS Command :
ANTYP = 2 Dynamic Analysis
MSUM > 0 Calculation of Sum of Masses and Centroid

The singularity constant for membrane and shell elements
CSING = 1.0000E-08

Lowest accepted condition number in reduction
EPSSOL= 1.1102E-14

Input from EIGL Command :

Specification of eigenvalues to be calculated:
ENR = 10 eigenvalues are demanded.

MAXO 50 Maximum number of iterations.
NBLO 2 Block size.
NFIG 5 No. of digits of accuracy.
IU = 0 The stiffness matrix is triangularised.
PRIN 0 Print of eigenvalues.

Input from RSEL Command :

INTERPRETATION OF ANALYSIS CONTROL DATA
FOR SUPERELEMENT TYPE 1 ON LEVEL 1

Input from DYMA Command :

IMAS = 1 Consistent mass matrices from the subelements are demanded.

*** SUMMARY OF DATA FROM INPUT AND LOAD INTERFACE FILES ***
FOR SUPERELEMENT TYPE 1 ON LEVEL 1
The superelement has
13209 subelements
11311 nodes
6 specified (fixed) degrees of freedom
67860 internal (free) degrees of freedom
totally 67866 degrees of freedom
2 loadcases

Side information for hydropressure is given
The following kinds of loads are given:
gravitational load

The following basic elements are given:
1797 2 node beam elements BEAS
11128 4 node flat shell elements FQUS
284 3 node flat shell elements FTRS

Eccentricities are given

*** SUM OF LOADS AND MOMENTS FOR SUPERELEMENT TYPE 1 ON LEVEL 1 ***

X-LOAD = SUM OF GIVEN LOADS IN GLOBAL X-DIRECTION
Y-LOAD = SUM OF GIVEN LOADS IN GLOBAL Y-DIRECTION
Z-LOAD = SUM OF GIVEN LOADS IN GLOBAL Z-DIRECTION
X-MOM = SUM OF LOCAL MOMENTS ABOUT GLOBAL X-AXIS
Y-MOM = SUM OF LOCAL MOMENTS ABOUT GLOBAL Y-AXIS
Z-MOM = SUM OF LOCAL MOMENTS ABOUT GLOBAL Z-AXIS
X-RMOM = SUM OF MOMENTS ABOUT GLOBAL X-AXIS FROM GIVEN LOADS AND MOMENTS
Y-RMOM = SUM OF MOMENTS ABOUT GLOBAL Y-AXIS FROM GIVEN LOADS AND MOMENTS
Z-RMOM = SUM OF MOMENTS ABOUT GLOBAL Z-AXIS FROM GIVEN LOADS AND MOMENTS

LOADCASE	X-LOAD	Y-LOAD	Z-LOAD	X-MOM	Y-MOM	Z-MOM	X-RMOM	Y-RMOM	Z-RMOM
1	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
2	-9.1138E-12	4.8423E-12	-1.4419E+07	-8.3358E+01	-3.5649E+02	2.3386E+01	2.0254E+02	1.1732E+09	7.0997E+01

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*** SUM OF MASSES AND CENTROID FOR SUPERELEMENT TYPE 1 ON LEVEL 1 ***

Appendix 6: Condensed Static Sestra Results (continued)

MASS MATRIX IN GLOBAL COORDINATE SYSTEM (OF THE SUPERELEMENT):

1.47032E+06	1.25933E-12	9.48871E-13	1.39642E+01	7.98233E+06	9.95754E+00
1.25933E-12	1.47032E+06	-7.03162E-14	-7.98239E+06	-7.45105E+00	1.19631E+08
9.48871E-13	-7.03162E-14	1.47032E+06	-2.06529E+01	-1.19631E+08	-7.23972E+00
1.39642E+01	-7.98239E+06	-2.06529E+01	1.61611E+08	-5.49188E+02	-6.25039E+08
7.98233E+06	-7.45105E+00	-1.19631E+08	-5.49188E+02	1.27983E+10	1.38814E+03
9.95754E+00	1.19631E+08	-7.23972E+00	-6.25039E+08	1.38814E+03	1.28098E+10

COORDINATES OF CENTROID:

8.1364E+01 -1.0409E-05 5.4290E+00

MASS MATRIX AT CENTROID:

1.47032E+06	1.25933E-12	9.48871E-13	1.39642E+01	-3.00585E+01	-5.34768E+00
1.25933E-12	1.47032E+06	-7.03162E-14	-3.00585E+01	-7.45105E+00	2.46832E+01
9.48871E-13	-7.03162E-14	1.47032E+06	-5.34768E+00	2.46832E+01	-7.23972E+00
1.39642E+01	-3.00585E+01	-5.34768E+00	1.18274E+08	-2.34586E+03	2.44419E+07
-3.00585E+01	-7.45105E+00	2.46832E+01	-2.34586E+03	3.02124E+09	1.35128E+03
-5.34768E+00	2.46832E+01	-7.23972E+00	2.44419E+07	1.35128E+03	3.07613E+09

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DATAGENERATION - SUPERELEMENT TYPE 1

*** Estimated size of stiffness matrix for superelement 1: 107895744 variables

*** Estimate of total size of stiffness matrices for new superelements: 107895744 variables

DYNAMIC ANALYSIS OF STRUCTURE
- EIGENVALUEPROBLEM SOLVED BY LANCZOS METHOD

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DYNAMIC ANALYSIS OF STRUCTURE
* E I G E N V A L U E S *
* *
* F R E Q U E N C I E S *

ALL EIGENVALUES BEING CAL-
CULATED ARE PRINTED TOGE-
THER WITH THE CORRESPONDING
FREQUENCIES AND PERIODS.
FREQ = SQRT(EIGENV)/(2.*PI)
PERI = 1./FREQ

NO.	EIGENVALUE UNIT: (SEC)-2	FREQUENCY UNIT: HERTZ	PERIOD UNIT: SEC
1	0.7362895E-05	0.000	2315.55742
2	0.2850339E+01	0.269	3.72162
3	0.2859708E+01	0.269	3.71552
4	0.3059905E+01	0.278	3.59191
5	0.3460258E+01	0.296	3.37774
6	0.3503785E+01	0.298	3.35669
7	0.5178583E+01	0.362	2.76105
8	0.7079450E+01	0.423	2.36146
9	0.1366105E+02	0.588	1.69996
10	0.1415003E+02	0.599	1.67033

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DYNAMIC ANALYSIS OF STRUCTURE

SUB PAGE: 3

Results file name: 20150731_125244_R1.SIN

SUPERELEMENT TYPE: 1 ACTUAL ELEMENT: 1
HAS BEEN STORED ON RESULT FILE
TOTAL TIME CONSUMED IN SESTRA CPU TIME: 119.72 CLOCK TIME: 89.78 CHANNEL TIME: 0.00