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Windows 10

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Computer Aided ship's STructural design prOceduRe

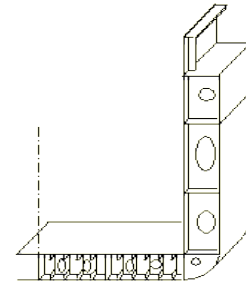
Short overview - february 2021



CASTOR is an aid for ships structural design. Already starting at the first design stage one can create reliable results.

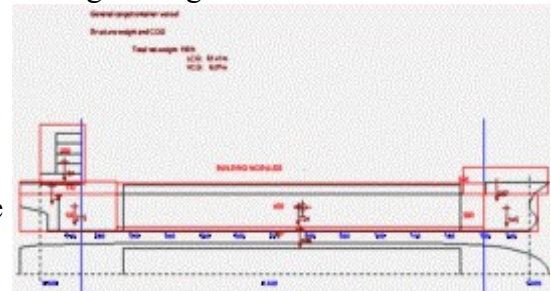
A model of the structure, simply and quickly generated, is the base for all examinations like calculation of steel weight, centres of gravity working hours en costs. One can create a model of the ship's structure in the early design stage within a short time using a minimum input.

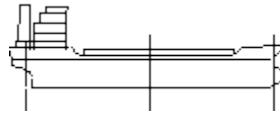
CASTOR uses the best method to make reliable forecasts of the steel weight at the first design state based on a structure model generated by the user!



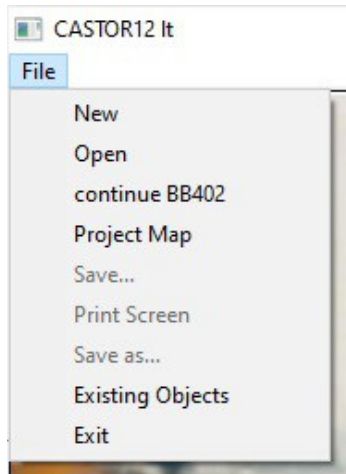
Results from CASTOR:

1. Major scantlings calculated according class rules; based on parameter studies for instance to find the best spacing
2. Cross sections
Detailed modelling of parts possible
Supported by a dxf drawing export
Longitudinal bending criteria check including buckling of longitudinal
3. Structure Weight, including surfaces and centre of gravity sorted for structure modules, plates (shell separated), profiles and so on.
4. Activity based costing with cost parameters like length of flame cutting and welding, working hours and –costs as well as detailed material costs given per cost stage, structure module and total for the midship body.
5. Open interfaces in text format to make all CASTOR data available to other design or engineering procedures





Working with CASTOR

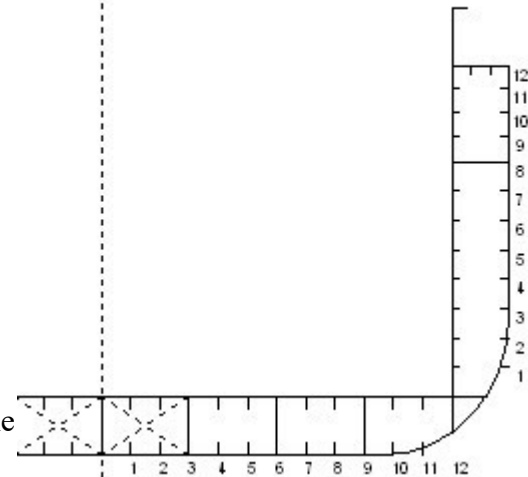


Start working on a new object a structure concept has to be defined and the major scantlings may be calculated according to general rules of a certain class authority.

Additional procedures are available to support several special problems.

Minimum input required:

- Specifications, main dimensions
- Outline - general arrangement
- Special requirements



To continue the structural design procedure, a model containing the structure parts of amidships cross section has to be generated. Parts of this cross section will be defined on several frames for primary and secondary structure parts

All cross sections of this model can be shown and edited to the user's convenience.

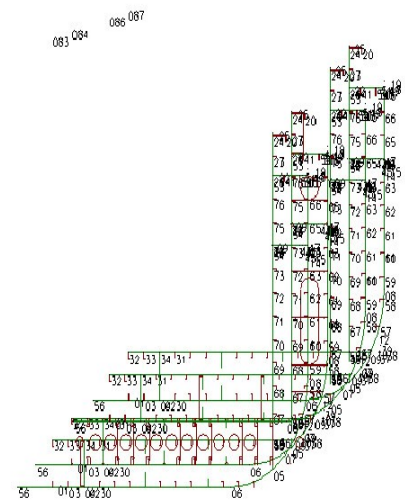
For this cross section a longitudinal criteria check including buckling will be performed.

CASTOR12 It Cross Section criteria check - BB402

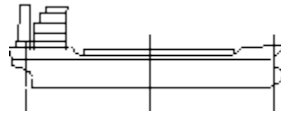
File View Edit Results Sections Check section on.. Next/Previous menu

Eff. Sec. Modulus (cont. coaming) :	0.1010095E+07	cm3
Required Section Modulus :	0.9243949E+06	cm3
Moment of Inertia :	0.2763014E+09	cm4
Admissible moments		
Condition:	Hogging	Sagging
Total bending moment	201754. kNm	112670. kNm
Still water bending	71531. kNm	-28557. kNm
Wave bending moment	130222. kNm	141227. kNm
Stress at Top	200. N/mm2	-112. N/mm2
at deck	130. N/mm2	-73. N/mm2
in bottom	-78. N/mm2	43. N/mm2

Compression is negative stress: check buckling
The maximum admissible stress is: 243. N/mm2



Buckling criteria are taking into account reduction for corrosion on longitudinal loaded plate panels. To meet all criteria, may be one has to improve the structure of the topsides step by step.



The model can be used as an interface next procedures in design and engineering, so that you can integrate CASTOR in your design environment.

Example for integrated interfaces:

- Import of a general arrangement background using DXF files
- Export of cross sections using DXF files
- Interface to use GL inland water way rules
- Import of PIAS/FAIRWAY hull form for cross sections. Frames can be imported and defined as hull and internal structure has to be added.

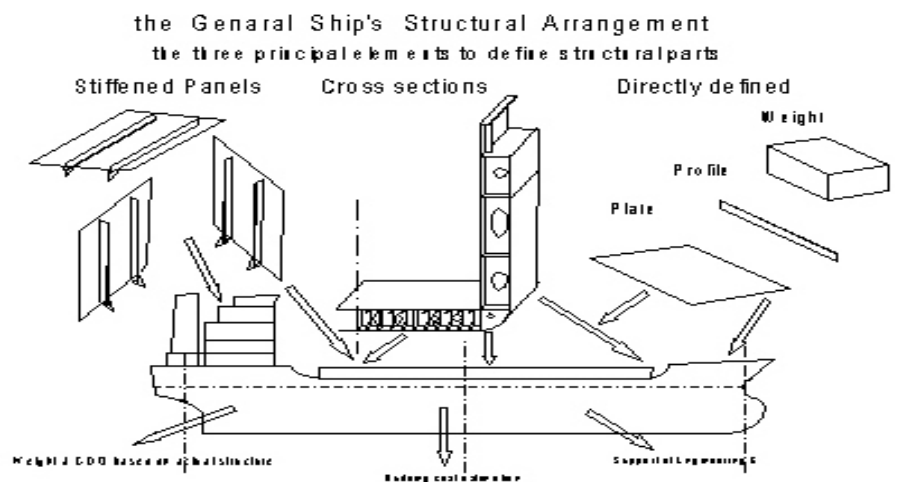
One can define several cross sections at any frame of the ship to describe the steel structure exactly, but suppose there is only one midship section. In this normal case the ends can be generated by a default distribution with reliably accurate results. Distribution of cross sections over the length of the vessel can be defined by the user to take into account the repetition sequence of secondary and primary parts.

The CASTOR-model can be completed by three different types of parts:

Parts on cross sections

Stiffened plate panels

Direct input of weight parameters.



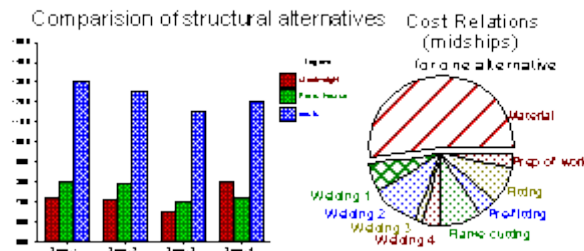
Normally only additional structures defined as panels and girders has to be added to cross sections to complete the model of the whole ship structure.



CASTOR offers you more than a very reliable forecast of structure weights depending on the correctness of the model:

Activity Based Costing is available for structure parts to define hours and costs per coststage.

You have the opportunity to make parameter studies, to find minimum weight, hours and costs. Already in an early design stage one get insight on the influence of design parameters on the weight and costs by variation of the ships structure.



Also for reseach for returns on investments using ABC is the only way to get a reliable answer. CASTOR - ABC uses a virtual production plan. Changing tools of the plant may give you necessary insight about to invest or not.

Early decisions about improvements of the design could be based from the structure model and ABC. There is a better control of design parameters; which can result in quality, a minimum structure weight and/or costs. It is an important advantage to know the differences in weight and costs between several possible structure alternatives.

Also knowledge about the share of a group of parts in weight, or activities in costing, may help more to make better decisions than the use of “the rule of thumb”!

After getting a minimized structure weight by parameter variation with CASTOR take into account the following:

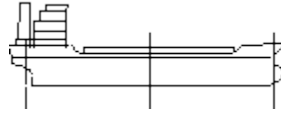
Later changings caused during engineering i.e. by approval, in general, will result in increasing the vessels weight but never in a lesser weight! Of course this increase will happen unresolved also if CASTOR is not used!

By using CASTOR frequently during the whole design period after changings of the steel structure, you get a good control about a possible increasing of the structure weight. It is recommended to try to predict the final weight in an early stage. For this task you may build your history about how the weight is growing by maintaining the CASTOR model so long as possible!

Realise that only the real steel structure as defined in the structure model is part of the investigation of a vessels weight, hours ands costs! No, so called, emperical additions are made. Read also the corresponding [hints](#) of the user guide if you want to compare the structure weight found by CASTOR with the rest weight got from experience based methods!

Also take into account that the CASTOR determined weight gives you the opportunity to know the difference between the approximated weight found from the model and the structure weight “as built”; **that difference is your money** that you have spent in excess of your first plan based on the model! Next you should find out how to save this money.

Often shipbuilders do not even know that the structure weight can grow uncontrolled between 5 and 20 % caused by measures during design and engineering!



Do you know how much better you must be than the concurrent? CASTOR-ABC is also a competitive intelligence tool which you can use to simulate building costs of other yards in an other virtual production plant. Therefore you may use plant data found by “looking over the fence”

Also create your future production plant to check your investment plans in tools!

How do you can profit by the advantages of CASTOR ?

The application of CASTOR shows that much of your time during used for the design can be saved, but in practice this advantage will be seldom used to deduct the costs for the design. One can use this time better to investigate more structure variants for possibilities to optimize weight, hours and costs!

Herewith some examples:

1. Using CASTOR you are able to improve the accuracy of your calculated structure weight of a vessel. For example for a steel weight of 1500t and a cost price coefficient of € 1,80/kg) there is a profit on the cost price of € 27.300,-- for each percent more accurate weight!
2. A publication shows that a certain shipyard has saved 4% of the weight of an inland waterway tank vessel. These savings are the result of using CASTOR making systematic calculations of alternative structures! The steel weight is about 1000t and by means of a simple calculation you will find a reduction of the costs of about €73.000,-- . By the way for this vessel also structure variants are investigated, related to minimum costs, which gives you still much more profit than the mentioned reduction by saving only steel but it isn't published .
3. Experience in investigation of structure variants shows that you can save at least 10 % of the costs for the midship structure if you minimize the costs using CASTOR in stead of applying a conventional approach with a structure concept found by the rule of thumb. This means a reduction of €180.000, -- of the cost price for a simple midship structure of 1000t!
4. Even for another minimum cost design, CASTOR may help to find alternative structures, which brings you an appreciable profit.

Based on above-mentioned examples a cost conscious company shall not doubt to use CASTOR.

CASTOR is an indispensable tool in the international struggle for competition!