MEC-E1004 Principles of Naval Architecture

Light ship Weight Estimation

Light ship Weight estimation

Tips before going to calculations !

✓ This tutorial is to explain how to empirically estimate your ship's weight

✓ Your ship's main characteristics must be defined

✓ Also, some information on the superstructure dimensions and machinery power must be defined before calculations

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Ship Displacement and Weights

The displacement is computed by:

$$\Delta = \gamma . L_{BP} . B . T . Cb$$

The displacement is equal to the sum of the fixed and variable weights of the ship:

$$\Delta = DW + W_{LS}$$

in which:

        DW   - deadweight
        W_{LS} - lightship weight

$$DW = CDW + DW_S$$

        CDW   - cargo deadweight
        DWs   - ship's own deadweight

Light Ship Weight estimation

Components to consider accurate estimate of the Lightship Weight

- Structure / Hull

- Machinery

- Outfitting

- *Centers of Gravity*

- *Longitudinal distribution of the lightship weight*

Light Ship Weight

For the purpose of estimate, generally the lightship weight is considered to be the sum of three main components:

$$W_{LS} = W_S + W_E + W_M$$

in which:

W_S - Weight of the structural steel of the hull, the superstructure and of the outfit steel (machinery foundations, supports, masts, ladders, handrails, etc).

$$W_S = W_H + W_{SPS}$$

W_E - Weight of the equipment, outfit, deck machinery, etc.

W_M – Weight of all the machinery located in the engine room

Ship's Main Characteristics

- **As the hull form at this stage should be ready; you can insert the ship's main dimensions and LCB from the hydrostatic calculations.**

Ship's main characteristics	
L(m)	100
B(m)	32,5
T(m)	10
D(m)	13
CB	0,84
LCB(m) @AP (m)	50

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Structure / Hull weight

- **To calculate the ship's hull weight, besides the main dimensions, you have to define the dimensions of the superstructure and the deckhouse. Additonally, the K factor is provided from tabular values for different types of ships (see lecture notes Chapter 10.3).**

Structural weight	
Length of superstructure (m)	20
Height of superstructure (m)	5
Length of deckhouse (m)	7
Height of deckhouse (m)	5
E	4616,25
K	0,031
WS (tonne)	3192,85
KG_{hull} (m)	5,671
LCG_{hull} (m)	49,85

Machinery Weight (see Ch 10, lecture notes)

- For machinery weight estimation, the maximum continous rate of the main prime movers of your ship and rpm must be defined.

- Additionally, the engine room height and the height of the engine room.

- Machinery weights are divided into main machinery weight and remainder weight of other auxiliary machinery.

- There are recommended values for cm based on the ship's type.

Machinery weight	
MCR (KW)	3000
N (rpm)	150
type of plant	other
cm	0,69
W_M (tonne)	336,037
Height of engine room (m)	5
Height of double bottom (m)	0,7
KG_M (m)	2,205

Outfitting Weight (see Ch 10, Lecture notes)

- **The outfitting weight is a function of the main dimensions and the coefficient Co which depends on the ship type.**

Outfitting weight	
Co	0,2
W_o (tonne)	650
KG_o (m)	14,25