

MEC-E1004 Principles of Naval Architecture

Light ship Weight Estimation



Aalto University
School of Engineering

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

Ship Displacement and Weights

The displacement is computed by:

$$\Delta = \gamma \cdot L_{BP} \cdot B \cdot T \cdot C_b$$

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
DW_s - 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

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. Additionally, 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 continuous 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 C_o which depends on the ship type.

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