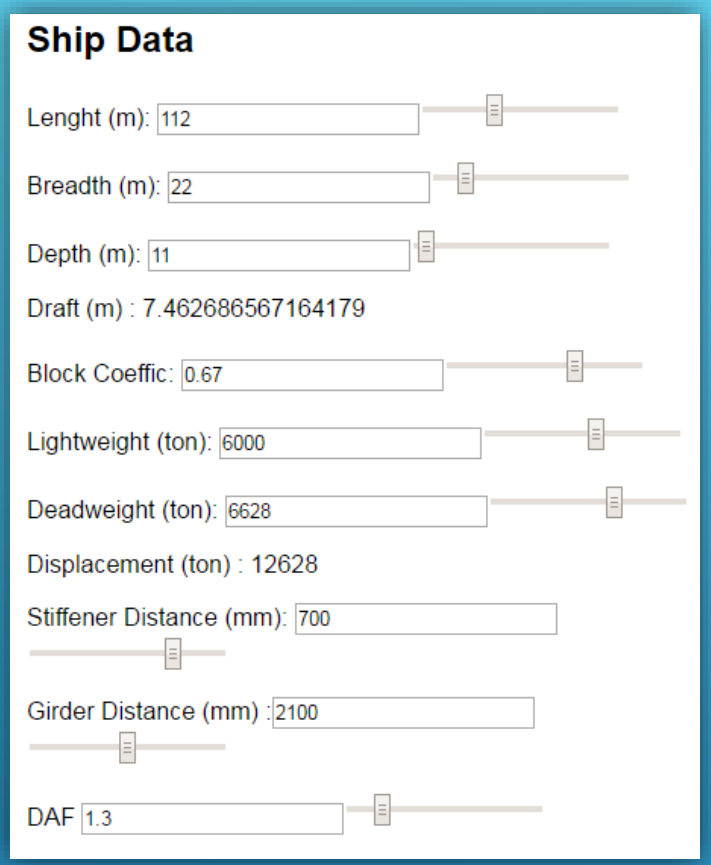
LOCAL AND GLOBAL STRESS ANALYSIS



SHIP DATA

- Draft: $D = \frac{\nabla}{L*B*CB*\rho}$
- Displacement: $\nabla = Lw + Dw$
- DAF = Dynamic Amplification Factor
- Stiffener distance = s
- Girder distance = l
- Normal stress: $\sigma = 160\ MPa$

LOCAL STRENGTH

Local Strength of Bottom Plating

Pressure (N/mm^2): 0.0975509328358209

Stiffener

Section Modulus (cm^3): 156.8436092000933

Inertia (cm^4): 1783

Profile (mm) : 160x9

Girder

Section Modulus (cm^3): 15492.307520988807

Plate

Plate Thickness (mm): 8.642189129637547

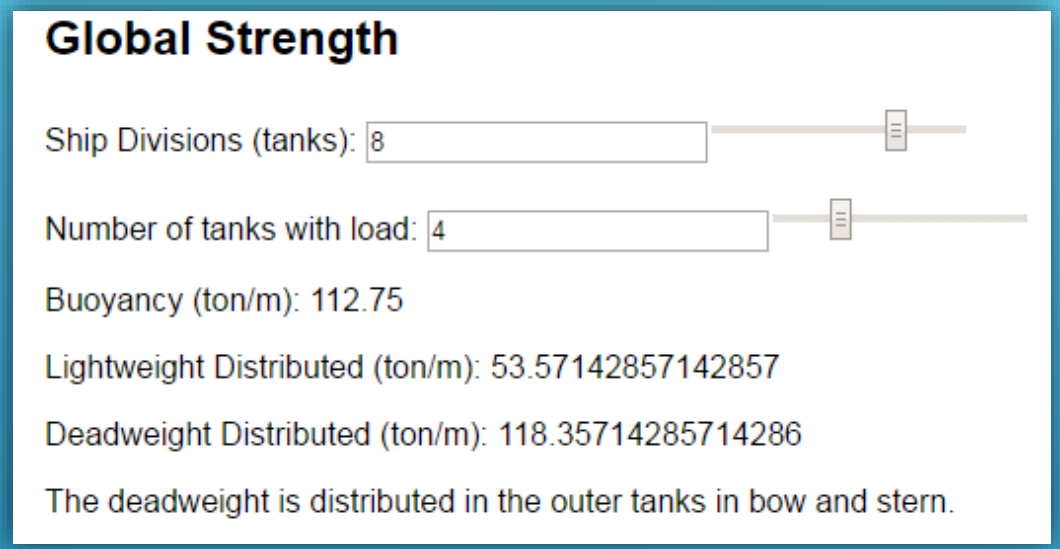
Equivalent Plate Thickness (mm): 10.699331986780404

Inertia (mm^4): 3547541842416.8228

Section Modulus (cm^3): 506791.69177383184

- Pressure: $P = \rho * g * D * \frac{DAF}{1000}$
- Stiffener
  - Section Modulus: $Z = \frac{P*S*l^2}{12*\sigma} * \frac{1}{1000}$
  - Inertia and Profile from Table 1
- Girder
  - Section Modulus : $Z_g = \frac{P*l*B^2}{10*\sigma} * \frac{1}{1000}$
- Plate
  - Thickness: $t = \frac{s}{2}\sqrt{\frac{P}{\sigma}}$
  - Equivalent Thickness: $t_{eq} = t + \frac{A_{profile}}{s}$
  - Neutral Axis: $NA = \frac{L}{ST} * 2 * 1000$
  - Inertia: $I = \frac{l}{2} * t_{eq} * NA^2 * 2 + \frac{1}{12}\frac{L}{ST}^3 * t_{eq}$
  - Section Modulus: $Z_{plat} = \frac{I}{NA} * \frac{1}{1000}$

GLOBAL STRENGTH DATA



- Ship divisions: Ship equally divided in number of tanks (ST).
- Tanks with load: Paired number of tanks in each end of the ship (LT)
- $Bouyancy = \frac{\nabla}{L}$
- $LW\ distributed = \frac{LW}{L}$
- $DW\ distributed = \frac{DW}{L * \frac{LT}{ST}}$

Resulting Load

Load Full Tanks (ton/m): -59.17857142857143

Load Empty Tanks (ton/m): 59.17857142857143

Established conditions: Always hogging.

Maximum Force (N*m): 1657

Maximum Moment (MN*m): 463.96

DNV Rules

Wave Coefficient (Cw) : 8.172273870249207

Stillwater Bending Moment (kN*m): 253606.91918153374

Wave Bending Moment (kN*m): 287097.917401594

Worst case scenario, seagoing condition.

GLOBAL STRENGTH DATA

- *Resulting load*
  - $L_{full} = Buoyancy - LW_d - DW_d$
  - $L_{empty} = Buoyancy - LW_d$
  - Always hogging condition, loaded tanks on the sides of the ship
  - $F_{max}\ and\ M_{max}$ from applying resulting loads to the ship
- DNV rules
  - CW: Table in pag 53.
  - $M_{so} = C_w * L^2 * B * (0.1225 - 0.015 * Cb)$ Pag 69.
  - $M_{wo} = 0.19 * C_w * L^2 * B * Cb$ Pag 70

GLOBAL STRENGTH DATA

Strenght Evaluation

Stillwater Bending Moment (kN*m): 463960

Total Bending Moment (kN*m): 751057.917401594

Midship Section Modulus (cm^3): 429175.9528009108

Conclusion: Plate holds

- *Strength evaluation*
  - *Comparison between DNV rules and values obtained in Resulting load*
  - *Maximum value is used*
  - $M_{tot} = M_{so} + M_{wo}$
  - $Z_{midship} = \frac{M_{tot}}{175}$
- *Conclusion*
  - *Check:* $Z_{plat} > Z_{midship}$