Height of the container $y_1 := 2m$

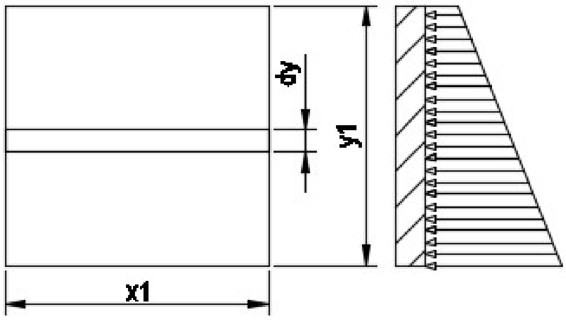
Density of the water $\rho_{water} := 1000\frac{kg}{m^3}$

Width of the container $x_1 := 2.5m$

Pressure can be defined as : $p = \frac{F}{A}$

Aera da is part of the height dy time the lenght $da = dy \cdot x1$

The change of force equals change of area time pressure $dF = p_{druk} \cdot da$



The pressure on the wall depends on the depth of the wall in the fluild. The Bernoulli equation ca be used to calculate the pressure acting on the wall. Bernoulli equation states.

$$p + h \cdot g \cdot \rho + \frac{1}{2} \cdot \rho \cdot v^2 = \text{Constant}$$

Using only the static part of the Bernounlli equation

$p_1 = y \cdot \rho_{water} \cdot g$ $\quad p_1 := y_1 \cdot \rho_{water} \cdot g$ $\quad p_1 = 0.196 \cdot bar$

$$F = \int p1\, da$$

Maximum height $y_{max} := 2m$

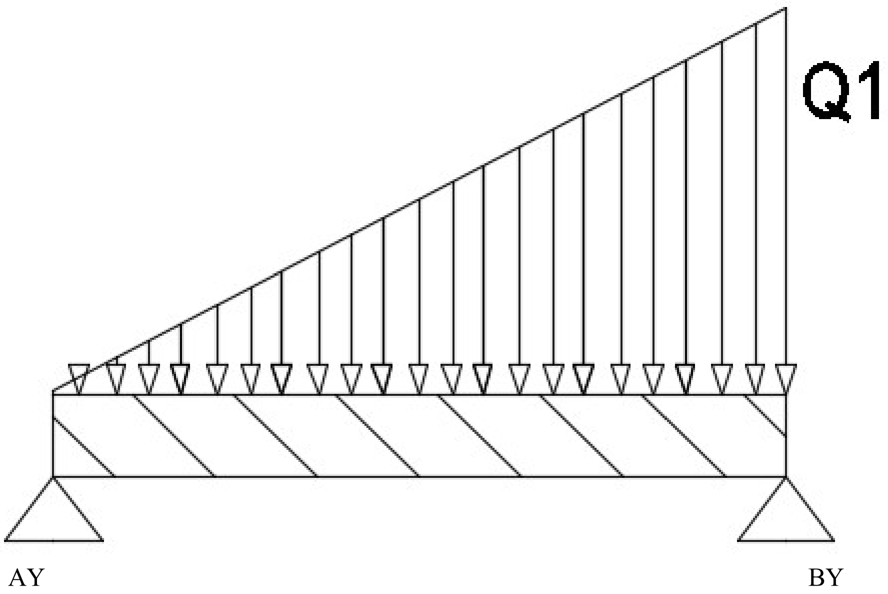
Minimum height $y_{min} := 0m$

Forces an the wall $F_{wall} = x_1 \cdot \rho_{water} \cdot g \cdot \int_{ymin}^{y_{max}} y1\, dy$

$$F_{wall} := \left[\frac{1}{2} y_{max}^2 \cdot (x_1 \cdot \rho_{water} \cdot g)\right] - \frac{1}{2} y_{min}^2 \cdot (x_1 \cdot \rho_{water} \cdot g) \qquad F_{wall} = 49.033 \cdot k$$

Force over the height of the wall

Force per meter $Q_1 := \frac{F_{wall}}{2m}$ $Q_1 = 24.517 \cdot \frac{kN}{m}$



$base := y_{max}$

$height := Q_1$

$F_1 := \frac{1}{2} \cdot base \cdot height$ $F_1 = 24.517 \cdot kN$

Centeriod of a triangle is a 1/3 of the bas

Sum of moments $M_a = -F_1 \cdot \left(\frac{2}{3} \cdot y_{max}\right) + by \cdot y_{max}$

Reaction force in by $b_y := \frac{F_1 \cdot \left(\frac{2}{3} \cdot y_{max}\right)}{y_{max}}$ $b_y = 16.344 \cdot kN$

Reaction force in ay $a_y := F_1 - b_y$ $a_y = 8.172 \cdot kN$

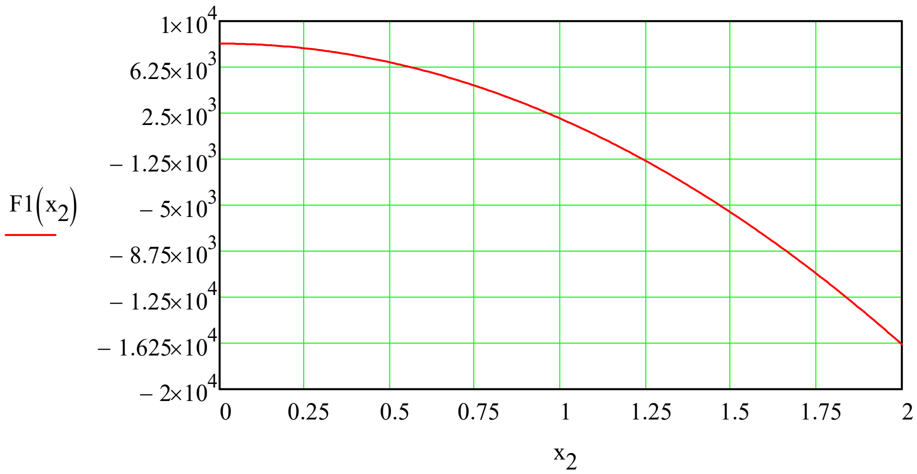
Slope of the load over the beam $a := \frac{Q_1}{y_{max}}$

position Vector $x_2 := 0m, 0.01m..2m$

Force equation $F1(x_2) := a_y - a \cdot \frac{x_2^{\ 2}}{2}$

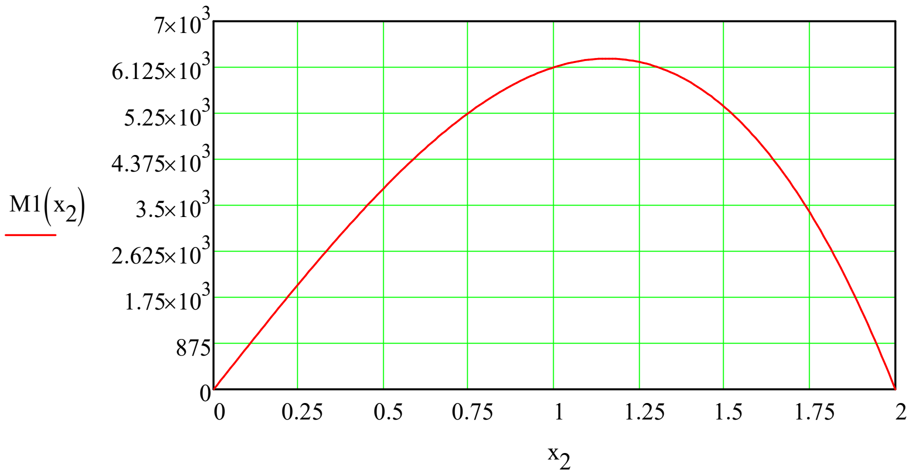
Point where the moments is at his max $x_{dom} := \sqrt{\frac{-a_y}{a} \cdot -2}$ $x_{dom} = 1.155\,m$

Load diagram



Shear diagram

$$M1(x_2) := a_y \cdot x_2 - a \cdot \frac{x_2^{\ 3}}{6}$$



$$Max_{mom} := a_y \cdot x_{dom} - a \cdot \frac{x_{dom}^3}{6} \qquad Max_{mom} = 6.291 \cdot kN \cdot m$$

Yield stress of the steel plate $\sigma_{steel} := 235 \frac{N}{mm^2}$

Safety factor $n := 2$

Allowable stress $vx := \frac{\sigma_{steel}}{n}$ $\quad vx = 117.5 \cdot \frac{N}{mm^2}$

Width of the plate $b := y_{max}$

Plate thickness $h := 6mm$

Area Section $A_y := y_{max} \cdot h$ $\quad A_y = 0.012\,m^2$

Moment of Inertia $Iy := \frac{1}{12} \cdot b \cdot h^3$ $\quad Iy = 36000 \cdot mm^4$

Distance centeriod beam and outer side beam $e_{ly} := \frac{y_{max}}{2}$ $\quad e_{ly} = 1000 \cdot mm$

Section Modulus $W_{by} := \frac{1}{6} \cdot \left(b \cdot h^2\right)$ $\quad W_{by} = 12 \cdot cm^3$

Stress in the plate $sp := \frac{Max_{mom}}{W_{by}}$ $\quad sp = 524.247 \cdot \frac{N}{mm^2}$

Only using a plate of 6mm will is not correct the stress is to high. Adding a rectangular tube as support will be needed.

Sheet metal has almost no influence on the resistance against bending so it can be neglected

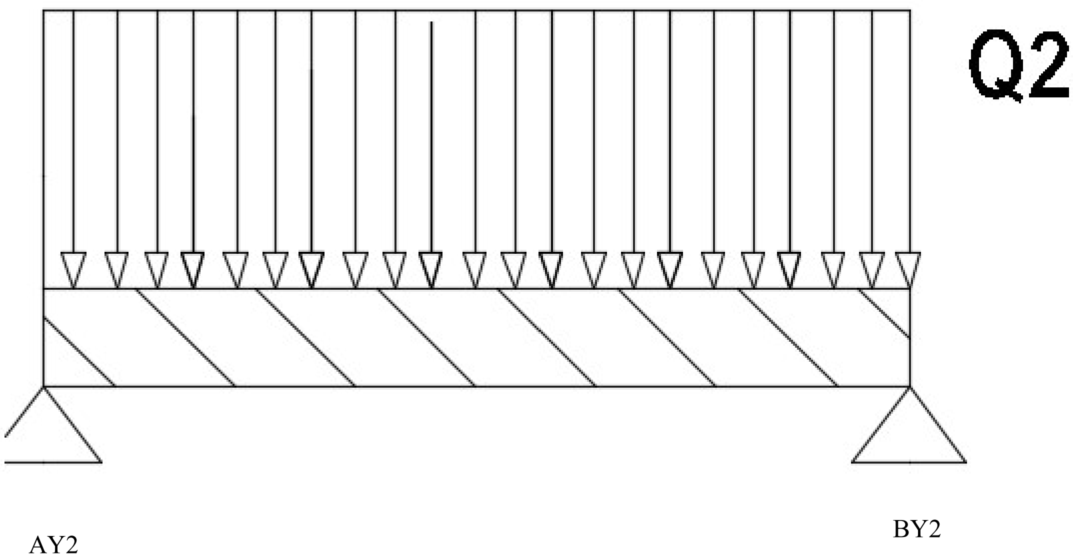
Required Section Modulus $sp2 := \frac{Max_{mom}}{vx}$ $\quad sp2 = 5.354 \times 10^4 \cdot mr$

100 x 100 x 5 has a Section of Modulus of $Tube_{80} := 56.3cm^3$

Calculated stress on the wall $sp3 := \frac{Max_{mom}}{Tube_{80}}$ $\quad sp3 = 111.74 \cdot \frac{N}{mm^2}$

Force over the lenght of the wall and the lowest section on the wall where the pressure is at is highest.

Force per meter $Q_2 := \frac{F_{wall}}{2m}$ $Q_2 = 24.517 \cdot \frac{kN}{m}$



Lenght between the supports $Lenght2 := x_1$

Load in the middle $F_2 := Lenght2 \cdot Q_2$ $F_2 = 61.292 \cdot kN$

Sum of moments $M_a = -F_2 \cdot \left(\frac{1}{2} \cdot Lenght2\right) + by2 \cdot Lenght2$

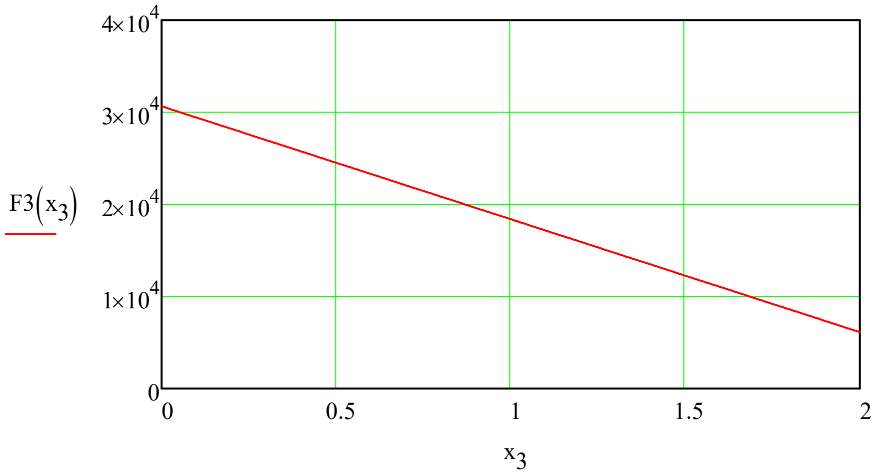
Reaction force in by2 $b_{y2} := \frac{F_2 \cdot \left(\frac{1}{2} \cdot Lenght2\right)}{Lenght2}$ $b_{y2} = 30.646 \cdot kN$

Reaction force in ay2 $a_{y2} := F_2 - b_{y2}$ $a_{y2} = 30.646 \cdot kN$

$x_3 := 0m, 0.01m .. 2m$

$$F3(x_3) := a_{y2} - \frac{Q_2}{2} \cdot x_3 \qquad Q_2 = 24.517 \cdot \frac{kN}{m}$$

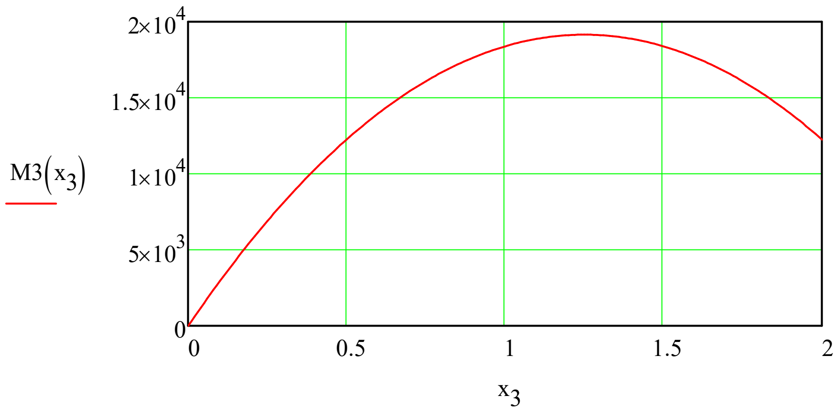
Load diagram



$x_{dom2} := 1m$

Shear diagram

$$M3(x_3) := a_{y2} \cdot x_3 - \frac{Q_2}{2} \cdot x_3^2$$



$$Max_{mom2} := a_{y2} \cdot x_{dom2} - \frac{Q_2}{2} \cdot x_{dom2}^{\;2} \qquad Max_{mom2} = 18.387 \cdot kN \cdot m$$

Yield stress of the steel plate $\sigma_{steel2} := 235 \frac{N}{mm^2}$

Safety factor for dynamic forces $n2 := 2$

Allowable stress $vx2 := \frac{\sigma_{steel}}{n2}$ $vx2 = 117.5 \cdot \frac{N}{mm^2}$

Width of the plate $b2 := y_{max}$

Plate thickness $h2 := 6mm$

Area Section $A_{y2} := y_{max} \cdot h$ $A_y = 0.012\, m^2$

Moment of Inertia $Iy2 := \frac{1}{12} \cdot b2 \cdot h2^3$ $Iy = 36000 \cdot mm^4$

Distance centeriod beam and outer side beam $e_{ly2} := \frac{y_{max}}{2}$ $e_{ly2} = 1000 \cdot mm$

Section Modulus $W_{by2x} := \frac{1}{6} \cdot \left(b \cdot h^2\right)$ $W_{by2x} = 12 \cdot cm^3$

Stress in the plate $sp2x := \frac{Max_{mom2}}{W_{by}}$ $sp2x = 1.532 \times 10^3 \cdot \frac{N}{mm}$

Only using a plate of 6mm will is not correct the stress is to high. Adding a rectangular tube as support will be needed.

Sheet metal has almost no influence on the resistance against bending so it can be neglected

Required Section Modulus $sp2xx := \frac{Max_{mom2}}{vx}$ $sp2xx = 1.565 \times 10^5 \cdot mm$

120 x 120 x 12.5 has a Section of Modulus of $Tube_{120} := 161 \cdot 10^3 mm^3$

Calculated stress on the wall $sp3xx := \frac{Max_{mom2}}{Tube_{120}}$ $sp3xx = 114.208 \cdot \frac{N}{mm}$

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