

# Licenciatura em Engenharia Informática



## Relatório LAPR3

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## US 417

### Ultra Large Container Vessel (ULCV)

- Capacity: 13,092
- Length: 366.46 m
- Draft: 15.5 m
- Tonnage: 142,105 DWT
- Depth: 29.85 m
- Beam: 48.2 m

Ultra Large Container Vessel is a type of container ship. They are used to transport container between the principal ports and then use the smallest type of vessels to distribute to smallest ports.

### Panamax

The size of a Panamax vessel is limited by the original Panama canal's lock chambers (width and length), by the depth of the water in the canal and by the height of the Bridge of the Americas since that bridge's construction. A Panamax cargo ship would typically have a [DWT](#) of 65,000–80,000 [tonnes](#), but its maximum cargo would be about 52,500 tonnes during a transit due to draft limitations in the canal

- Capacity (TEU) : 3,001–5,100
- Length: 965 ft (294.13 m)
- Draft: 39.5 ft (12.04 m)
- Tonnage: 52,500 DWT
- Height: 190ft (57.91m)
- Beam: 32.3 m

DWT → The more heavily loaded a ship is, the lower it sits in the water. Maximum DWT is the amount of weight a ship can carry without riding dangerously low in the water.

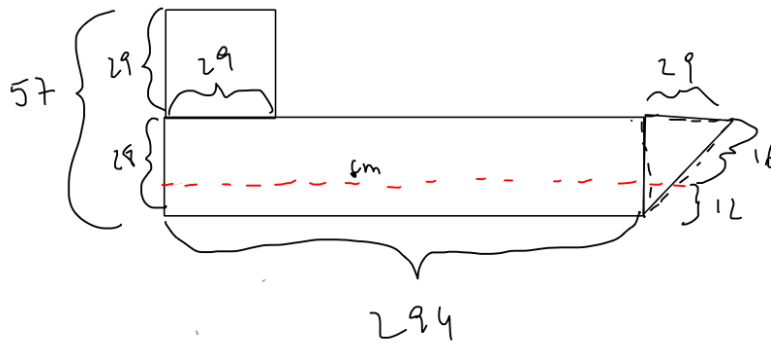
### Lake Freighter

Lake freighters, or lakers, are bulk carrier vessels that ply the Great Lakes of North America. Since the late 19<sup>th</sup> century, lakers have carried bulk cargoes of materials such as limestone, iron ore, grain, coal, or salt from the mines and fields of the upper Great Lakes to the populous industrial areas farther east.

- Capacity – 25,300 tons
- Length – 234 meters
- Tonnage: 25,525 DWT
- Beam: 21 m
- Draft: 11m

US 418

Panamax



$$A_1 = 294 \times 28 = 8232 \text{ m}^2$$

$$A_2 = 29 \times 29 = 841$$

$$A_3 = \frac{29 \times 28}{2} = 406$$

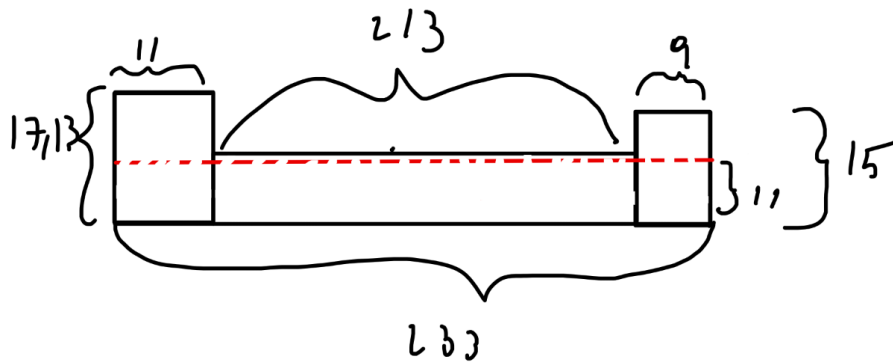
$$A_T = 8232 + 841 + 406 = 9479$$

$$x_{cm} = \left( \frac{8232}{9479} \times \frac{294}{2} \right) + \left( \frac{841}{9479} \times \frac{29}{2} \right) + \left( \frac{406}{9479} \times \frac{29}{2} \right) = 129,57$$

$$y_{cm} = \left( \frac{8232}{9479} \times \frac{28}{2} \right) + \left( \frac{841}{9479} \times \frac{29}{2} \right) + \left( \frac{406}{9479} \times \frac{28}{2} \right) = 14,05$$

Centro de massa do vessel Panamax : ( 129,57 ; 14,05 )

## Lake Freighter



$$A_1 = 213 \, m \times 11 = 2343 \, m^2$$

$$A_2 = 17,13 \times 11 = 188,43 \, m^2$$

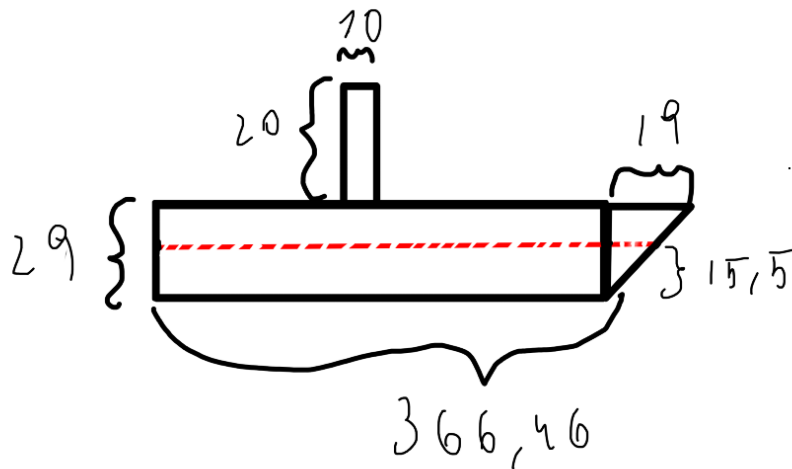
$$A_3 = 9 \times 15 = 135 \, m^2$$

$$A_T = 2343 + 188,43 + 135 = 2666,43 \, m^2$$

$$x_{cm} = \left( \frac{2343}{2630,43} \times \frac{213}{2} \right) + \left( \frac{188,43}{2630,43} \times \frac{11}{2} \right) + \left( \frac{135}{2630,43} \times \frac{9}{2} \right) = 95,49$$

$$y_{cm} = \left( \frac{2343}{2630,43} \times \frac{11}{2} \right) + \left( \frac{188,43}{2630,43} \times \frac{17,3}{2} \right) + \left( \frac{135}{2630,43} \times \frac{15}{2} \right) = 5,90$$

Centro de massa do vessel Lake Freighter: ( 95,49 ; 5,90 )



$$A_1 = 366,46 \times 29 = 10627,34 \text{ m}^2$$

$$A_2 = \frac{29 \times 19}{2} = 275,5 \text{ m}^2$$

$$A_3 = 20 \times 10 = 200 \text{ m}^2$$

$$A_T = 10627,34 + 275,5 + 200 = 11102,34 \text{ m}^2$$

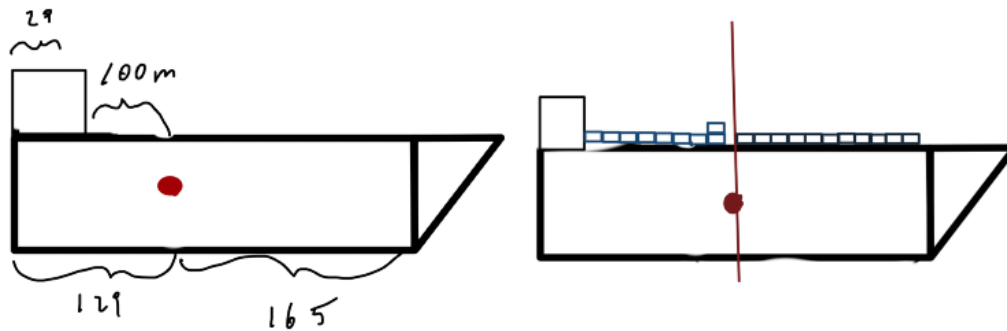
$$x_{cm} = \left( \frac{10627,34}{11102,34} \times \frac{366,46}{2} \right) + \left( \frac{275,5}{11102,34} \times \frac{19}{2} \right) + \left( \frac{200}{11102,34} \times \frac{10}{2} \right) = 175,71 \text{ m}^2$$

$$y_{cm} = \left( \frac{10627,34}{11102,34} \times \frac{29}{2} \right) + \left( \frac{275,5}{11102,34} \times \frac{29}{2} \right) + \left( \frac{200}{11102,34} \times \frac{20}{2} \right) = 14,42 \text{ m}^2$$

Centro de massa do vessel Lake Freightier : ( 175,71 ; 14,42 )

## US 419

### Panamax



Number of containers: 50

Back percentage of the mass center:  $\frac{129}{294} = 0,439 = 43,9 \%$

Front percentage of the mass center:  $\frac{165}{294} = 0,561 = 56,1 \%$

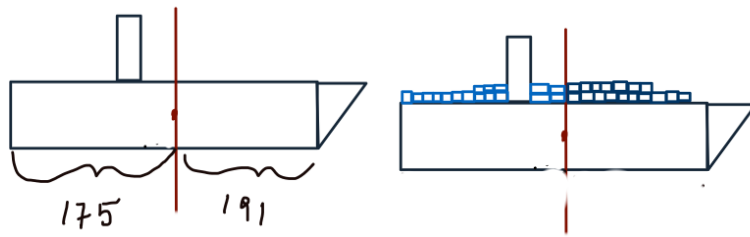
Number of containers in the back of the mass center:  $50 * 0,439 = 22$

Number of containers in the front of the mass center:  $50 * 0,561 = 28$

Number of containers that can be placed in the horizontal, in the back of the mass center:  $\frac{100}{5} = 20$

Number of containers that can be placed in the horizontal, in the front of the mass center:  $\frac{165}{5} = 33$

ULCV



Number of containers: 50

Back percentage of the mass center:  $\frac{175}{366} = 0,478 = 47,8 \%$

Front percentage of the mass center:  $\frac{191}{366} = 0,522 = 52,2 \%$

Number of containers in the back of the mass center:  $100 * 0,478 = 48$

Number of containers in the front of the mass center:  $100 * 0,522 = 52$

Number of containers that can be placed in the horizontal, in the back of the mass center:  $\frac{175}{5} = 35$

Number of containers that can be placed in the horizontal, in the front of the mass center:  $\frac{191}{5} = 38$



US 420  
Panamax

$$W_i = \frac{H_i}{H} \times W = \frac{12.04}{28} \times 32.3 = 13.89m$$

$$V_{prisma} = \frac{1}{2} \times 13.89 \times 12.04 \times 294.13 = 124354m^3$$

$$V = \frac{m}{p} \quad (=) \quad m = v \times p \quad (=) \quad m = 124354 \times 1030 = 128084620kg$$

$$P = 1030 \text{ kg}/m^3$$

$$500kg \times 1000 = 500000kg$$

$$m_{TOTAL} = 500000 + 1258084620 = 128584620kg$$

$$V = \frac{128584620}{1030} = 124839.43m^3$$

$$H_i = \sqrt{\frac{124839,43 \times 2 \times 28}{294,13 \times 32,3}} = 18.44m$$

$$\Delta h = 18.44 - 12.04 = 6.4m$$

ULCV

$$W_i = \frac{H_i}{H} \times W = \frac{15.5}{29.85} \times 48.2 = 25.03m$$

$$V_{prisma} = \frac{1}{2} \times 15.5 \times 25.03 \times 366.46 = 102726.25m^3$$

$$V = \frac{m}{p} \quad (=) \quad m = v \times p \quad (=) \quad m = 71086,83 \times 1030 = 10\,530\,803,75kg$$

$$P = 1030 \, kg/m^3$$

$$500kg \times 1000 = 500000kg$$

$$m_{TOTAL} = 500000 + 10530803.75 = 10580803.75kg$$

$$V = \frac{10580803.75}{1030} = 102774.79m^3$$

$$H_i = \sqrt{\frac{102774.79 \times 2 \times 29.85}{366.46 \times 48.2}} = 21.51m$$

$$\Delta h = 21.51 - 15.5 = 6.01m$$

## Lake Freighter

$$W_i = \frac{H_i}{H} \times W = \frac{11}{12.5} \times 21 = 18.48m$$

$$V_{prisma} = \frac{1}{2} \times 13.49 \times 11 \times 234 = 36093.75m^3$$

$$V = \frac{m}{p} \quad (=) \quad m = v \times p \quad (=) \quad m = 36093.75 \times 1030 = 3271537.5kg$$

$$P = 1030 \text{ kg}/m^3$$

$$500kg \times 1000 = 500000kg$$

$$m_{TOTAL} = 500000 + 3271537.5 = 3\,321\,537.5kg$$

$$V = \frac{3\,321\,537.5}{1030} = 31762.5m^3$$

$$H_i = \sqrt{\frac{31762.5 \times 2 \times 12.5}{234 \times 21}} = 11.73m$$

$$\Delta h = 11.73 - 11 = 0.73m$$