

PROBLEM 3.135

3.135 A barge 20ft wide and 50ft long is loaded with rock as shown. Assume that the center of gravity of the rock and barge is located along the centerline at the top surface of the barge. If the rock and the barge weigh 400,000lbf, will the barge float upright or tip over?

Solution:

$$\sum F_{vert} = -W + \rho g V = 0$$

where

$$V = d \times 20 \times 50 \text{ft}^3$$

$$\rho g = \gamma = 62.4 \text{lbf/ft}^3$$

Therefore,

$$d = W / (\gamma \times 20 \times 50) = 6.41 \text{ft}$$

$$c = d/2 = 3.21 \text{ft}$$

$$CG = 8 - 3.21 = 4.8 \text{ft}$$

$$\therefore V = 6410 \text{ft}^3$$

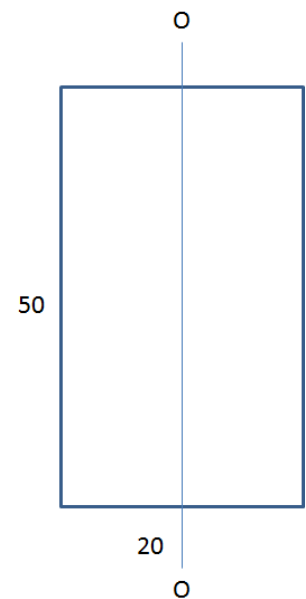
Since

$$I_{oo} = \frac{50 \times 20^3}{12} = 33,333 \text{ft}^4,$$

$$GM = \frac{I_{oo}}{V} - CG$$

$$= \frac{33,333}{6410} - 4.8$$

$$= .4 > 0 \therefore \text{stable}$$



Water plane