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Applications of Linear Momentum

Assignment 4.1

1. Find the force on the deflector

Assume $\delta = 62.4 \text{ lb/ft}^3$

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Assumptions

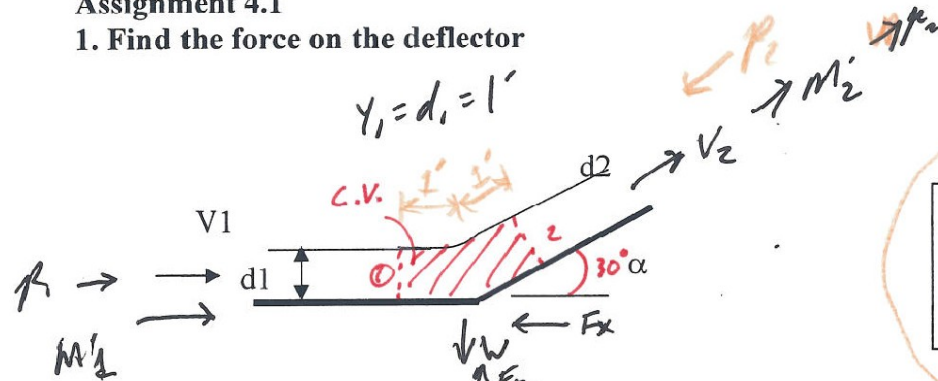
- Neglect weight of water
 $W = \delta (\text{width}) (\text{depth}) L$
 $= 62.4 (6) (1) (2) = 748.8 \text{ lb}$

$P_1 = \delta w d_1^2 / 2$

$P_2 = \frac{1}{2} \delta w d_2^2 (\cos \alpha)$

$P_{2x} = P_2 (\cos \alpha)$

W = 6 ft
 d1 = 1 ft
 V1 = 40 ft/sec
 $\alpha = 30^\circ$



Assume $d1 = d2$ and neglect the weight of the water.

$Q = V_1 d_1 w = 40 (1) (6) = 240 \text{ cfs}$

$Q = V_2 d_2 w$; $V_2 = \frac{Q}{d_2 w} = \frac{240}{1(6)} = 40 \text{ ft/s}$

$\Sigma F_x = P_1 - F_x - F_{fx} - P_2 \cos 30^\circ = M_2' \cos 30^\circ - M_1'$

$-F_x = \rho Q V_2 \cos 30 - \rho Q V_1 \rightarrow F_x = \rho Q V (1 - \cos 30^\circ) = 2495 \text{ lbs}$
 * neglecting pressure & friction

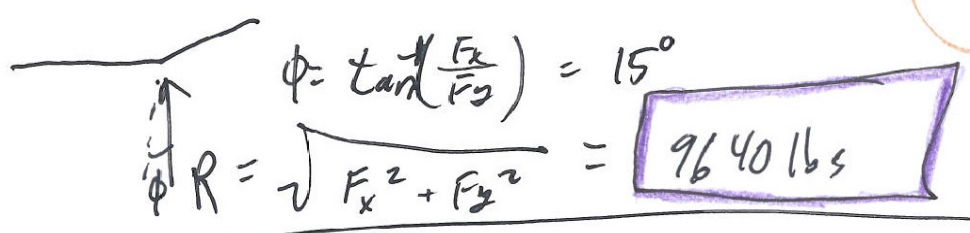
$\Sigma F_y = F_y - W - P_2 \sin 30^\circ - F_{fy} = M_2' \sin 30^\circ - M_1' \sin \phi$

$F_y = M_2' \sin 30 = \rho Q V_2 \sin 30 = 9312 \text{ lbs}$

Forces of Deflector on water

with weight of water

$P_1 =$ correction for water



$\phi = \tan^{-1} \left(\frac{F_x}{F_y} \right) = 15^\circ$

$R = \sqrt{F_x^2 + F_y^2} = 9640 \text{ lbs}$

For force on Deflector = opposite of

