Forces on flat gate  CE319F  © S.A. Kinnas (2008)
Perspective view

Free surface of liquid of spec. weight \( \gamma \)

As shown in class:
\[
\Delta = y_{cp} - \bar{y} = \frac{I}{\gamma A}
\]

- \( dF \): Elementary pressure force acting normal to the shown (shaded) gate strip of height \( dy \) and length \( l(y) \); \( dF = p(y) \, dA \)
- \( dA \): Elementary area of gate strip; \( dA = l(y) \, dy \)
- \( F_{gate} \): Total pressure force acting normal to the gate
- \( A \): Total area of gate
Forces on flat gate
Looking from a direction normal to the gate

\[ y = 0 \]

\[ +y \]

\[ l(y) \]

\[ dy \]

\[ C \]

\[ C' \]

\[ Y \]

\[ Y_{cp} \]

\[ Y_{bot} \]

\[ A \]

\[ A' \]

\[ \text{center of pressure of gate} \]

\[ \text{or point through which the force } F_{\text{gate}} \text{ passes} \]

\[ \text{Horizontal axis through gate centroid} \]

\[ I_{oo'} : \text{Moment of inertia of gate w.r.t. } 00' \]

\[ I_{cc'} : \text{ " " " " " " } \]

\[ I_{oo'} = I_{cc'} + \bar{y}^2 A \]

\[ \text{also denoted as } \bar{I} \]

"parallel-axis theorem"