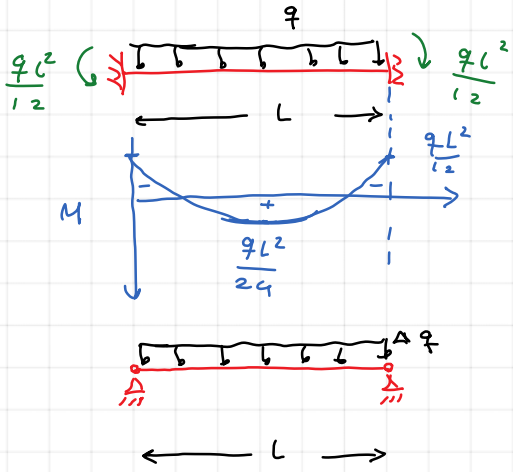
In this series of videos, we are going through Euorocode 1993-1-1.

This video explains how to classify steel cross-sections and provides insight into the calculations involved. You'll learn about critical stresses for stiffened plates and how to prevent local buckling by limiting the width ratio to the plate's thickness.



$q = q_y \rightarrow M_{max} = M_y$

$q = q_p \rightarrow M_{max} = M_p$

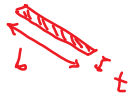
Annex A [informative] – Calculation of critical stresses for stiffened plates

A.1 Equivalent orthotropic plate

(1) Plates with at least three longitudinal stiffeners may be treated as equivalent orthotropic plates.

(2) The elastic critical plate buckling stress of the equivalent orthotropic plate may be taken as:

$$\sigma_{cr,p} = k_{\sigma,p}\,\sigma_E \qquad \text{(A.1)}$$

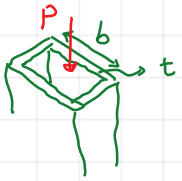


where $\sigma_E = \dfrac{\pi^2 E t^2}{12(1-\nu^2)b^2} = 190000\left(\dfrac{t}{b}\right)^2 \quad in\,[MPa]$

$k_{\sigma,p}$ is the buckling coefficient according to orthotropic plate theory with the stiffeners smeared over the plate;

b is defined in Figure A.1;

t is the thickness of the plate.



$\sigma_{plate} = \sigma_y \rightarrow F_y = \sigma_y\, b\, t$

$F_{cr} = \sigma_{cr,p}\, b\, t$

$F_y \leq F_{cr} \rightarrow \sigma_y \cancel{b}\,\cancel{t} \leq k_{\sigma,p}\, 190000 \left(\dfrac{t}{b}\right)^2 \cancel{b}\,\cancel{t}$

$\varepsilon = \sqrt{\dfrac{235}{f_y}}$

$\left(\dfrac{b}{t}\right)^2 \leq k_{\sigma,p} \cdot 190000 \times \dfrac{1}{\sigma_y} \rightarrow \dfrac{b}{t} \leq \sqrt{k_{\sigma,p}} \cdot \dfrac{\sqrt{190000}}{436} \cdot \dfrac{1}{\sqrt{f_y}}$

($\sigma_y \rightarrow f_y$)

$\dfrac{b}{t} \leq \sqrt{k_{\sigma,p}} \cdot \dfrac{436}{\sqrt{f_y}} \cdot \dfrac{\sqrt{235}}{\sqrt{235}} = \sqrt{k_{\sigma,p}} \cdot \dfrac{436}{\sqrt{235}} \cdot \varepsilon = 28.4\sqrt{k_{\sigma,p}}\,\varepsilon$