CIV102F Quiz # 10: Friday AM December 4, 2020
Plate Buckling

Shown below is a bridge made from matboard which has an I shaped cross section which is 120 mm tall. The dashed lines indicate diaphragms which help to stiffen the I-beam to avoid local crushing.

1) Calculate and draw the shear force and bending moment diagrams, labeling all important values in terms of P
2) Calculate the values of P which causes the following:
   a) Tensile failure (P_1)
   b) Compression failure (P_2)
   c) Shear failure in the matboard (P_3)
   d) Plate buckling failure in the flange (P_4) and a buckling failure in the web (P_5)
   e) Shear buckling failure in the web (P_6)
3) Based on your calculations, how will the bridge fail? Indicate P_{fail} and the associated mechanism.

Matboard Properties	
Tensile strength, $\sigma_{ult}^+ = 30$ MPa Crushing strength, $\sigma_{ult}^- = -6$ MPa Shear strength, $\tau_{ult} = 4$ MPa	Young's modulus, E = 4000 MPa Poisson's ratio, $\mu = 0.2$ Thickness, t = 1.5 mm

$I = 1.148 \times 10^6 \ mm^4$
$Q_{max} = 10.57 \times 10^3 \ mm^3$