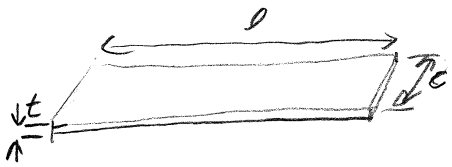
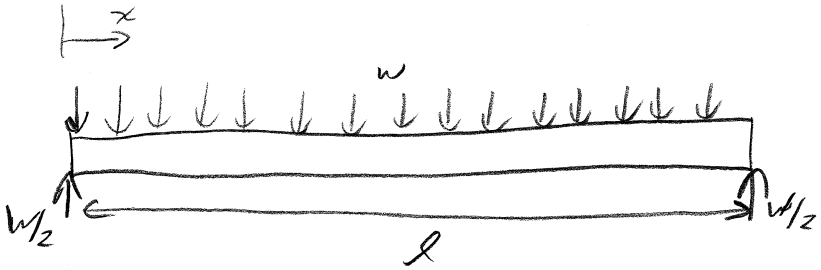
DEFLECTION AND STRESS IN FLAT PLATE

2/23/10
JAH





$$w = \frac{W}{l}$$

$$M = \frac{wx}{2}(l-x) \qquad V = \frac{wl}{2} - wx$$

$$Y_{MAX} = -\frac{5wl^4}{384EI}$$

$$E_{ALUMINUM} = 10\times10^6 \ lb/in^2$$

$$I = \frac{ct^3}{12}$$

$c = .5m = 19.7''$
$t = 1''$
$\} \rightarrow I = \frac{19.7''}{12}(1'')^3 = 1.64\ in^4$
$W = 666\ lbs$
$l = 118''$
$w = \frac{W}{l} = \frac{666\ lbs}{118''} = 5.64\ \frac{lbs}{in}$

$$Y_{MAX} = -\frac{5(5.64\ \frac{lbs}{in})(118\ in)^4}{384(1.64\ in^4)(10\times10^6\ \frac{lb}{in^2})}$$

$$= .87''$$

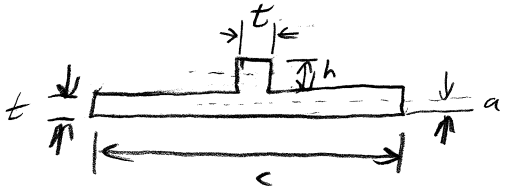
$$M = \frac{5.64\ \frac{lbs}{in}(59\ in)}{2}(118\ in - 59\ in) = 9816\ in\cdot lbs$$

$$\sigma = \frac{M}{I/c} = \frac{9816\ in\cdot lbs}{1.64\ in^4/.5\ in} = 2993\ lb/in^2$$

$$V_{MAX} = \frac{wl}{2} = \frac{5.64\ \frac{lbs}{in}\cdot 118\ in}{2} = 332\ lbs$$

$$\tau_{MAX} = \frac{V_{MAX}}{A} = \frac{332\ lbs}{19.7\ in^2} = 17\ lbs/in^2$$

DEFLECTION IN FLAT PLATE WITH STIFFENER.



$h = 2\,in$
$c = .5m = 19.7''$
$t = 1''$
$W = 666\,lbs$
$l = 118''$
$w = W/l = 5.64\,lbs/in$

NEUTRAL AXIS:

$$A_{TOTAL} = ct + th$$

$$aA_{TOTAL} = ct\left(\frac{t}{2}\right) + th\left(t + \frac{h}{2}\right)$$

$$a = \frac{ct\left(\frac{t}{2}\right) + th\left(t + \frac{h}{2}\right)}{A_{TOTAL}}$$

$a = .64\,in$ } NEUTRAL AXIS DISTANCE FROM BOTTOM.

$$I = \frac{1}{12}ct^3 + ct\left(a - \frac{t}{2}\right)^2 + \frac{1}{12}th^3 + th\left(t + \frac{h}{2} - a\right)^2 = 6.4\,in^4$$

$$Y_{MAX} = \frac{-5\left(5.64\,\frac{lbs}{in}\right)(118\,in)^4}{384\,(6.4\,in^4)(10\times10^6\,lb/in^2)} = 0.22\,in$$