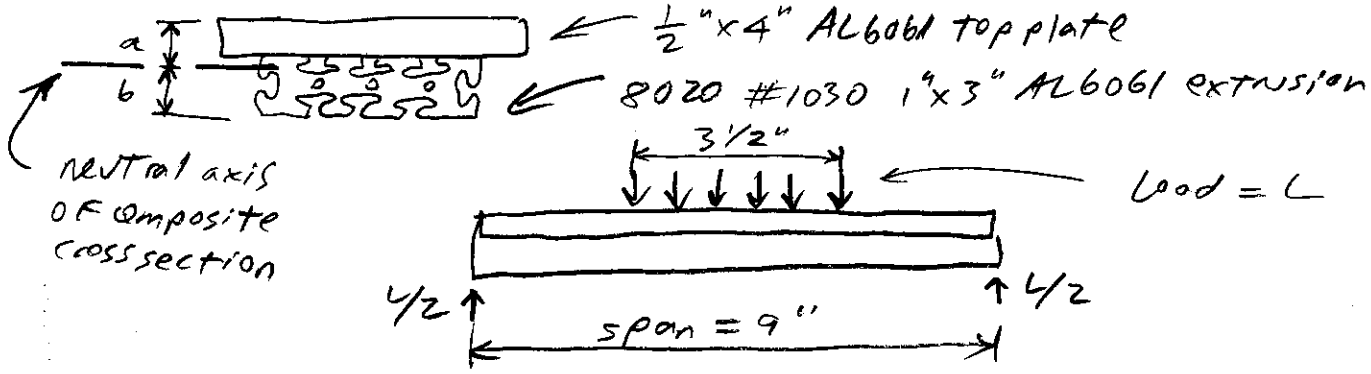
9-10-2020 Mike C

Stress calculation for Keith's "coffin railassembly" F10144371



Load L: horn weight = 3000 lbs, spread roughly evenly across 4 hillman rollers (w/ 3½" contact length)

Thus: $L = 3000/4 = 750$ lbs.

cross section:

extrusion: moment of inertia = 0.1238 in^4 (per 8020 catalog)

c.s. area = 1.140 in^2

top plate: moment of inertia $= \frac{1}{12}bh^3 = \frac{1}{12}(4)(.5)^3 = 0.04167\ in^4$

c.s. area $= (.5)(4) = 2.0\ in^2$

Locate neutral axis: $(2.0 + 1.140)(a) = (2.0)(.25) + (1.140)(1.0)$

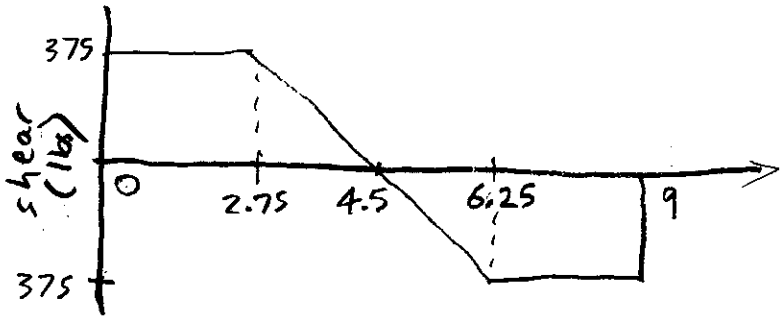
$\hookrightarrow a = 0.522"$, thus $b = 0.978"$

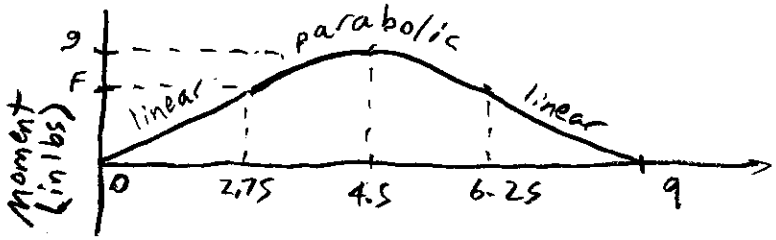
total moment of inertia about neutral axis (using parallel axis theorem):

$$I = [0.1238 + (1.140)(.978 - .500)^2] + [.04167 + (2.0)(.522 - .25)^2]$$

$$= .3843 + .1896 = 0.5739\ in^4$$

Shear & moment diagrams:





$$F = (375 \text{ lbs})(2.75'') = 1031 \text{ in lbs}$$

$$g = F + \frac{1}{2}(375)(4.5 - 2.75) = 1031 + 328 = 1359 \text{ in lbs}$$

$$\therefore M = \text{max moment} = 1359 \text{ in lbs}$$

Max stress...

$$\sigma = \frac{Mc}{I}$$

$$\sigma = (1359 \text{ in lbs})(0.978'') / 0.5739 \text{ in}^4$$

$$= 2316 \text{ psi}$$

6061T6 yield strength = 40 Kpsi (per matweb)

$$\therefore SF = 40{,}000 / 2316 = 17$$