DAMMON ENGINEERING, INC.
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ARCHITECTS ***ENGINEERS***

CONSULTING *DESIGN* *STUDIES* *EXPERT WITNESS*

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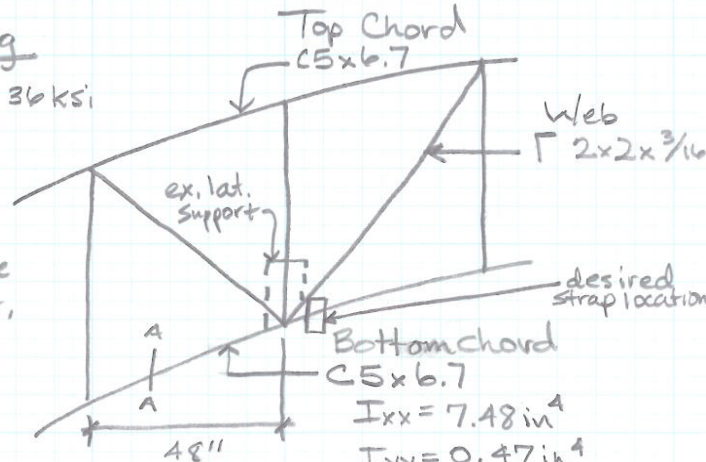
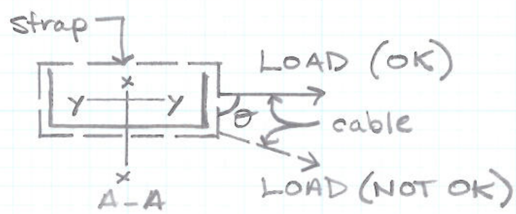
Textron - Cable Support <u>Main bldg</u>

Stl. Grade unknown: assume A36 w/ $F_y = 36$ ksi

Weld str. & size unknown: assume 1/8" fillet w/ E70 electrode



Existing structure to support a safety wire system, A 10k wire will span 25' btw two exist, trusses. The wire shall be secured to the truss @ a location nearest to the existing lateral truss support to prevent lateral torsional buckling.



The basis of this design assume that the cable shall be tightened to limit cable deflection as shown in the figure. This will prevent the chord from bending in the weak axis.

Per the requirements above: $\Delta_{max} = L/600 = 0.08" = 1/8"$

$$P = \frac{(\Delta) 48 E I}{L^3} = \frac{0.08 (48 \times 29000000 psi \times 7.48 in^4)}{48 in^3} = 7.5 \text{ kips}$$

$P_{max} = 7.5k$ @ $\theta = 90°$

Vertical load: $\Delta_{max} = 0.08"$

$P = 473.26$ <u>lb</u>

<u>Conclusion:</u> A vertical load is the most restrictive scenario and limits the max load that can be applied to cable @ 473 lb × 2 ≃ 950 lb

P_{max} = <u>950 lb</u>

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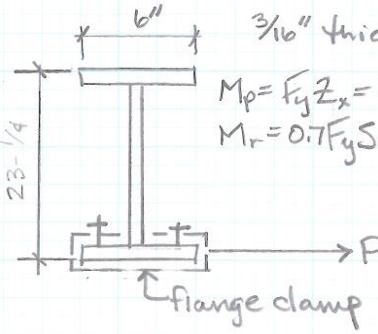
Textron - Cable Support Secondary Bldg.

Stl. grade unknown - assume A36 $F_y = 36ksi$



3/16" thick flange

$M_p = F_y Z_x = 402$ ft·k

$M_r = 0.7 F_y S_x = 239$ ft·k

Check for compactness -

Flange: $\lambda = b_f/2t_f = 6/2 \times 0.1875 = 16$

$\lambda_p = 0.38\sqrt{\frac{E}{F_y}} = 0.38\sqrt{\frac{29000000\,psi}{36000\,psi}} = 10.8$

$\lambda_r = 1.0\sqrt{\frac{E}{F_y}} = 28.4$

$\lambda_p < \lambda < \lambda_r$ flange is non-compact

Web: $\lambda = h/t_w = 22.75/0.25 = 91$

$\lambda_p = 3.76\sqrt{\frac{E}{F_y}} = 106.7$

$\lambda_r = 5.7\sqrt{\frac{E}{F_y}} = 161.8$

$\lambda < \lambda_p$ web is compact

Flange Local Buckling

$M_n = \left[M_p - (M_p - M_r)\left(\frac{\lambda - \lambda_p}{\lambda_r - \lambda_p}\right)\right] \leq M_p$

$= \left[402 - (402 - 239)\left(\frac{16 - 10.8}{28.4 - 10.8}\right)\right] = 353.9$ ft·k

$P_{max} = M_n/12' = 29.5$ kips OK

Estimated max person weight ≤ 300lb

$M_{max} = 300lb \times 12' = 3.6$ ft·k

Web Local Buckling

The web is compact therefore no local buckling.

Lateral Torsional Buckling

$L_b = 10'$ $L_p = 1.76 r_y \sqrt{\frac{E}{F_y}} = 1.76(9.11)\sqrt{\frac{29000000}{36000}} = 455$

$L_r = 1.95 r_{ts} \frac{E}{0.7F_y}\sqrt{\frac{JC_w}{S_x h_o}}\sqrt{1 + \sqrt{1 + 6.76\left(\frac{0.7F_y}{E}\frac{S_x h_o}{J_c}\right)^2}}$

$= \underbrace{1.95(1.71)\frac{29000000}{0.7(36000)}}_{1150.8}\underbrace{\sqrt{\frac{1.18(3870)}{114(23.1)}}}_{1.317}\underbrace{\sqrt{1 + \sqrt{1 + 6.76\left(\frac{0.7 \times 36000 \times 114 \times 23.1}{29000000 \times 1.18}\right)}}}_{2.18}$

$L_r = 11017$

$M_n = C_b\left[M_p - (M_p - M_r)\left(\frac{L_b - L_p}{L_r - L_p}\right)\right] \leq M_p$

$= 1.0\left[402 - (402 - 239)\left(\frac{10 - 455}{11017 - 455}\right)\right] = 408.87$

$P_{max} = M_n/12' = 34$ Kips OK

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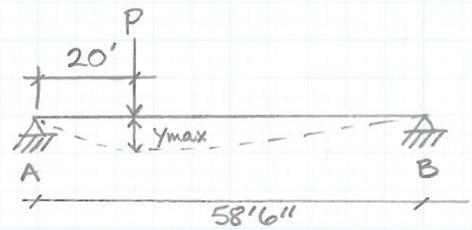
Beam Deflection

$L/600 = 1.17$ in



$$y_{max} = -\frac{Pb}{9\sqrt{3}EIL}(L^2-b^2)^{3/2}$$

$$= -\frac{5k(462in)}{9\sqrt{3}\ 29000ksi\ (1300in^4)(702in)}(702^2-462^2)^{3/2}$$

safety harness rating (→ 5k)

$$= 0.8in < L/600$$ OK