CALCULATION SHEET

Project title ______________________ Project number ______________

Designed by ______________________ Date ____________ Document number ______________

Checked by ______________________ Date ____________ Sheet ________ of ________

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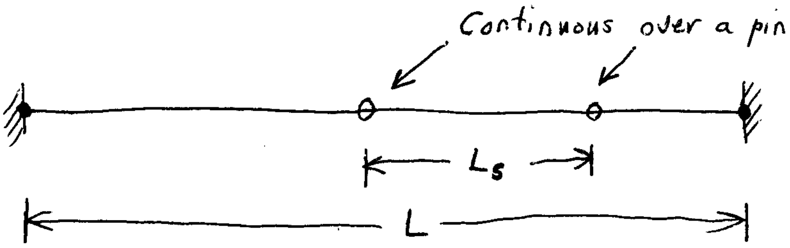

Unstressed length of cable $= L_o$

Axial stiffness of cable $= AE$

} Pre-tension in cable $= T_o = \dfrac{(L-L_o)AE}{L_o}$ where we require $L > L_o$

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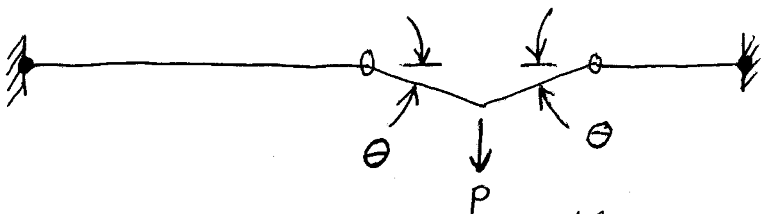

Tension now $= T$ from one end to the other

Let L_1 be the stretched length of the loaded cable.

Then geometry tells us $L_1 = L - L_s + \dfrac{L_s}{\cos\theta}$

Cable extensibility tells us $T = (L_1 - L_o)\,AE/L_o$

Eliminate L_1 between these two eqns $\rightarrow$ $T = \left(L - L_s + \dfrac{L_s}{\cos\theta} - L_o\right)\dfrac{AE}{L_o}$ ①

Statics tells us $2T\sin\theta = P$ ②

Two equations with two unknowns $(T \,\&\, \theta)$.

If we can assume that θ is small equation ② simplifies to $\theta = \dfrac{P}{2T}$ ③

and if we substitute this into the small-θ version of equation ① we get (after a bit of algebraic manipulation)

$$T^3 - \frac{AE(L-L_o)}{L_o}T^2 - \frac{AE\,L_s P^2}{8L_o} = 0$$

Solve for T.

Substitute in ③ to get θ.