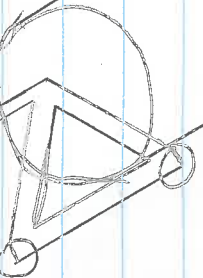
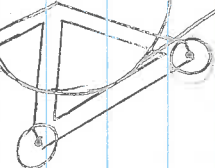
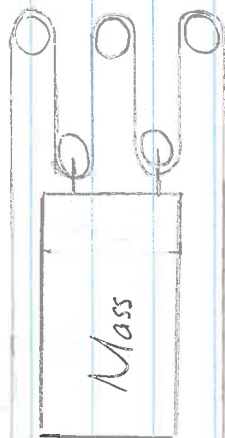


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Winch Drum

Counter weight



Hand Calcs

$$\begin{aligned} \text{Counterweight} &= 37.69T \\ \therefore T &= 37.69 \times 10^3 \times 9.806 \\ &= 369.59 \text{ kN} \end{aligned}$$

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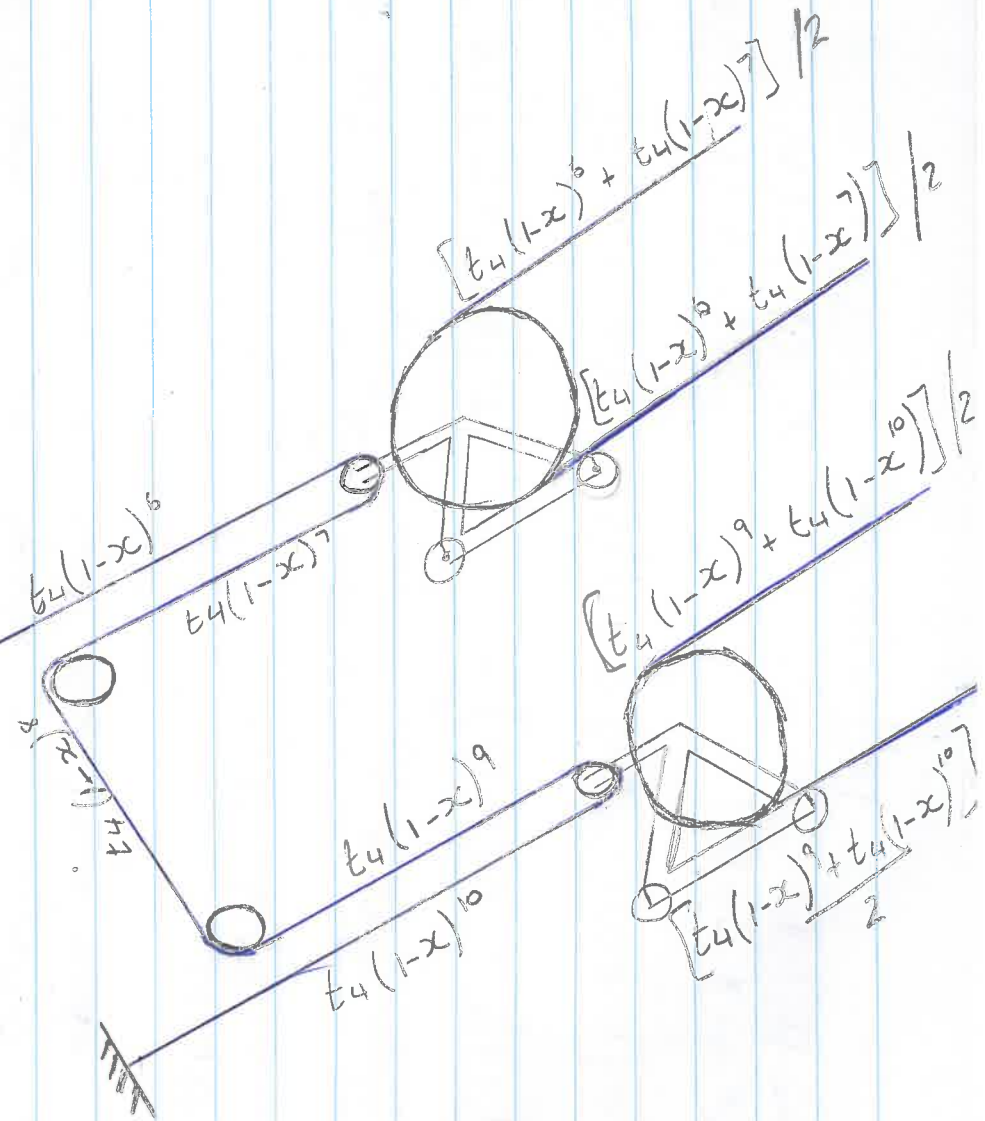
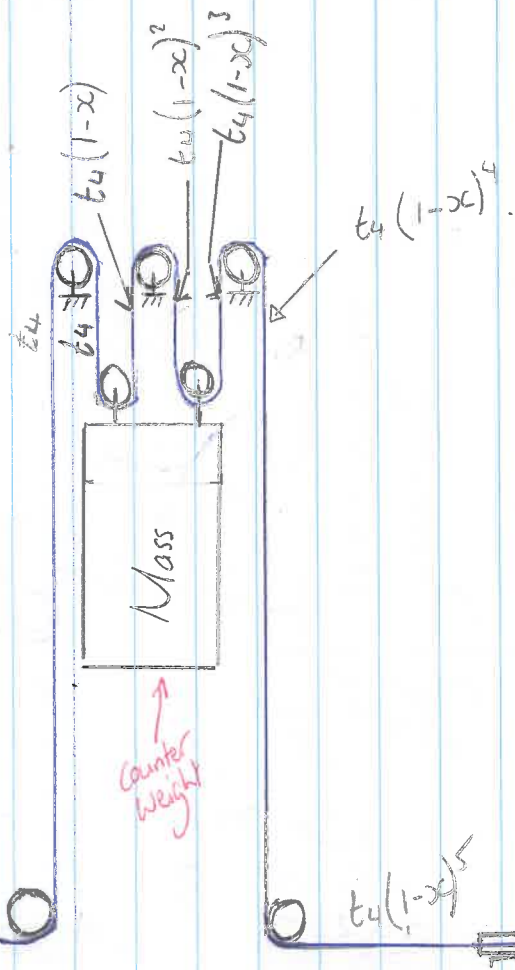
Tower Weights Lowering during start
& ONLOADING

Winch Drum

Counter weight

Hand Calcs

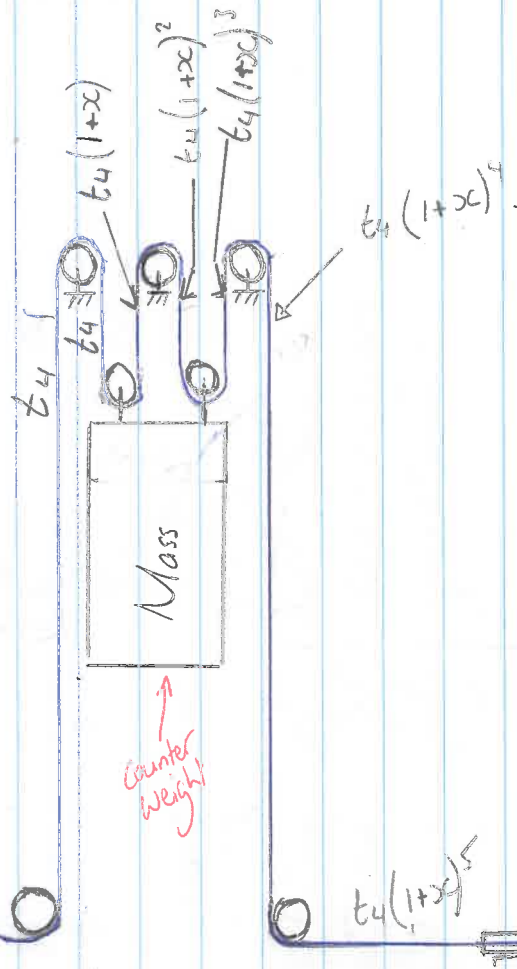
$$\begin{aligned} \text{Counterweight} &= 37.69T \\ \therefore T &= 37.69 \times 10^3 \times 9.806 \\ &= 369.59 \text{ kN} \end{aligned}$$



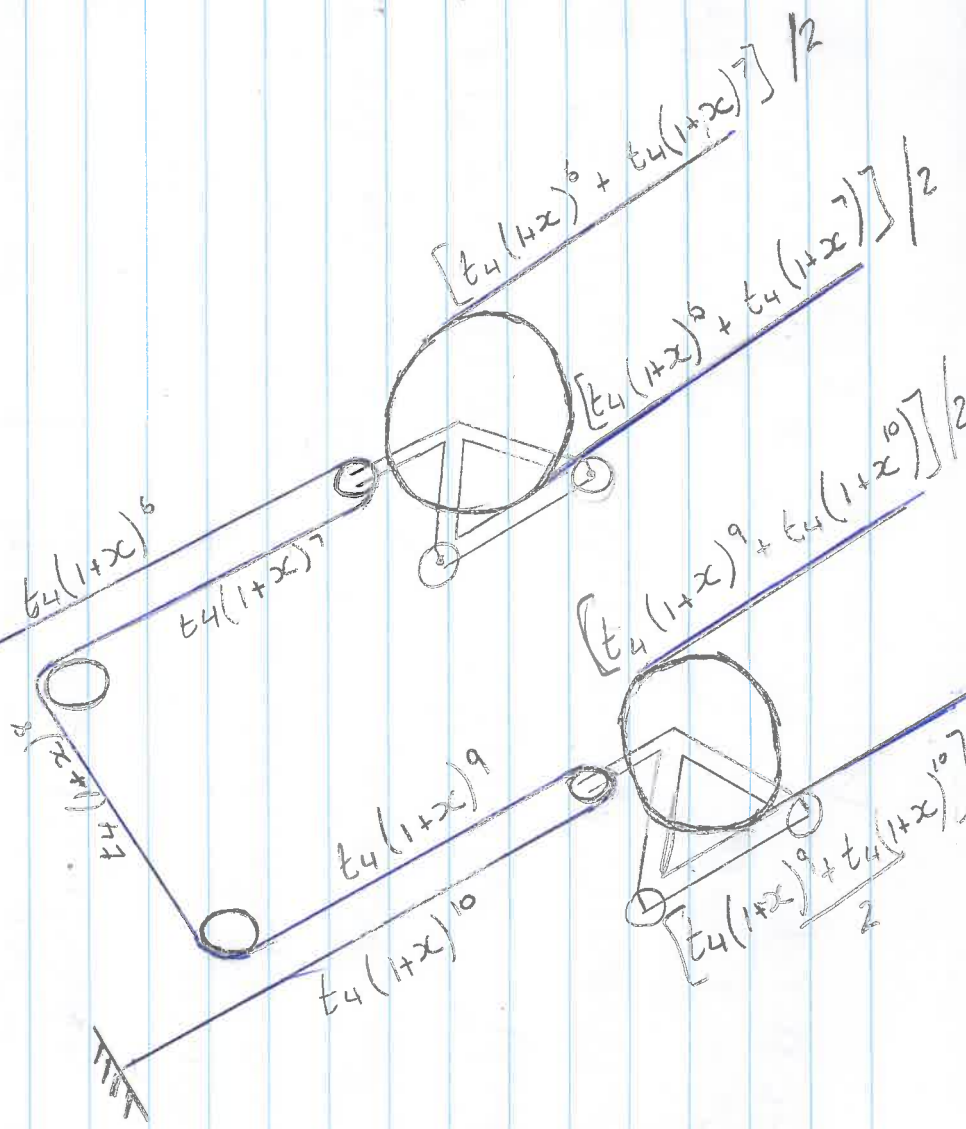
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Tower Weights Raising during stop
& OFFLOADING

Winch Drum



Counter weight



Hand Calcs

counterweight = 37.69T
 $\therefore T_4 = 37.69 \times 10^3 \times 9.806$
 $= 369.59 \text{ kN}$

369.59 kN across 4 ropes

$$\therefore T_4 = 92.40 \text{ kN}$$

Loss of 3% per reeve/pulley. (At Worst Case)

This incorporates friction primarily.

Consider 3 main conditions

1. When start-up of belt occurs
2. When run-down of belt occurs
3. When belt is fully operational

START-UP

At running speed, the cable stretches and cause less tension. Therefore, on startup, as the cable's stretch, the counterweight will lower.

$$T_4 = 92.4 \text{ kN}$$

$$l = 0.03 (\% \text{ friction loss})$$

RHS Rope (Min Tension)

$$[T_4 (1-l)^6 + T_4 (1-l)^7] / 2$$

$$= [92.4 (1-0.03)^6 + 92.4 (1-0.03)^7] / 2$$

$$= [76.97 + 74.66] / 2$$

$$= 75.82 \text{ kN}$$

LHS Rope (Min Tension)

$$[T_4 (1-l)^9 + T_4 (1-l)^{10}] / 2$$

$$= 92.4 (1-0.03)^9 + 92.4 (1-0.03)^{10} / 2$$

$$= [70.25 + 68.14] / 2$$

$$= 69.20 \text{ kN}$$

Run Down

On run down, cables will begin to contract and in turn the counterweight will rise.

∴ RHS

$$[T_4 (1+L)^6 + T_4 (1+L)^7] / 2$$

$$= [92.4 (1+0.03)^6 + 92.4 (1+0.03)^7] / 2$$

$$= [110.33 + 113.64] / 2$$

$$= 111.98 \text{ kN}$$

LHS

$$[T_4 (1+L)^9 + T_4 (1+L)^{10}] / 2$$

$$= [92.4 (1+0.03)^9 + 92.4 (1+0.03)^{10}] / 2$$

$$= [120.56 + 124.18] / 2$$

$$= 122.37 \text{ kN}$$

LHS > RHS by 10.39 kN