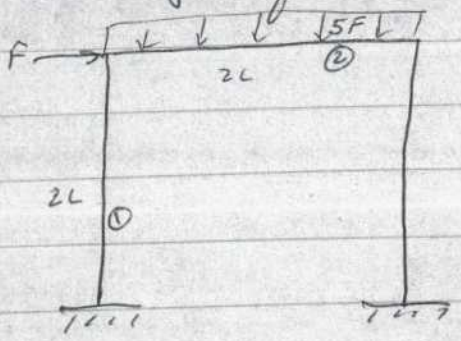
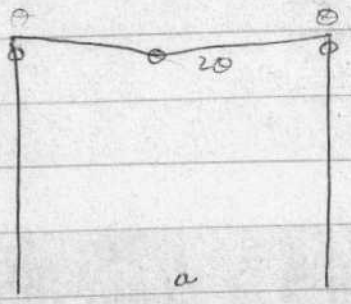
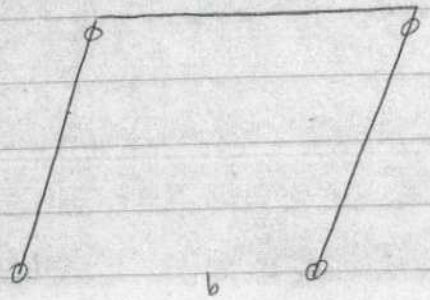
Simple frame : members of different strength





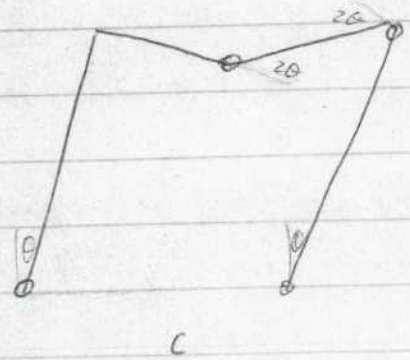
$W_i = M_0\theta(1 + 2(2) + 1) = 6M_0\theta$

$W_e = 5FL\theta/2$ $\qquad f^+ = \frac{F^+L}{M_0} = \frac{12}{5} = 2$



$W_i = M_0\theta(1 + 1 + 1 + 1) = 4M_0\theta$

$W_e = F(2L\theta)$ $\qquad f^+ = 2.0$

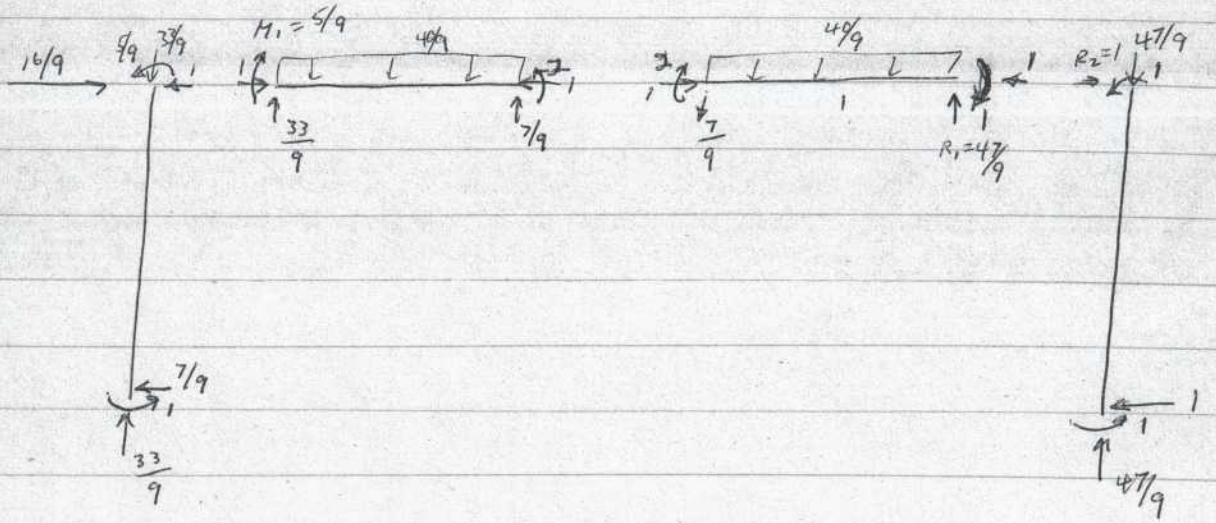


$W_i = M_0\theta(1 + 2\cdot2 + 1 + 1) = 8M_0\theta$

$W_e = F\cdot2L\theta + 5F(L\theta)/2 = \frac{9}{2}FL\theta$

$f^+ = \frac{16}{9} = 1.778$

calc reactions for mech "e" $f = \frac{16}{9}$ $SF = \frac{80}{9}$

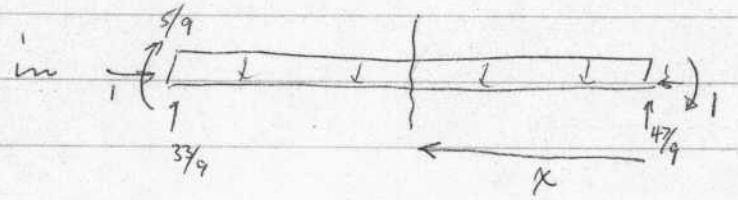


$$R_1 = 1 + 2 + \frac{40}{9} \times \frac{1}{2} = 3\frac{20}{9} = \frac{47}{9}$$

$$R_2 = \frac{1}{2}(1+1) = 1$$

$$M_1 = 2 + \frac{7}{9} - \frac{20}{9} = \frac{5}{9}$$

note in vert legs moment linear + ∴ ≤ 1



$$m(x) = -1 + \frac{47}{9}x - \frac{40}{9}\frac{x^2}{2}$$

$$\frac{dm(x)}{dx} = \frac{47}{9} - \frac{40}{9}x = 0 \rightarrow m_{max} \text{ @ } x = \frac{47}{40}$$

$$m\left(\frac{47}{40}\right) = -1 + \frac{(47)^2}{9 \cdot 40} - \frac{40}{9 \cdot 2}\cdot\frac{(47)^2}{(40)^2} = \frac{(47)^2}{18 \cdot 40} - 1 = \frac{1489}{720} = 2.07$$

since yield mom in span is 2

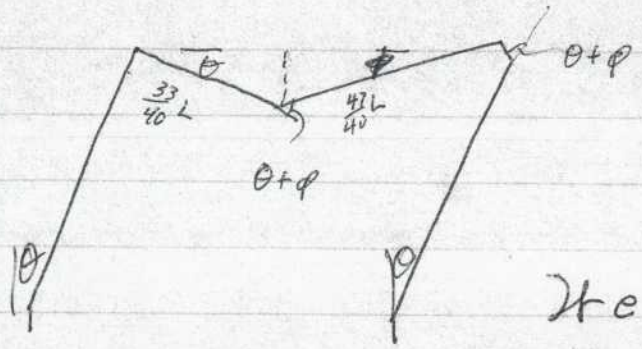
reduce loads by 3.5% + ∴ or multiply by $\frac{2}{1489/1720}$

$$f^- = \frac{2 \times 720^{80}}{1489} \times \frac{16}{9} = \frac{16 \times 160}{1489} = \frac{2560}{1489}$$

$$\begin{array}{r} 1.71 \\ 1489 \overline{)\,2560} \\ 1489 \\ \hline 1071\,0 \\ 1042\,3 \\ \hline 2870 \\ 1489 \\ \hline 1 \end{array}$$

$$f = 1.75 \pm .03$$

can redo ub with hinge @ $x = \frac{47}{40}$



$$\frac{33}{40}L\theta = \frac{47}{40}\phi \qquad \phi = \frac{33}{47}\theta$$

$$\Sigma W_e = (F)(2\Delta) + (5F)\tfrac{1}{2}\left(\tfrac{33}{40}L\theta\right) = \frac{65}{16}FL\theta = 4.0625\,FL\theta$$

$$\Sigma W_i = M_0\theta + 2M_0\left(1+\tfrac{33}{47}\right)\theta + M_0\left(1+\tfrac{33}{47}\right)\theta + M_0\theta$$

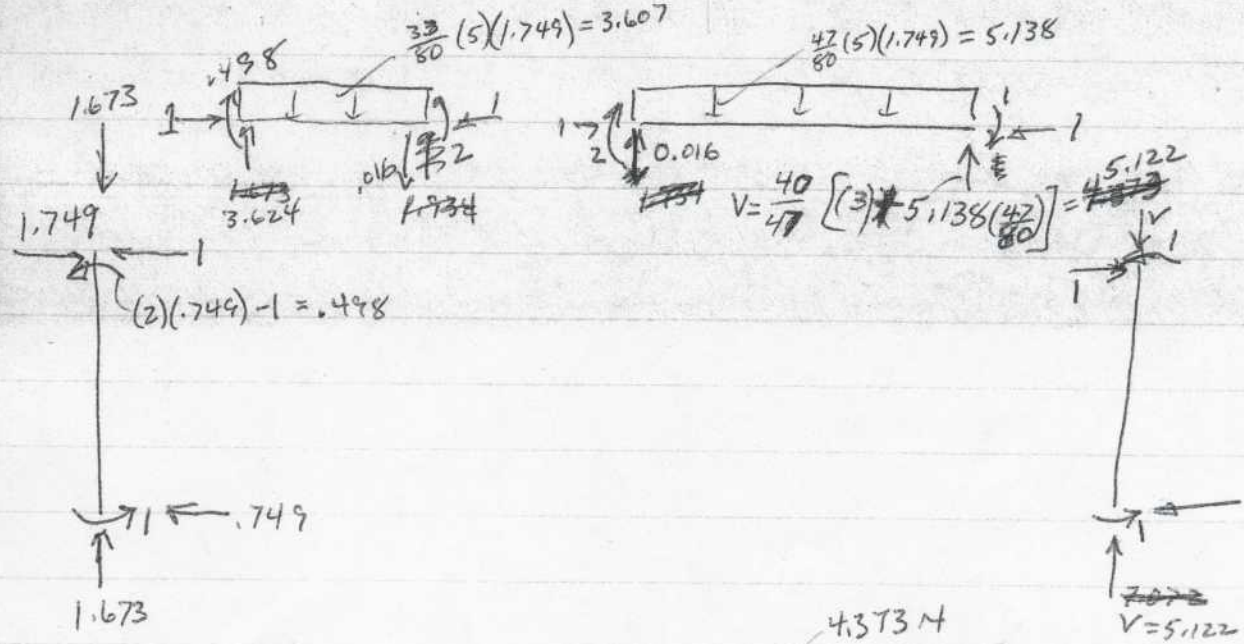
$$= \left[2 + 3\left(\tfrac{80}{47}\right)\right] M_0\theta = 7.1064\, M_0\theta$$

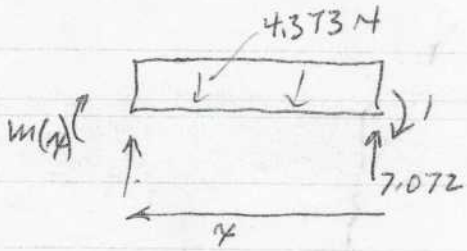
$$F^+ = 1.749\,\frac{M_0}{L} \qquad f^+ = 1.749$$

$$5f^+ \approx 8.746 \qquad \text{intensity} \doteq \frac{8.746}{2} = 4.373$$

SA ?

$\frac{47}{40}V = 2 + 1 + 5.138\left(\frac{42}{80}\right)$





$$m(x) = -1 + 5.122\,x - 4.373\,\frac{x^2}{2}$$

$$m'(x) = 5.122 + 4.373x \qquad m' = 0 \text{ @ } x = \frac{5.122}{4.373} = 1.171$$

$$m(1.171) = -1 + 5.122(1.171) - 4.373\frac{(1.171)^2}{2} = 1.9996 \approx 2.000$$ OK

SA

∴ collapse load is $\boxed{1.748}$