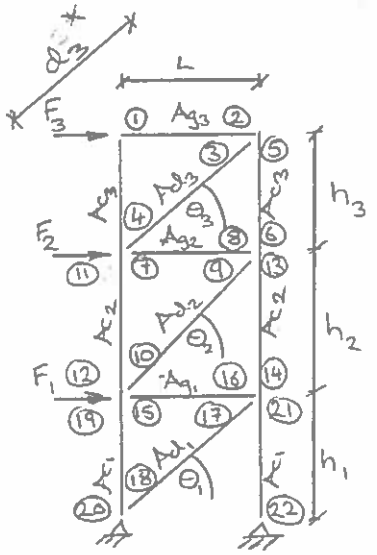
3 NO. STOREY BRACED FRAME DEFLECTION DERIVATION

FORCES (− INDICATES TENSION)



*d_2 & d_1 OF LOWER LEVELS

① $\leftarrow F_3$ ② $F_3 \rightarrow$

③ $\frac{F_3 d_3}{L}$ ④ $\frac{F_3 d_3}{L}$

⑤ $\frac{F_3 h_3}{L}$ ↑ ⑥ $\frac{F_3 h_3}{L}$ ↓

⑦ F_2+F_3 ← ⑧ F_2+F_3 →

⑨ $\frac{(F_2+F_3)d_2}{L}$ ⑩ $\frac{(F_2+F_3)d_2}{L}$

⑪ $\frac{F_3 h_3}{L}$ ↓ ⑫ $\frac{F_3 h_3}{L}$ ↑

⑬ $\frac{F_3 h_3}{L}$ ↑ $+\frac{(F_2+F_3)(h_2)}{L}$ ↑

⑭ $\frac{F_3 h_3}{L}$ ↓ $+\frac{(F_2+F_3)h_2}{L}$ ↓

⑮ $F_1+F_2+F_3$ ← ⑯ $F_1+F_2+F_3$ →

⑰ $\frac{(F_1+F_2+F_3)d_1}{L}$ ⑱ $\frac{(F_1+F_2+F_3)d_1}{L}$

⑲ $\frac{F_3 h_3}{L}$ ↑ $+\frac{(F_2+F_3)h_2}{L}$ ↓ ⑳ $\frac{F_3 h_3}{L}$ ↓ $+\frac{(F_2+F_3)h_2}{L}$ ↓

㉑ $\frac{F_3 h_3}{L}+\frac{(F_2+F_3)h_2}{L}+\frac{(F_1+F_2+F_3)h_1}{L}$ ↑ ㉒ $\frac{F_3 h_3}{L}+\frac{(F_2+F_3)h_2}{L}+\frac{(F_1+F_2+F_3)h_1}{L}$ ↓

$$\sigma = \frac{FL}{AE}$$

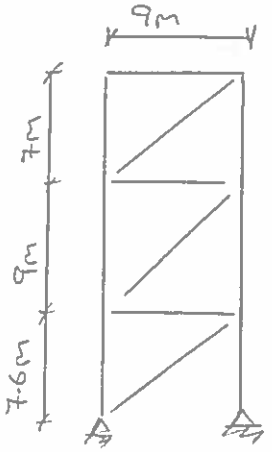
DEFLECTION DERIVATION @ ①

$$\sigma_h = \frac{F_3 L}{A_{g3} E}(1) + \frac{(F_3 d_3/L)\,d_3}{A_{d3} E}\frac{d_3}{L} + \frac{(F_3 h_3/L)\,h_3}{A_{c3} E}\frac{h_3}{L}$$ ⟵ LVL 3

$$+ \frac{(F_2+F_3)L}{A_{g2} E}(1) + \frac{[(F_2+F_3)d_2/L]\,d_2}{A_{d2} E}\frac{d_2}{L} + \frac{(F_3 h_3/L)\,h_3}{A_{c2} E}\frac{h_3}{L}$$
$$+ \left(\frac{\left[\left(\frac{F_3 h_3}{L}+\frac{(F_2+F_3)h_2}{L}\right)h_2\right]}{A_{c2} E}\right)\frac{h_2}{L}$$ ⟵ LVL 2

$$+ \frac{[(F_1+F_2+F_3)L]}{A_{g1} E}(1) + \frac{[(F_1+F_2+F_3)d_1/L]\,d_1}{A_{d1} E}\frac{d_1}{L} + \left(\frac{F_3 h_3+(F_2+F_3)h_2}{L}\right)\frac{h_2}{L}\Big/ A_{c2} E$$
$$+ \left(\frac{F_3 h_3+(F_2+F_3)h_2+(F_1+F_2+F_3)h_1}{L}\right)\frac{h_1}{L}\Big/ A_{c1} E$$ ⟵ LVL 1

APPLYING 1 kN LOAD AT EACH LEVEL:
(ALL CHS 168.3 × 8.0 mm SECTIONS)



$$\sigma_n = \frac{1000N \times 9000mm}{31.2\times10^2 mm^2 \times 210\times10^3 N/mm^2}$$ (1)

$$+\left(\frac{\left(1000N \times \frac{11,401mm}{9000mm}\right) 11,401mm}{31.2\times10^2 mm^2 \times 210\times10^3 N/mm^2}\right) \times \frac{11,401mm}{9000mm}$$

$$+\left(\frac{\left(1000N \times \frac{7000mm}{9000mm}\right) 7000mm}{31.2\times10^2 mm^2 \times 210\times10^3 N/mm^2}\right) \times \frac{7000mm}{9000mm}$$

$$+ \frac{2000N \times 9000mm}{31.2\times10^3 mm^2 \times 210\times10^3 N/mm^2}$$ (1)

$$+\left(\frac{\left(2000N \times \frac{12728mm}{9000mm}\right) 12728mm}{31.2\times10^2 mm^2 \times 210\times10^3 N/mm^2}\right) \frac{12728mm}{9000mm}$$

$$+\left(\frac{(1000N \times 7000mm + 2000N \times 9000mm)}{9000mm} 9000mm\right) \times \frac{9000mm}{9000mm} + 0.00646mm^*$$

$$+ \frac{3000N \times 9000mm}{31.2\times10^3 mm^2 \times 210\times10^3 N/mm^2}$$ (1)

$$+\left(\frac{\left(3000N \times \frac{11780mm}{9000mm}\right) 11780mm}{31.2\times10^2 mm^2 \times 210\times10^3 N/mm^2}\right) \frac{11780mm}{9000mm} + 0.0382mm^*$$

$$+\left(\frac{(1000N \times 7000mm + 2000N \times 9000mm + 3000N \times 7600mm)}{9000mm} 7600mm\right) \times \frac{7600mm}{9000mm}$$

* BASED ON

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$$\sigma_n = 0.0137 + 0.0279 + 0.00646 + 0.0274 + 0.0778 + 0.0382 + 0.00646$$
$$+ 0.0411 + 0.0924 + 0.0382 + 0.052$$

$$\sigma_n = 0.42mm$$