

Shear Key Design:

$$f'_c := 250 \frac{\text{kgf}}{\text{cm}^2} \quad E_c := 15100 \cdot \sqrt{f'_c} \cdot \sqrt{\frac{\text{kgf}}{\text{cm}^2}} \quad E_c = 2.388 \times 10^5 \cdot \frac{\text{kgf}}{\text{cm}^2}$$

$$F_y := 2400 \frac{\text{kgf}}{\text{cm}^2} \quad E_s := 2.1 \cdot 10^6 \frac{\text{kgf}}{\text{cm}^2}$$

$$h_f := 15 \cdot \text{cm} \quad b_f := 15 \cdot \text{cm} \quad A := 85.5 \cdot \text{cm}^2$$

$$S_x := 357 \cdot \text{cm}^3 \quad S_y := 157 \cdot \text{cm}^3$$

• Shear Calculation

note : maximom moment of inertia should be in direction that resist main shear moment

grout depth

$$G := 5 \text{cm}$$

$$Dead := 0 \text{tonnef}$$

max shear:

$$V_1 := 19 \text{tonnef}$$

0054SOAT-ST

perpendicular to the major axis of shear key

$$V_2 := 16 \text{tonnef}$$

0204SIBE-ST

perpendicular to the minor axis of shear key

$$FrictionType := 3$$

1 :full plate thickness below the concrete surface

2:contact plane coincidental with the concrete surface

3:grouted condition with contact plane between grout and steel above the concrete surface

$$\mu := \begin{cases} 0.9 & \text{if } FrictionType = 1 \\ 0.7 & \text{if } FrictionType = 2 \\ 0.55 & \text{if } FrictionType = 3 \end{cases}$$

$$\mu = 0.55$$

$$confinement := 1$$

1:unconfined bearing stress(conservative)

2 :full confinemet

recommended allowble bearing capacity of base plate by torrenzo:

$$F_p := \begin{cases} 0.35 \cdot f'_c & \text{if } confinement = 1 \\ 0.7 \cdot f'_c & \text{if } confinement = 2 \end{cases}$$

$$F_p = 87.5 \cdot \frac{\text{kgf}}{\text{cm}^2}$$

$$V_{lg1} := V_1 - \frac{1}{2} \cdot (\mu \cdot Dead) = 19 \cdot \text{tonnef}$$

$$V_{lg2} := V_2 - \frac{1}{2} \cdot (\mu \cdot Dead) = 16 \cdot \text{tonnef}$$

note:1/2 factor is used for ASD factor of safety

$$A_{lg1} := \frac{V_{lg1}}{F_p} = 217.143 \cdot \text{cm}^2$$

$$A_{lg2} := \frac{V_{lg2}}{F_p} = 182.857 \cdot \text{cm}^2$$

$$h_{Lg1} := \frac{A_{lg1}}{b_f} + G = 19.476 \cdot \text{cm}$$

$$h_{Lg2} := \frac{A_{lg2}}{h_f} + G = 17.19 \cdot \text{cm}$$

height of shear key

$$h_{Lg} := \max(h_{Lg1}, h_{Lg2}) = 19.476 \cdot \text{cm}$$

use

$$h_{Lg} := 25 \text{cm}$$

Moment control:

$$M_{Lg1} := V_{lg1} \cdot \left(\frac{h_{Lg} + G}{2} \right) = 2.85 \times 10^5 \cdot \text{kgf} \cdot \text{cm}$$

$$\text{check} := \text{if} \left(\frac{M_{Lg1}}{S_x} \leq 0.66F_y, \text{"OK"} , \text{"increase section"} \right)$$

check = "OK"

$$\text{ratio} := \frac{\frac{M_{Lg1}}{S_x}}{0.66F_y} = 0.504$$

$$M_{Lg2} := V_{lg2} \cdot \left(\frac{h_{Lg} + G}{2} \right)$$

$$\text{check} := \text{if} \left(\frac{M_{Lg2}}{S_y} \leq 0.75F_y, \text{"OK"} , \text{"increase section"} \right)$$

check = "OK"

$$\text{ratio} := \frac{\frac{M_{Lg2}}{S_y}}{0.75F_y} = 0.849$$

$$\sigma := \frac{V_{lg1}}{A} = 222.222 \cdot \frac{\text{kgf}}{\text{cm}^2}$$

$$\text{check} := \text{if} \left(\sigma \leq 0.4F_y, \text{"OK"} , \text{"increase section"} \right)$$

check = "OK"

$$\text{ratio} := \frac{\sigma}{0.4F_y} = 0.231$$