HORIZONTAL EARTHQUAKE LOAD : $E_h = 54$ lb

VERTICAL EARTHQUAKE LOAD : $E_v = 33$ lb

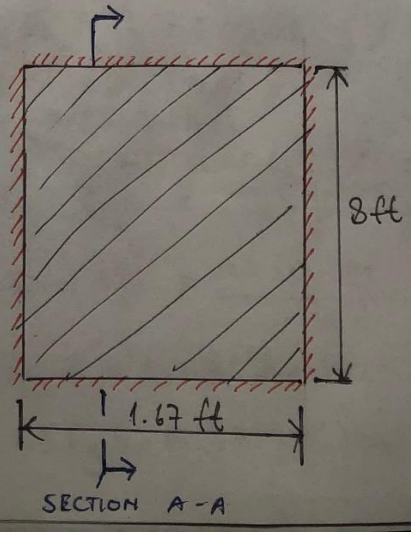
STRUCTURAL ANALYSIS:

* PER SECTION 2205.1, PARA. 1 OF IBC-2018 & THE EXCEPTION NOTED IN SECTION 2205.2.1.1 OF IBC-2018, ALL STRUCTURAL ELEMENTS USED IN THIS PROJECT SHALL BE DESIGNED IN ACCORDANCE WITH AISC 360-2016 UNLESS SPECIFICALLY NOTED OTHERWISE.

FLOOR PLATE:

MATERIAL : CARBON STEEL, ASTM A1011, GRADE 36, TYPE 1

FLEXTURE DESIGN :



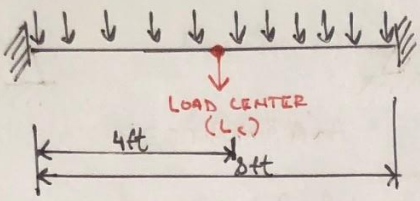
APPLIED LOADS :

DEAD LOAD : $D = 16.35\ lb/ft^2$

LIVE LOAD : $L = 60\ lb/ft^2$

$D \approx 27.31$ lb/ft

$L = 100.2$ lb/ft



SECTION A-A

$F = 0$ $\quad L_r = 0$ $\quad R = 0$

$H = 0$ $\quad S = 0$

LOAD COMBINATIONS:

* PER SECTION 1605.2 OF IBC-2018 & SECTION 2.3.6 OF AISC 7-2016, THE MOST CRITICAL LOAD COMBINATION IS DEFINED BY EQUATION 16-2 OF IBC-2018.

$$1.2(D+F) + 1.6(L+H) + 0.5(L_r \text{ OR } S \text{ OR } R) \quad [\text{EQ. 16-2, IBC-2018}]$$

$$(1.2 \times 27.31) + (1.6 \times 100.2) = 193.1 \text{ lb/ft} = w$$

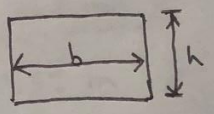
$$M_{max} = M_u = \frac{w L_c^2}{8} = \frac{193.1\,(4)^2}{8} = 386.2 \text{ lb·ft} \approx 4.64 \text{ kip·in}$$

$R_u \leq \phi R_n$ $\quad [\text{EQ. B3-1, AISC 360-2016}]$

$M_u \leq \phi M_n$

$b = 1.67 \text{ ft} = 20 \text{ in}$

$h = 0.375 \text{ in}$



$\phi = 0.9$

$$M_n = F_y Z \leq 1.6 F_y S_x \quad [\text{EQ. F11-1, AISC 360-2016}]$$

$F_y = 36.3$ ksi

$$S_x = \frac{bh^2}{6} = \frac{20\,(0.375)^2}{6} = 0.46875 \text{ in}^3$$

$$Z = \frac{bh^3}{4} = \frac{20\,(0.375)^3}{4} \approx 0.26367 \text{ in}^3$$

$F_y Z \approx 9.571$ kip·in

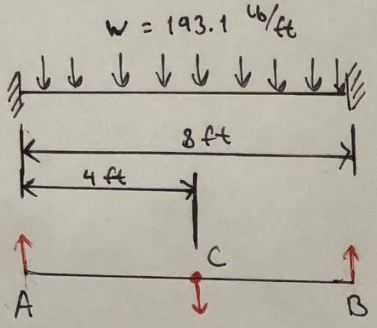
$1.6 F_y S_x = 27.225$ kip·in

$\therefore M_n = 9.571$ kip·in

$$M_u \leq \phi M_n \implies 4.64 \leq 0.9 \times 9.571$$

$$4.64 \text{ kip·in} \leq 8.61 \text{ kip·in} \therefore \text{ok} \checkmark$$

SHEAR DESIGN:



$$V_c = 193.1 \times 8$$

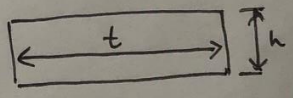
$$V_c = 1544.8 \text{ lb}$$

$$V_A = V_B = \frac{V_c}{2}$$

$$V_A = V_B = 772.4 \text{ lb} = V_u$$

$$R_u \leq \phi R_n \quad [\text{EQ. B3-1, AISC 360-2016}]$$

$$V_u \leq \phi V_n$$



$$h = 0.375 \text{ in}$$
$$t = 20 \text{ in}$$

$$\phi = 0.9$$

$$V_n = 0.6 F_y A_w C_{v2} \quad [\text{EQ. G4-1, AISC 360-2016}]$$

$$F_y = 36.3 \text{ ksi}$$

$$A_w = th = 20 \times 0.375 = 7.5 \text{ in}^2$$

C_{v2}: [SECTION G4., AISC 360-2016]

$k_v = 5$

$E = 29{,}000 \text{ ksi}$

$$\frac{h}{t} = \frac{0.375}{20} \approx 0.0188$$

$$1.1\sqrt{\frac{k_v E}{F_y}} = 1.1\sqrt{\frac{(5)(29{,}000{,}000)}{36{,}300}} \approx 69.5$$

$$C_{v2} = 1.0 \quad [\text{EQ. G2-9, AISC 360-2016}]$$

$V_n = 0.6 \times 36{,}300 \times 7.5 \times 1.0$

$V_n = 163.35 \text{ kip}$

$V_u \leq \phi V_n \Rightarrow \quad 0.7724 \leq 0.9 \times 163.35$

$0.7724 \text{ kip} \leq 147.015 \text{ kip} \quad \therefore \text{ ok} \checkmark$