floor 4 | L shape calcs

$TB = 4.5ft$, $L = 32'$, $D = 20PSF + 56PSF + 37(8)lb/ft$ (SDL, CONC, 8X37)

$L = 150PSF$

$F_y = 36\ Ksi$

① $w_u = 1.4D$

② $w_u = 1.2D + 1.6L$

① $w_u = 1.4\left[(20PSF)(4.5FT) + (56PSF)(4.5FT) + (8)(37lb/ft)\right] = 893.2\ lb/ft$

② $w_u = 1.2\left[20(4.5) + 56(4.5) + 8(37)\right] + 1.6(150PSF)(4.5FT) = 1845.6\ lb/ft$

$$M_u = \frac{w_u L^2}{8} = \frac{(1845.6lb/ft)(32)^2}{8} = 236.2368\ ft\cdot kips$$

$$Z_x \geq \frac{M_u}{F_y \phi} \rightarrow Z_x \geq \frac{236.2368\ ft\ kips\ (12\ in/ft)}{36Ksi\ (0.9)}$$

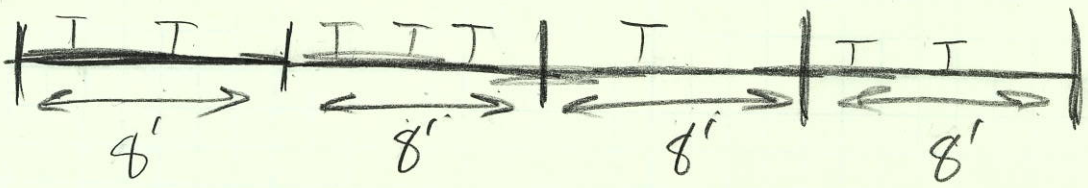
$$Z_x \geq 87.50\ in^2$$

largest Z_x value $= 31.6\ in^2$

try splitting into 4 pieces

Floor 4 — L shape Calcs

TB = 16′ (A) TB = 30′ (B) TB = 30′ (C) TB = 30′ (D)



(A)

$1.4D = 1.4(20 \times 16' + 56 \times 16' + 2 \times 37) = 1806\ lb/ft$

$1.2D + 1.6L = 1.2(20 \times 16' + 56 \times 16' + 2 \times 37) + 1.6(150 \times 16') = 6936\ lb/ft$

$$M_u = \frac{(6936\ lb/ft)(8)^2}{8(1000)} = 55.49\ ft \cdot kips$$

$$Z_x \geq \frac{(55.49\ ft \cdot kips)(12\ in/ft)}{(36\ ksi)(0.9)} \rightarrow Z_x \geq 20.55\ in^2$$

SELECT L 8 x 8 x 3/4 , $Z_x = 22.0\ in^2$

(B)

$1.4D = 1.4(20 \times 30' + 56 \times 30' + 3 \times 37) = 3347.4\ lb/ft$

$1.2D + 1.6L = 1.2(20 \times 30' + 56 \times 30' + 3 \times 37) + 1.6(150 \times 30') = 10{,}069.2\ lb/ft$

$$M_u = \frac{(10{,}069.2\ lb/ft)(8)^2}{8(1000)} = 80.55\ ft \cdot kips$$

$$Z_x \geq \frac{(80.55\ ft \cdot kips)(12\ in/ft)}{36\ ksi\ (0.9)} \rightarrow Z_x \geq 29.83\ in^2$$

SELECT L 8 x 8 x 1 1/8 , $Z_x = 31.6\ in^2$

(C)

$1.4D = 1.4(20 \times 30' + 56 \times 30' + 37) = 3243.8\ lb/ft$

$1.2D + 1.6L = 1.2(20 \times 30' + 56 \times 30' + 37) + 1.6(150 \times 30') = 9980.4\ lb/ft$

$$M_u = \frac{(9980.4\ lb/ft)(8')^2}{8(1000)} = 79.84\ ft \cdot kips$$

$$Z_x \geq \frac{(79.84\ ft \cdot kips)(12\ in/ft)}{36\ ksi\ (0.9)} \rightarrow Z_x \geq 29.57\ in^2$$

SELECT L 8 x 8 x 1 1/8 , $Z_x = 31.6\ in^2$

(D) $1.4D = 1.4(20\times30' + 56\times30' + 2\times37) = 3295.6$ lb/ft

$1.2D+1.6L = 1.2(20\times30' + 56\times30' + 2\times37) + 1.6(150\times30) = 10{,}024.8$ lb/ft

$$M_u = \frac{(10{,}024.8 \text{ lb/ft})(8')^2}{8(1000)} = 80.20 \text{ ft·kips}$$

$$Z_x \geq \frac{(80.20 \text{ ft·kips})(12 \text{ in/ft})}{36 \text{ ksi}\,(0.9)} \rightarrow Z_x \geq 29.70 \text{ in}^2$$

SELECT L8X8X1⅛ , $Z_x = 29.70$ in²