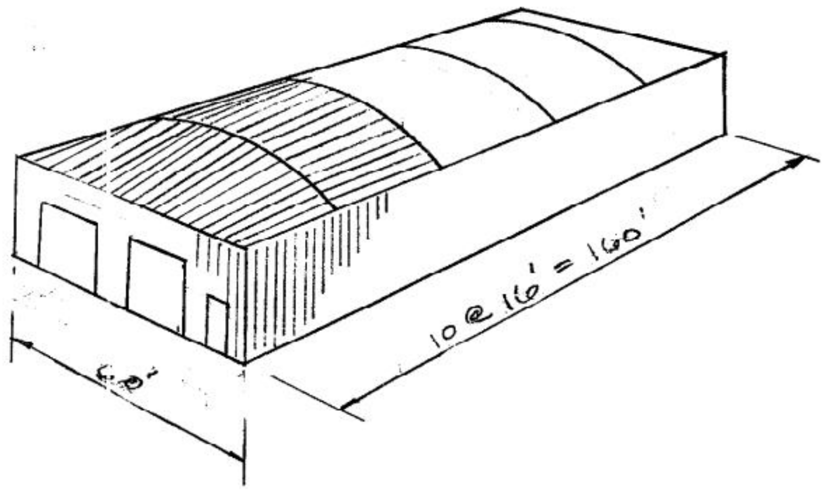
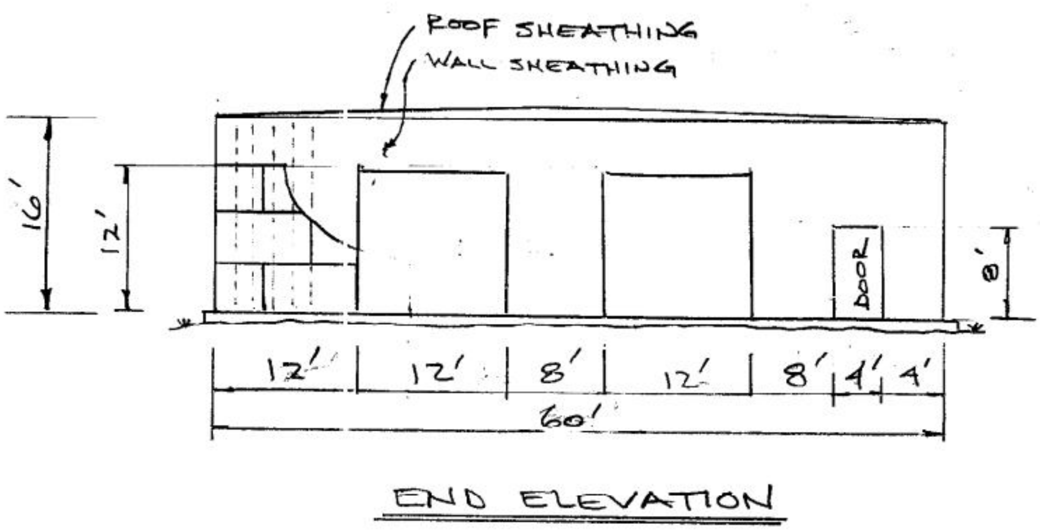
Given:



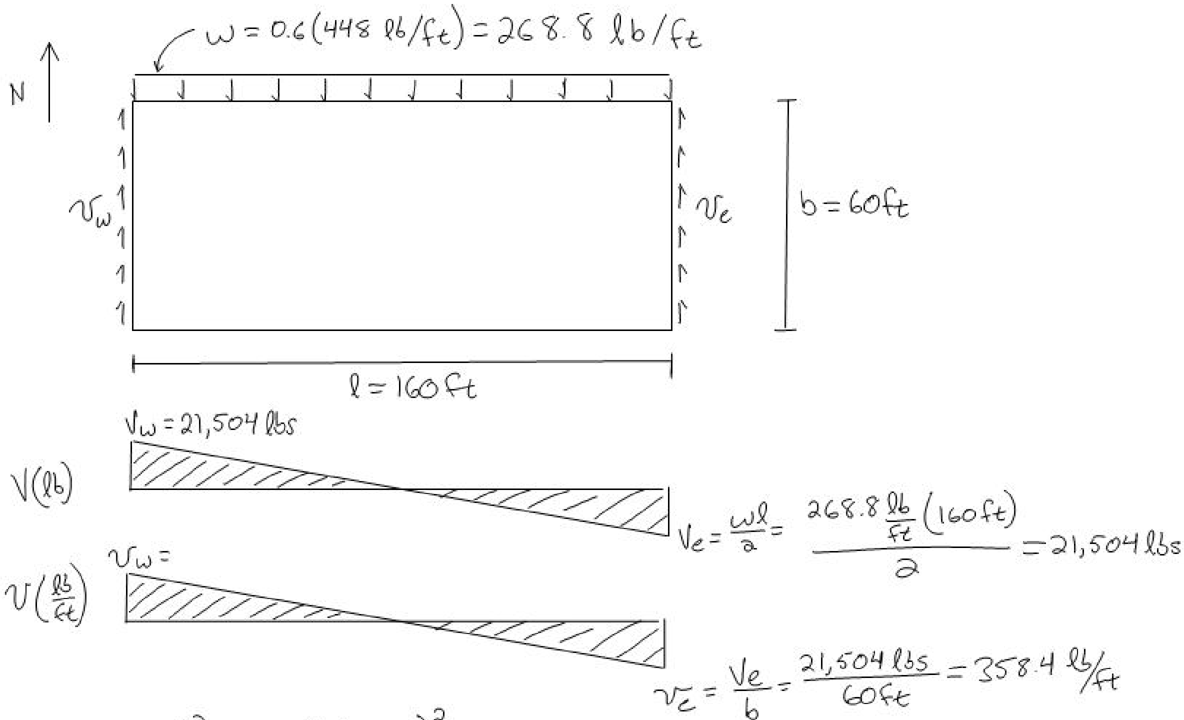


$l := 160 \cdot ft$ $b := 60 \cdot ft$

From the Project #6P we used the PDS design procedure to determine that we would need a minimum of 3/8", 24/0 OSB Sheathing.

Roof Diaphragm:

- Transverse Wind:



$$M_{max} = \frac{wl^2}{8} = \frac{268.8\frac{lb}{ft}(160ft)^2}{8} = 860{,}160\ lb\cdot ft$$

$$T_{max} = \frac{M_{max}}{b} = \frac{860{,}160\ lb\cdot ft}{60ft} = 14{,}336\ lb$$

$v_{required} := 358.4\cdot\frac{lbf}{ft}$ $\quad M_{max} := 860160\cdot lbf\cdot ft$ $\quad T_{max} := 14336\cdot lb$

- Determine Minimum Nailing Requirements: FBC 2007, Table 2304.9.1

Use 8d common:
@ 6" o.c. for edges
@ 12" o.c. for intermediate

- Check Diaphragm Aspect Ratio: FBC 2007, Table 2305.2.3

Aspect ratio provided: $\frac{l}{b} = 2.667 < \frac{3}{1}$ Therefore, ok.

- Determine Plywood Layout and Nailing Scheme:

From FBC 2007, Table 2305.2.3:

- 3/8", 24/0 OSB sheathing.
- Blocked diaphragm.
- 2" framing.
- Minimum fastener penetration of 1.25".
- 8d common fasteners at 6" o.c. at supported edges and 4" o.c. on diaphragm edges.
- Plywood is oriented as shown in Cases 3 or 4.

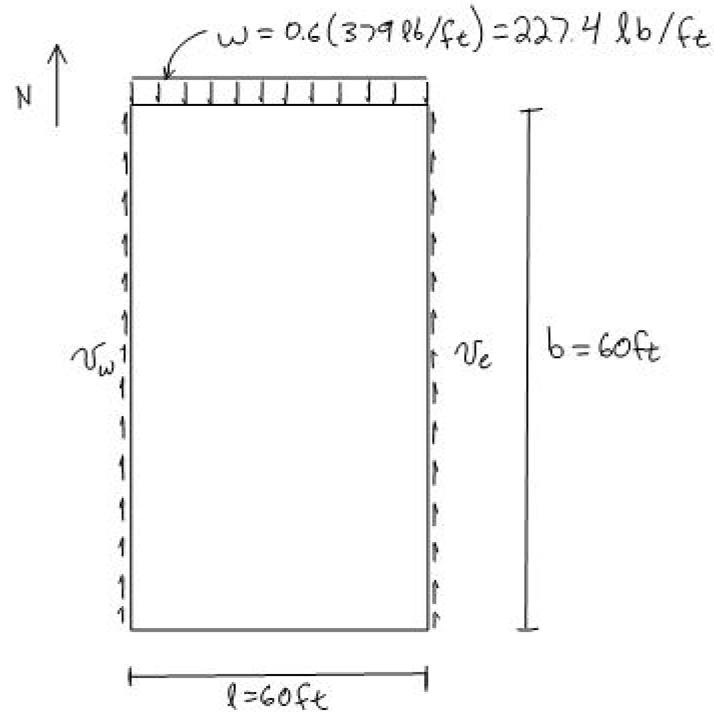
Therefore:

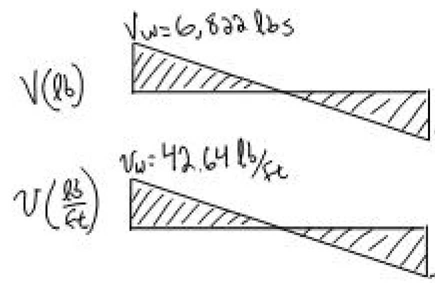
$$v_{capacity} := 320 \cdot \frac{lbf}{ft}$$

This "shall be increased" by 40%: FBC 2007, Section 2306.3.2

$$v_{capacity} := 1.4 \cdot \left(320 \cdot \frac{lbf}{ft}\right) = 448 \cdot \frac{lbf}{ft} \quad > \quad v_{required} = 358.4 \cdot \frac{lbf}{ft}$$

- Longitudinal Wind:





$$V_e = \frac{\omega l}{2} = \frac{227.4\,\frac{lb}{ft}(60ft)}{2} = 6{,}822\ lbs$$

$$v_e = \frac{V_e}{b} = \frac{6822\ lbs}{160ft} = 42.64\ lb/ft$$

$$M_{max} = \frac{\omega l^2}{8} = \frac{227.4\,\frac{lb}{ft}(60ft)^2}{8} = 102{,}330\ lb\cdot ft$$

$$T_{max} = \frac{M_{max}}{b} = \frac{102330\ lb\cdot ft}{160ft} = 639.56\ lb$$

$v_{required} := 42.64\cdot\frac{lbf}{ft}$ $\quad$ $M_{max} := 102330\cdot lbf\cdot ft$ $\quad$ $T_{max} := 639.56\cdot lb$

*****Therefore, we will use the layout provided for the Transverse Wind scenario:**

- 3/8", 24/0 OSB sheathing.
- Blocked diaphragm.
- 2" framing.
- Minimum fastener penetration of 1.25".
- 8d common fasteners at 6" o.c. at supported edges and 4" o.c. on diaphragm edges.
- Plywood is oriented as shown in Cases 3 or 4.

Roof Diaphragm Deflections:

- Transverse Wind Direction:

$A :=$ $\qquad$ $b := 60 \cdot ft$

$E :=$ $\qquad$ $L := 160 \cdot ft$

8d fasteners at 6" o.c. for interior panels (Note c):

$$Load_{fastener} := \frac{358.4 \cdot \frac{lbf}{ft}}{\frac{3}{ft}} = 119.467 \cdot lbf \text{ per fastener}$$

$$e_n := \frac{0.01 \cdot in \cdot .2}{2} = 1 \times 10^{-3} \cdot in$$

2006 IBC, Table 2305.2.2(1) (Notes a,d)

3/8", 24/0 OSB Sheathing:

$$G_t := 77500 \cdot \frac{lbf}{in}$$

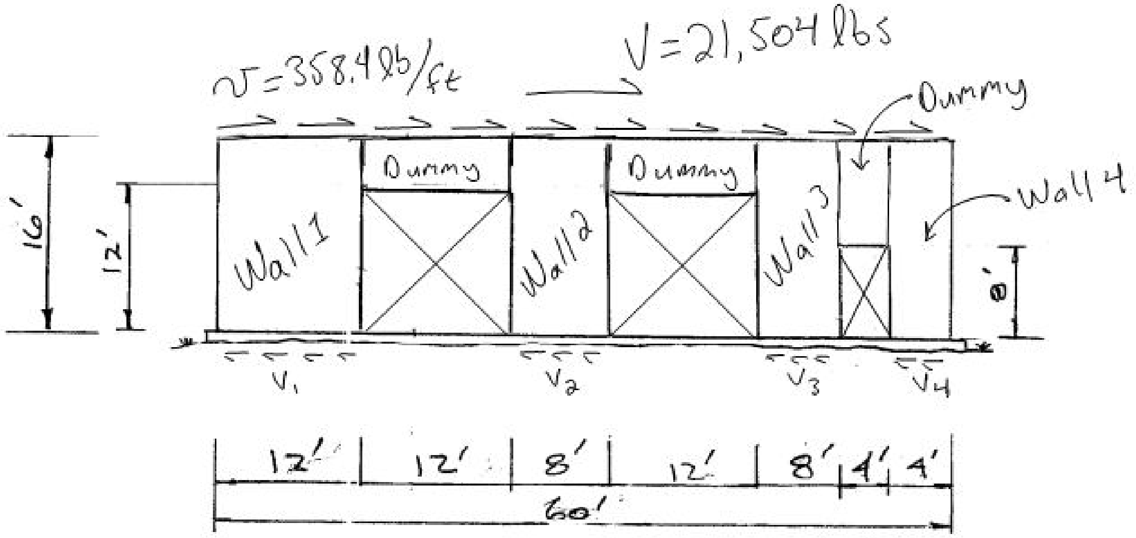
2006 IBC, Table 2305.2.2(2)

$$v := 358.4 \frac{lbf}{ft}$$

Therefore:

$$\Delta := \frac{5 \cdot v \cdot L^3}{8 \cdot E \cdot A \cdot b} + \frac{v \cdot L}{4 \cdot G_t} + 0.188 \cdot L \cdot e_n =$$

Short Shear Walls:



Wall 1: $\frac{16'}{12'} = \frac{4}{3} < \frac{3.5}{1}$ ∴ ok

Wall 3: $\frac{16'}{8'} = \frac{2}{1} < \frac{3.5}{1}$ ∴ ok

Wall 2: $\frac{16'}{8'} = \frac{2}{1} < \frac{3.5}{1}$ ∴ ok

Wall 4: $\frac{16'}{4'} = 4 > \frac{3.5}{1}$ ∴ Not ok

$$\therefore v_1 = v_2 = v_3 = \frac{21{,}504 \text{ lbs}}{12' + 8' + 8'} = 768 \text{ lbs/ft}$$

- Determine Plywood Layout and Nailing Scheme: FBC 2007, Section 2306.3.2

$$v_{required} := 768 \frac{\text{lbf}}{\text{ft}} \qquad C_D := 1.6$$

From FBC 2007, Table 2306.4.1:

The requirements of this table are too strict to use 3/8" OSB. Therefore, for the shear walls only, we will provide Structural 1 15/32" Sheathing. This will allow/require us to utilize the following:

- 2" framing.
- Minimum fastener penetration of 1.375".
- 8d common fasteners at 3" o.c. at supported edges and 12" o.c. at intermediate supports.
- Blocking on all edges of sheathing.

Therefore:

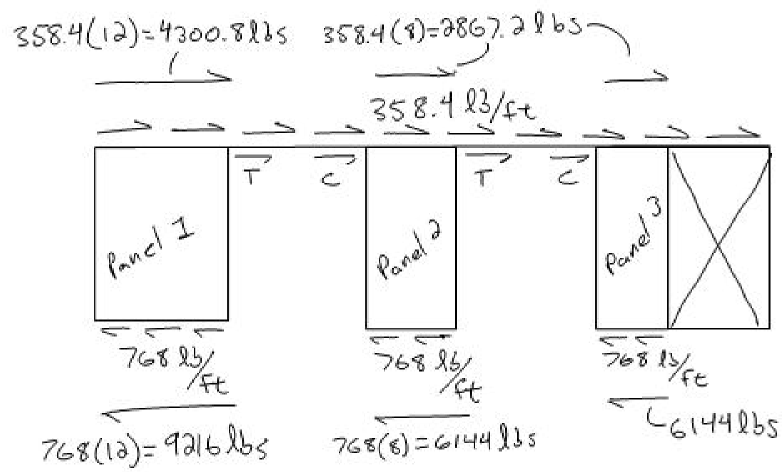
$$v_{capacity} := 550 \cdot \frac{lbf}{ft}$$

This "shall be increased" by 40%: FBC 2007, Section 2306.4.1

$$v_{capacity} := 1.4 \cdot \left(550 \cdot \frac{lbf}{ft}\right) = 770 \cdot \frac{lbf}{ft} \qquad > \qquad v_{required} = 768 \cdot \frac{lbf}{ft}$$

*****Also, for the other short wall on the opposite side of the building, we will provide the same length of shear wall (28 ft) in order to use the same plywood layout and nailing scheme. This will consist of two 14 ft sections on each end of the wall.**

- Determine Short Wall Drag Strut Forces:



Panel 1:

T = 9216 lbs − 4300.8 lbs = 4915.2 lbs

Panel 2:

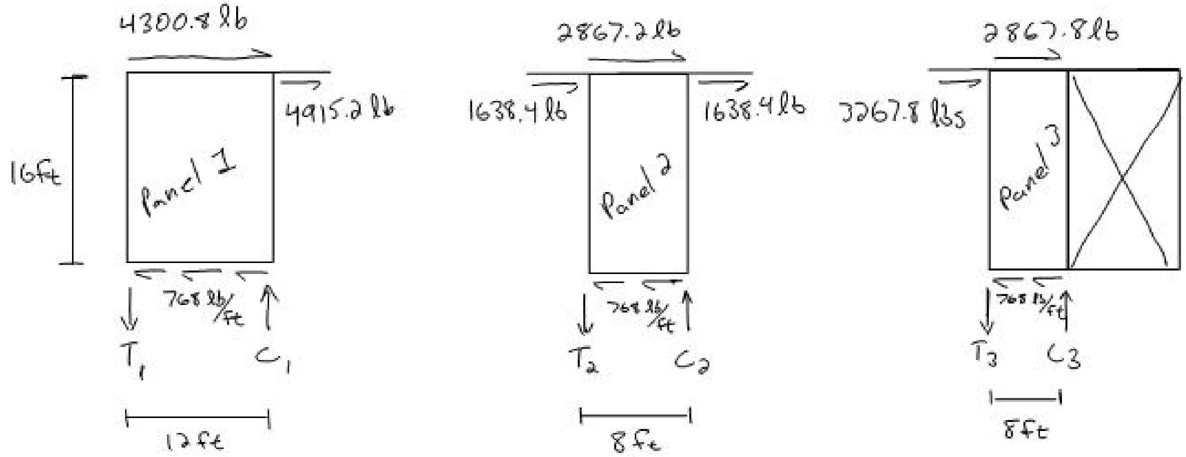
T + C = 6144 lbs − 2867.2 lbs = 3267.8 lbs , $T = C = \frac{3267.8\ lbs}{2} = 1638.4$ lbs

Panel 3:

C = 6144 lbs − 2867.2 lbs = 3267.8 lbs

Design for the worst case, ∴ Drag Strut Force = **± 4915.2 lbs**

- Determine Short Wall Chord Forces:



Panel 1:

$\Sigma M_c = 0$:

$12(T_1) = 16(4300.8 + 4915.2)$

$T_1 = C_1 = 12,288$ lbs

Panel 2:

$\Sigma M_c = 0$

$8(T_2) = 16(6144)$

$T_2 = C_2 = 12,288$ lbs

Panel 3:

$\Sigma M_c = 0$

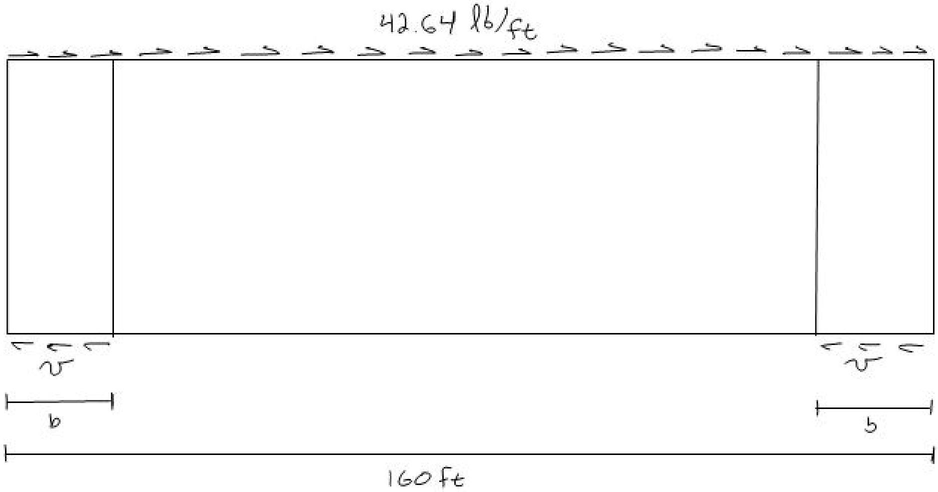
$8(T_3) = 16(6144)$

$T_3 = C_3 = 12,288$ lbs

$\therefore$ Chord Force = $\boxed{\pm\ 12,288 \text{ lbs}}$

- Determine Short Wall Deflections:

Long Shear Walls:



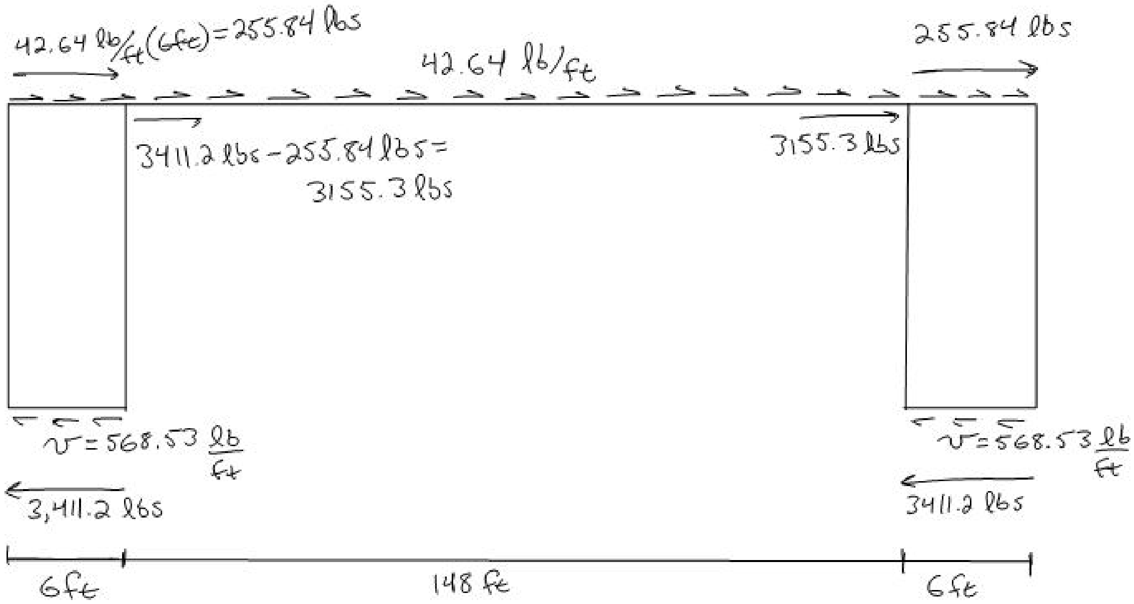
From Short Shear Wall design we determined $v_{capacity} = 1.4(550) = 770 \frac{lb}{ft}$

Therefore:

$$2 \cdot b \cdot v = 42.64 \frac{lb}{ft}(160\,ft) \longrightarrow b = \frac{42.64 \frac{lb}{ft}(160\,ft)}{2(770 \frac{lb}{ft})} = 4.43\,ft \quad \therefore \text{use } b = 6\,ft$$

$$v_{actual} = \frac{42.64 \frac{lb}{ft}(160\,ft)}{6\,ft + 6\,ft} = 568.53 \frac{lb}{ft} < 770 \frac{lb}{ft} \quad \therefore \text{OK} \checkmark$$

- Determine Long Wall Drag Strut Forces:

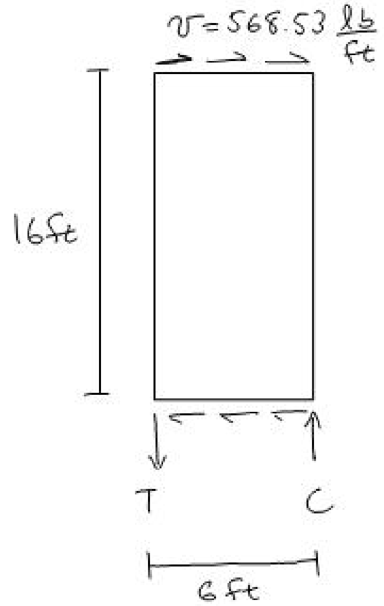


∴ Drag Strut Forces for Long Wall

$= 3155.3 \text{ lbs}$

- Determine Long Wall Chord Forces:

Cut the wall just short of the top



$\Sigma M_c = 0:$

$\cancel{6ft}(T) = \cancel{6ft}\left(568.53 \frac{lb}{ft}\right)(16 ft)$

$\therefore T = C = 9{,}096.5 \text{ lbs}$

- Determine Long Wall Deflections: