Given:

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:

\[ v_r = 0.6(448 \text{ lb/ft}) = 268.8 \text{ lb/ft} \]

\[ v_w = 21,504 \text{ lbs} \]

\[ M_{\text{max}} = \frac{wL^2}{8} = \frac{268.8 \text{ lb/ft}(160 \text{ ft})^2}{8} = 860,160 \text{ lb-ft} \]

\[ T_{\text{max}} = \frac{M_{\text{max}}}{b} = \frac{860,160 \text{ lb-ft}}{60 \text{ ft}} = 14,336 \text{ lb} \]

\[ v_{\text{required}} = 358.4 \text{ lbf/ft} \]

\[ M_{\text{max}} = 860,160 \text{ lbf-ft} \]

\[ T_{\text{max}} = 14,336 \text{ lb} \]

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: \[ \frac{1}{b} = 2.667 < \frac{3}{1} \]

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:

\[ v_{\text{capacity}} = \frac{320 \text{ lbf}}{\text{ft}} \]

This "shall be increased" by 40%:\n
\[ v_{\text{capacity}} \cdot 1.4 \left( \frac{320 \text{ lbf}}{\text{ft}} \right) = 448 \frac{\text{lbf}}{\text{ft}} > v_{\text{required}} = 358.4 \frac{\text{lbf}}{\text{ft}} \]
Longitudinal Wind:

\[
\begin{align*}
\omega &= 0.6 \left( 379 \text{ lb/ft} \right) = 227.4 \text{ lb/ft} \\
\omega &= \frac{w l^2}{8} = \frac{227.4 \text{ lb/ft} \left( 60 \text{ ft} \right)^2}{8} = 6,832 \text{ lbs} \\
\omega &= \frac{V_0}{b} = \frac{6,832 \text{ lbs}}{160 \text{ ft}} = 42.64 \text{ lb/ft} \\
M_{\text{max}} &= \frac{w l^3}{8} = \frac{227.4 \text{ lb/ft} \left( 60 \text{ ft} \right)^3}{8} = 102,330 \text{ lb-ft} \\
T_{\text{max}} &= \frac{M_{\text{max}}}{b} = \frac{102,330 \text{ lb-ft}}{160 \text{ ft}} = 639.56 \text{ lb}
\end{align*}
\]

\[v_{\text{required}} = 42.64 \frac{\text{lbf}}{\text{ft}}, \quad M_{\text{max}} = 102,330 \text{ lbf-ft}, \quad T_{\text{max}} = 639.56 \text{ lb}\]

***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:

\[ A : = \text{---} \quad b : = 60 \text{-ft} \]
\[ E : = \text{---} \quad L : = 160 \text{-ft} \]

8d fasteners at 6\(^\circ\) o.c. for interior panels (Note c):

\[ \frac{358.4 \text{lbf}}{\text{ft}} \cdot \frac{3}{\text{ft}} = 119.467 \text{lbf per fastener} \]

\[ e_n = \frac{0.01\text{-in} \cdot .2}{2} = 1 \times 10^{-3} \text{in} \]

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

3/8\(^\circ\), 24/0 OSB Sheathing:

\[ G_t = 77500 \frac{\text{lbf}}{\text{in}} \]

2006 IBC, Table 2305.2.2(2)

\[ v = 358.4 \frac{\text{lbf}}{\text{ft}} \]

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:

\[ V = 21,504 \text{ lbs} \]

\[ V = 358.4 \text{ lbs/ft} \]

Determine Plywood Layout and Nailing Scheme:

FBC 2007, Section 2306.3.2

\[ V_{\text{required}} = 768 \frac{\text{lbf}}{\text{ft}} \]

\[ C_D = 1.6 \]

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:

\[ v_{\text{capacity}} = 550 \frac{\text{lbf}}{\text{ft}} \]

This "shall be increased" by 40%:

\[ v_{\text{capacity}} = 1.4 \cdot \left( 550 \frac{\text{lbf}}{\text{ft}} \right) = 770 \frac{\text{lbf}}{\text{ft}} \]

\[ v_{\text{required}} = 768 \frac{\text{lbf}}{\text{ft}} \]

***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:

\[ T = 9216 \text{ lbs} - 4200.8 \text{ lbs} = 4915.2 \text{ lbs} \]

Panel 2:

\[ T + C = 6144 \text{ lbs} - 2867.2 \text{ lbs} = 3267.8 \text{ lbs} \]

\[ T = C = \frac{3267.8 \text{ lbs}}{2} = 1633.9 \text{ lbs} \]

Panel 3:

\[ C = 6144 \text{ lbs} - 2867.2 \text{ lbs} = 3267.8 \text{ lbs} \]

Design for the worst case, \( \therefore \) Drag strut force = \( \pm 4915.2 \text{ lbs} \)
Determine Short Wall Chord Forces:

Panel 1:
\[ \Sigma M_c = 0: \]
\[ 12(T_1) = 16(4300.8 + 4215.3) \]
\[ T_1 = C_1 = 12,288 \text{ lbs} \]

Panel 2:
\[ \Sigma M_c = 0 \]
\[ 8(T_2) = 16(4144) \]
\[ T_2 = C_2 = 12,288 \text{ lbs} \]

Panel 3:
\[ \Sigma M_c = 0 \]
\[ 8(T_3) = 16(4144) \]
\[ T_3 = C_3 = 12,288 \text{ lbs} \]

\[ \therefore \text{ Chord Force} = \pm 12,288 \text{ lbs} \]

Determine Short Wall Deflections:
Long Shear Walls:

\[ v_{actual} = \frac{4264 \text{ lb/ft}}{6 \text{ ft} + 6 \text{ ft}} = 568.53 \text{ lb/ft} < 770 \text{ lb/ft} \]

From Short Shear wall design we determined \( v_{comly} = 1.4(550) = 770 \text{ lb/ft} \)

Therefore:

\[ 2b\sqrt{v} = 4264 \text{ lb/ft} (160 \text{ ft}) \]

\[ b = \frac{4264 \text{ lb/ft} (160 \text{ ft})}{2(770 \text{ lb/ft})} = 4.43 \text{ ft} \]

\( \therefore \) Use \( b = 6 \text{ ft} \)
Determine Long Wall Drag Strut Forces:

\[
\frac{42.64 \text{ lb/ft}}{3} = 14.2133 \text{ lb/ft}
\]

\[
3411.2 \text{ lbs} - 255.84 \text{ lbs} = 3155.3 \text{ lbs}
\]

\[
\frac{42.64 \text{ lb/ft}}{3} = 14.2133 \text{ lb/ft}
\]

\[
\frac{7155.3 \text{ lbs}}{3411.2 \text{ lbs}}
\]

\[
= 255.84 \text{ lbs}
\]

\[
\text{Drag Strut Forces for Long Wall}
\]

\[
= 3155.3 \text{ lbs}
\]

Determine Long Wall Chord Forces:

Cut the wall just short of the top

\[
\frac{568.53 \text{ lb}}{\text{ft}}
\]

\[
\sum M = 0:
\]

\[
6 \times 16 (568.53 \text{ lb/ft}) (16 \text{ ft})
\]

\[
\therefore T = C = 9096.5 \text{ lbs}
\]
Determine Long Wall Deflections: