WIND DESIGN PER ASCE 7-16

$V_{wind} := 115$ Wind speed, in mph.

$V_{asd} := \sqrt{0.6} \cdot V_{wind} = 89$

$EXP := "C"$ Exposure category

$K_{zt} := 1.0$ Topographic factor

$K_d := 0.85$ Wind directionality factor

$G := 0.85$ Gust effect factor - Section 26.9.1

$GC_{pi} := (0.18 \quad -0.18)^T$ Internal pressure coefficients

$z_r := 20 \cdot ft$ Mean roof height above grade (**not to exceed**)

$\theta_r := 20 \cdot deg$ Slope of roof

$L_{x1} := 40 \cdot ft$

$L_{y1} := 120 \cdot ft$

$H_{unit} := 20ft$

$L_{ceil} := L_{x1} = 40\ ft$

$H_{wall} := 10 \cdot ft$

$\alpha_z := if(EXP = "B", 7, if(EXP = "C", 9.5, if(EXP = "D", 11.5, 0)))$

$z_g := if(EXP = "B", 1200 \cdot ft, if(EXP = "C", 900 \cdot ft, if(EXP = "D", 700 \cdot ft, 0)))$

$K_z(z) := 2.01 \cdot \left(\frac{max(z, 15 \cdot ft)}{z_g}\right)^{\frac{2}{\alpha_z}}$ $K_z(z_r) = 0.9$ Average velocity pressure exposure coefficient

$q_z(z) := 0.00256 \cdot K_z(z) \cdot K_{zt} \cdot K_d \cdot V_{wind}^2 \cdot psf$ $q_z(z_r) = 26.0 \cdot psf$

$a_{end} := max(min(0.1 \cdot min(L_{x1}, L_{y1}), 0.4H_{unit}), 0.04 \cdot min(L_{x1}, L_{y1}), 3ft)$ $a_{end} = 4\ ft$

$H_r := tan(\theta_r) \cdot (20 \cdot ft)$ $H_r = 87.353 \cdot in$

$H_{eave} := (H_{unit} - H_r)$ $H_{eave} = 12.72\ ft$ Eave height of the structure

$H_{mean} := H_{unit} - 0.5 \cdot H_r$ $H_{mean} = 16.36\ ft$ Mean roof height of assembled structure

$END_y := min[2 \cdot (2 \cdot a_{end}), L_{y1}]$ $END_y = 16\ ft$

$INT_y := max(L_{y1} - END_y, 0)$ $INT_y = 104\ ft$

$END_x := min[2 \cdot (2 \cdot a_{end}), L_{x1}]$ $END_x = 16\ ft$

$INT_x := max(L_{x1} - END_x, 0)$ $INT_x = 24\ ft$

Main Wind Force Resisting System Loads

▸ Directonal Procedure (Chapter 27 - All Heights)
▾ Envelope Procedure (Chapter 28 - Low-Rise)

Main Wind Force Loads

Load Case A

$\theta_A := (5 \quad 20 \quad 30 \quad 45 \quad 90)^T \cdot deg$

$GC_1 := (0.40 \quad 0.53 \quad 0.56 \quad 0.56 \quad 0.56)^T$ $GC_{1E} := (0.61 \quad 0.80 \quad 0.69 \quad 0.69 \quad 0.69)^T$

$GC_2 := (-0.69 \quad -0.69 \quad 0.21 \quad 0.21 \quad 0.56)^T$ $GC_{2E} := (-1.07 \quad -1.07 \quad 0.27 \quad 0.27 \quad 0.69)^T$

$GC_3 := (-0.37 \quad -0.48 \quad -0.43 \quad -0.43 \quad -0.37)^T$ $GC_{3E} := (-0.53 \quad -0.69 \quad -0.53 \quad -0.53 \quad -0.48)^T$

$GC_4 := (-0.29 \quad -0.43 \quad -0.37 \quad -0.37 \quad -0.37)^T$ $GC_{4E} := (-0.43 \quad -0.64 \quad -0.48 \quad -0.48 \quad -0.48)^T$

$GC_A(GC) := if(\theta_r < \theta_{A_1}, GC_1, if(90 \cdot deg < \theta_r, 99, linterp(\theta_A, GC, \theta_r)))$ Function for interpolating GC values

Load Case B

$GC_B := (-0.45 \quad -0.69 \quad -0.37 \quad -0.45 \quad 0.40 \quad -0.29 \quad -0.48 \quad -1.07 \quad -0.53 \quad -0.48 \quad 0.61 \quad -0.43)^T$

Case A (Equated to Simplified Zones in Windward and Leeward Components)

$p_{A\_Aw}(z) := q_z(z)\cdot\left(GC_A\left(GC_{1E}\right) - GC_{pi}\right)$ $\quad p_{A\_Aw}(z_r) = \begin{pmatrix} 16.1 \\ 25.4 \end{pmatrix}\cdot psf$ Windward Zone A

$p_{A\_Al}(z) := q_z(z)\cdot\left(GC_A\left(GC_{4E}\right) - GC_{pi}\right)$ $\quad p_{A\_Al}(z_r) = \begin{pmatrix} -21.3 \\ -11.9 \end{pmatrix}\cdot psf$ Leeward Zone A

$p_{C\_Aw}(z) := q_z(z)\cdot\left(GC_A\left(GC_{1}\right) - GC_{pi}\right)$ $\quad p_{C\_Aw}(z_r) = \begin{pmatrix} 9.1 \\ 18.4 \end{pmatrix}\cdot psf$ Windward Zone C

$p_{C\_Al}(z) := q_z(z)\cdot\left(GC_A\left(GC_{4}\right) - GC_{pi}\right)$ $\quad p_{C\_Al}(z_r) = \begin{pmatrix} -15.8 \\ -6.5 \end{pmatrix}\cdot psf$ Leeward Zone C

$p_{E\_A}(z) := q_z(z)\cdot\left(GC_A\left(GC_{2E}\right) - GC_{pi}\right)$ $\quad p_{E\_A}(z_r) = \begin{pmatrix} -32.4 \\ -23.1 \end{pmatrix}\cdot psf$ Roof Zone E

$p_{EOH\_A}(z) := q_z(z)\cdot\left[\left(GC_A\left(GC_{2E}\right) - GC_{pi}\right) - 0.7\right]$ $\quad p_{EOH\_A}(z_r) = \begin{pmatrix} -50.6 \\ -41.3 \end{pmatrix}\cdot psf$ Zone E Overhang

$p_{F\_A}(z) := q_z(z)\cdot\left(GC_A\left(GC_{3E}\right) - GC_{pi}\right)$ $\quad p_{F\_A}(z_r) = \begin{pmatrix} -22.6 \\ -13.2 \end{pmatrix}\cdot psf$ Roof Zone F

$p_{FOH\_A}(z) := q_z(z)\cdot\left[\left(GC_A\left(GC_{3E}\right) - GC_{pi}\right) - 0.7\right]$ $\quad p_{FOH\_A}(z_r) = \begin{pmatrix} -40.7 \\ -31.4 \end{pmatrix}\cdot psf$ Zone F Overhang

$p_{G\_A}(z) := q_z(z)\cdot\left(GC_A\left(GC_{2}\right) - GC_{pi}\right)$ $\quad p_{G\_A}(z_r) = \begin{pmatrix} -22.6 \\ -13.2 \end{pmatrix}\cdot psf$ Roof Zone G

$p_{GOH\_A}(z) := q_z(z)\cdot\left[\left(GC_A\left(GC_{2}\right) - GC_{pi}\right) - 0.7\right]$ $\quad p_{GOH\_A}(z_r) = \begin{pmatrix} -40.7 \\ -31.4 \end{pmatrix}\cdot psf$ Zone G Overhang

$p_{H\_A}(z) := q_z(z)\cdot\left(GC_A\left(GC_{3}\right) - GC_{pi}\right)$ $\quad p_{H\_A}(z_r) = \begin{pmatrix} -17.1 \\ -7.8 \end{pmatrix}\cdot psf$ Roof Zone H

$p_{HOH\_A}(z) := q_z(z)\cdot\left[\left(GC_A\left(GC_{3}\right) - GC_{pi}\right) - 0.7\right]$ $\quad p_{HOH\_A}(z_r) = \begin{pmatrix} -35.3 \\ -26 \end{pmatrix}\cdot psf$ Zone H Overhang

Case B (Equated to Simplified Zones in Windward and Leeward Components)

$p_{A\_Bw}(z) := q_z(z)\cdot\left(GC_{B_{11}} - GC_{pi}\right)$ $\quad p_{A\_Bw}(z_r) = \begin{pmatrix} 11.2 \\ 20.5 \end{pmatrix}\cdot psf$ Windward Zone A

$p_{A\_Bl}(z) := q_z(z)\cdot\left(GC_{B_{12}} - GC_{pi}\right)$ $\quad p_{A\_Bl}(z_r) = \begin{pmatrix} -15.8 \\ -6.5 \end{pmatrix}\cdot psf$ Leeward Zone A

$p_{C\_Bw}(z) := q_z(z)\cdot\left(GC_{B_{5}} - GC_{pi}\right)$ $\quad p_{C\_Bw}(z_r) = \begin{pmatrix} 5.7 \\ 15.1 \end{pmatrix}\cdot psf$ Windward Zone C

$p_{C\_Bl}(z) := q_z(z)\cdot\left(GC_{B_{6}} - GC_{pi}\right)$ $\quad p_{C\_Bl}(z_r) = \begin{pmatrix} -12.2 \\ -2.9 \end{pmatrix}\cdot psf$ Leeward Zone C

$p_{E\_B}(z) := q_z(z)\cdot\left(GC_{B_{8}} - GC_{pi}\right)$ $\quad p_{E\_B}(z_r) = \begin{pmatrix} -32.4 \\ -23.1 \end{pmatrix}\cdot psf$ Roof Zone E

$p_{EOH\_B}(z) := q_z(z)\cdot\left[\left(GC_{B_{8}} - GC_{pi}\right) - 0.7\right]$ $\quad p_{EOH\_B}(z_r) = \begin{pmatrix} -50.6 \\ -41.3 \end{pmatrix}\cdot psf$ Zone E Overhang

$p_{F\_B}(z) := q_z(z)\cdot\left(GC_{B_{9}} - GC_{pi}\right)$ $\quad p_{F\_B}(z_r) = \begin{pmatrix} -18.4 \\ -9.1 \end{pmatrix}\cdot psf$ Roof Zone F

$p_{FOH\_B}(z) := q_z(z)\cdot\left[\left(GC_{B_{9}} - GC_{pi}\right) - 0.7\right]$ $\quad p_{FOH\_B}(z_r) = \begin{pmatrix} -36.6 \\ -27.3 \end{pmatrix}\cdot psf$ Zone F Overhang

$p_{G\_B}(z) := q_z(z)\cdot\left(GC_{B_{2}} - GC_{pi}\right)$ $\quad p_{G\_B}(z_r) = \begin{pmatrix} -22.6 \\ -13.2 \end{pmatrix}\cdot psf$ Roof Zone G

$p_{GOH\_B}(z) := q_z(z)\cdot\left[\left(GC_{B_{2}} - GC_{pi}\right) - 0.7\right]$ $\quad p_{GOH\_B}(z_r) = \begin{pmatrix} -40.7 \\ -31.4 \end{pmatrix}\cdot psf$ Zone E Overhang

$p_{H\_B}(z) := q_z(z)\cdot\left(GC_{B_{3}} - GC_{pi}\right)$ $\quad p_{H\_B}(z_r) = \begin{pmatrix} -14.3 \\ -4.9 \end{pmatrix}\cdot psf$ Roof Zone H

$p_{HOH\_B}(z) := q_z(z)\cdot\left[\left(GC_{B_{3}} - GC_{pi}\right) - 0.7\right]$ $\quad p_{HOH\_B}(z_r) = \begin{pmatrix} -32.4 \\ -23.1 \end{pmatrix}\cdot psf$ Zone F Overhang

Worst-Case Sum of Windward and Leeward Pressures

$p_{A\_trans}(z) := \max\left(p_{A\_Aw}(z) - p_{A\_Al}(z)\right)$ $\quad p_{A\_trans}(z_r) = 37.4\cdot psf$

$p_{C\_trans}(z) := \max\left(p_{C\_Aw}(z) - p_{C\_Al}(z)\right)$ $\quad p_{C\_trans}(z_r) = 24.9\cdot psf$

$p_{B\_trans}(z) := \min\left[q_z(z)\cdot\left[\left(GC_A\left(GC_{2E}\right) - GC_{pi}\right) - \left(GC_A\left(GC_{3E}\right) - GC_{pi}\right)\right]\right]$ $\quad p_{B\_trans}(z_r) = -9.9\cdot psf$

$p_{D\_trans}(z) := \min\left[q_z(z)\cdot\left[\left(GC_A\left(GC_{2}\right) - GC_{pi}\right) - \left(GC_A\left(GC_{3}\right) - GC_{pi}\right)\right]\right]$ $\quad p_{D\_trans}(z_r) = -5.5\cdot psf$

$p_{E\_trans}(z) := \min\left(p_{E\_A}(z)\right)$ $\quad p_{E\_trans}(z_r) = -32.4\cdot psf$

$p_{EOH\_trans}(z) := \min\left(p_{EOH\_A}(z)\right)$ $\quad p_{EOH\_trans}(z_r) = -50.6\cdot psf$

$p_{F\_trans}(z) := \min\left(p_{F\_A}(z)\right)$ $\quad p_{F\_trans}(z_r) = -22.6\cdot psf$

$p_{G\_trans}(z) := \min\left(p_{G\_A}(z)\right)$ $\quad p_{G\_trans}(z_r) = -22.6\cdot psf$

$p_{GOH\_trans}(z) := \min\left(p_{GOH\_A}(z)\right)$ $\quad p_{GOH\_trans}(z_r) = -40.7\cdot psf$

$p_{H\_trans}(z) := \min\left(p_{H\_A}(z)\right)$ $\quad p_{H\_trans}(z_r) = -17.1\cdot psf$

$p_{A\_long}(z) := \max(p_{A\_Bw}(z) - p_{A\_Bl}(z))$ $\quad p_{A\_long}(z_r) = 27 \cdot psf$

$p_{C\_long}(z) := \max(p_{C\_Bw}(z) - p_{C\_Bl}(z))$ $\quad p_{C\_long}(z_r) = 17.9 \cdot psf$

$p_{B\_long}(z) := \min\left[q_z(z) \cdot \left[\left(GC_{B_8} - GC_{pi}\right) - \left(GC_{B_9} - GC_{pi}\right)\right]\right]$ $\quad p_{B\_long}(z_r) = -14.0 \cdot psf$

$p_{D\_long}(z) := \min\left[q_z(z) \cdot \left[\left(GC_{B_2} - GC_{pi}\right) - \left(GC_{B_3} - GC_{pi}\right)\right]\right]$ $\quad p_{D\_long}(z_r) = -8.3 \cdot psf$

$p_{E\_long}(z) := \min(p_{E\_B}(z))$ $\quad p_{E\_long}(z_r) = -32.4 \cdot psf$

$p_{EOH\_long}(z) := \min(p_{EOH\_B}(z))$ $\quad p_{EOH\_long}(z_r) = -50.6 \cdot psf$

$p_{F\_long}(z) := \min(p_{F\_B}(z))$ $\quad p_{F\_long}(z_r) = -18.4 \cdot psf$

$p_{G\_long}(z) := \min(p_{G\_B}(z))$ $\quad p_{G\_long}(z_r) = -22.6 \cdot psf$

$p_{GOH\_long}(z) := \min(p_{GOH\_B}(z))$ $\quad p_{GOH\_long}(z_r) = -40.7 \cdot psf$

$p_{H\_long}(z) := \min(p_{H\_B}(z))$ $\quad p_{H\_long}(z_r) = -14.3 \cdot psf$

$p_A(z) := \max(p_{A\_trans}(z), p_{A\_long}(z))$ $\quad p_A(z_r) = 37.4 \cdot psf$

$p_C(z) := \max(p_{C\_trans}(z), p_{C\_long}(z))$ $\quad p_C(z_r) = 24.9 \cdot psf$

$p_B(z) := \min(p_{B\_trans}(z), p_{B\_long}(z))$ $\quad p_B(z_r) = -14.0 \cdot psf$

$p_D(z) := \min(p_{D\_trans}(z), p_{D\_long}(z))$ $\quad p_D(z_r) = -8.3 \cdot psf$

$p_E(z) := \min(p_{E\_trans}(z), p_{E\_long}(z))$ $\quad p_E(z_r) = -32.4 \cdot psf$

$p_{EOH}(z) := \min(p_{EOH\_trans}(z), p_{EOH\_long}(z))$ $\quad p_{EOH}(z_r) = -50.6 \cdot psf$

$p_F(z) := \min(p_{F\_trans}(z), p_{F\_long}(z))$ $\quad p_F(z_r) = -22.6 \cdot psf$

$p_G(z) := \min(p_{G\_trans}(z), p_{G\_long}(z))$ $\quad p_G(z_r) = -22.6 \cdot psf$

$p_{GOH}(z) := \min(p_{GOH\_trans}(z), p_{GOH\_long}(z))$ $\quad p_{GOH}(z_r) = -40.7 \cdot psf$

$p_H(z) := \min(p_{H\_trans}(z), p_{H\_long}(z))$ $\quad p_H(z_r) = -17.1 \cdot psf$

$P_{w\_e}(z) := \text{absmax}(\text{stack}(p_{A\_Aw}(z), p_{A\_Al}(z), p_{A\_Bw}(z), p_{A\_Bl}(z)))$

$P_{w\_i}(z) := \text{absmax}(\text{stack}(p_{C\_Aw}(z), p_{C\_Al}(z), p_{C\_Bw}(z), p_{C\_Bl}(z)))$

$P_{r\_e}(z) := q_z(z) \cdot \text{absmax}\left(\text{stack}\left(GC_A(GC_{2E}) - GC_{pi}, GC_A(GC_{3E}) - GC_{pi}, GC_{B_8} - GC_{pi}, GC_{B_9} - GC_{pi}\right)\right)$

$P_{r\_i}(z) := q_z(z) \cdot \text{absmax}\left(\text{stack}\left(GC_A(GC_2) - GC_{pi}, GC_A(GC_3) - GC_{pi}, GC_{B_2} - GC_{pi}, GC_{B_3} - GC_{pi}\right)\right)$

$P_{r\_e}(z_r) = 32.443 \cdot psf$

Envelope Procedure (Chapter 28 - Low-Rise)

Transverse Pressures

$p_{A\_trans}(z_r) = 37.4 \cdot psf$	$p_{B\_trans}(z_r) = -9.9 \cdot psf$	$p_{C\_trans}(z_r) = 24.9 \cdot psf$	$p_{D\_trans}(z_r) = -5.5 \cdot psf$
$p_{E\_trans}(z_r) = -32.4 \cdot psf$	$p_{F\_trans}(z_r) = -22.6 \cdot psf$	$p_{G\_trans}(z_r) = -22.6 \cdot psf$	$p_{H\_trans}(z_r) = -17.1 \cdot psf$
$p_{EOH\_trans}(z_r) = -50.6 \cdot psf$	$p_{FOH\_trans}(z_r) = -33.4 \cdot psf$	$p_{GOH\_trans}(z_r) = -40.7 \cdot psf$	$p_{HOH\_trans}(z_r) = -33.4 \cdot psf$

Longitudinal Pressures

$p_{A\_long}(z_r) = 27 \cdot psf$	$p_{B\_long}(z_r) = -14.0 \cdot psf$	$p_{C\_long}(z_r) = 17.9 \cdot psf$	$p_{D\_long}(z_r) = -8.3 \cdot psf$
$p_{E\_long}(z_r) = -32.4 \cdot psf$	$p_{F\_long}(z_r) = -18.4 \cdot psf$	$p_{G\_long}(z_r) = -22.6 \cdot psf$	$p_{H\_long}(z_r) = -14.3 \cdot psf$
$p_{EOH\_long}(z_r) = -50.6 \cdot psf$	$p_{FOH\_long}(z_r) = -39.8 \cdot psf$	$p_{GOH\_long}(z_r) = -40.7 \cdot psf$	$p_{HOH\_long}(z_r) = -39.8 \cdot psf$

Worst-Case Pressures

$p_A(z_r) = 37.4 \cdot psf$	$p_B(z_r) = -14.0 \cdot psf$	$p_C(z_r) = 24.9 \cdot psf$	$p_D(z_r) = -8.3 \cdot psf$
$p_E(z_r) = -32.4 \cdot psf$	$p_F(z_r) = -22.6 \cdot psf$	$p_G(z_r) = -22.6 \cdot psf$	$p_H(z_r) = -17.1 \cdot psf$
$p_{EOH}(z_r) = -50.6 \cdot psf$	$p_{FOH}(z_r) = -39.8 \cdot psf$	$p_{GOH}(z_r) = -40.7 \cdot psf$	$p_{HOH}(z_r) = -39.8 \cdot psf$

Base Shears

$$V_q(z_l, z_u, q) := \int_{z_l}^{z_u} q(z)\, dz$$

Function for shear sum of adustment factor for building height and exposure over a range of elevations- Table 28.3-1

$$V_{w\_y} := \begin{bmatrix} V_q(z_r - H_{unit} - H_r, z_r - H_r, P_{w\_e}) \cdot END_x + V_q(z_r - H_{unit} - H_r, z_r - H_r, P_{w\_i}) \cdot INT_x \ldots \\ + V_q(z_r - H_r, z_r, P_{r\_e}) \cdot END_x + V_q(z_r - H_r, z_r, P_{r\_i}) \cdot INT_x \\ if(V_{wind} = 0, 0, 16 \cdot psf) \cdot L_{x1} \cdot H_{unit} + (8 \cdot psf) \cdot L_{x1} \cdot H_r \end{bmatrix}$$

$$V_{w\_x} := \begin{bmatrix} V_q(z_r - H_{unit} - 0.5 \cdot H_r, z_r - 0.5 \cdot H_r, p_A) \cdot END_y + V_q(z_r - H_{unit} - 0.5 \cdot H_r, z_r - 0.5 \cdot H_r, p_C) \cdot INT_y \\ (if(V_{wind} = 0, 0, 16 \cdot psf)) \cdot L_{y1} \cdot (H_{unit} + 0.5 \cdot H_r) \end{bmatrix}$$

$V_{w\_y} = \begin{pmatrix} 23418 \\ 15129 \end{pmatrix} lbf$ Transverse wind base shear

$V_{w\_x} = \begin{pmatrix} 60074 \\ 45388 \end{pmatrix} lbf$ Longitudinal wind base shear

Overturning Moments

$$M_q(z_l, z_u, q) := \int_{z_l}^{z_u} q(z) \cdot [z - (z_r - H_{unit} - H_r)]\, dz$$

Function for moment sum of adustment factor for building height and exposure over a range of elevations about the base - Table 28.3-1

$$M_{w\_y} := \begin{bmatrix} M_q(z_r - H_{unit} - H_r, z_r - H_r, P_{w\_e}) \cdot END_x + M_q(z_r - H_{unit} - H_r, z_r - H_r, P_{w\_i}) \cdot INT_x \ldots \\ + M_q(z_r - H_r, z_r, P_{r\_e}) \cdot END_x + M_q(z_r - H_r, z_r, P_{r\_i}) \cdot INT_x \\ if(V_{wind} = 0, 0, 16 \cdot psf) \cdot L_{x1} \cdot (0.5 \cdot H_{unit}^2) + if(V_{wind} = 0, 0, 8 \cdot psf) \cdot L_{x1} \cdot H_r \cdot (H_{unit} + 0.5 \cdot H_r) \end{bmatrix} + |p_E(z_r)| \cdot (L_{x1} \cdot L_{y1}) \cdot (0.5 \cdot L_y$$

$M_{w\_y} = \begin{pmatrix} 116152 \\ 114318 \end{pmatrix} \cdot kip \cdot ir$

$$M_{w\_x} := \begin{bmatrix} M_q(z_r - H_{unit} - H_r, z_r - H_r, P_{w\_e}) \cdot END_y + M_q(z_r - H_{unit} - H_r, z_r - H_r, P_{w\_i}) \cdot INT_y \\ if(V_{wind} = 0, 0, 16 \cdot psf) \cdot L_{y1} \cdot [0.5 \cdot (H_{unit} + 0.5 \cdot H_r)^2] \end{bmatrix} + |p_E(z_r)| \cdot (L_{x1} \cdot L_{y1}) \cdot (0.5 \cdot L_{x1})$$

$M_{w\_x} = \begin{pmatrix} 42622 \\ 43812 \end{pmatrix} \cdot kip \cdot in$

Lateral Force Resisting System Loads

$$V_{y\_wind} := \begin{bmatrix} V_q[z_r - (0.5 \cdot L_{wall} + t_{ceil} + H_r), z_r - H_r, P_{w\_e}] \cdot END_x + V_q[z_r - (0.5 \cdot L_{wall} + t_{ceil} + H_r), z_r - H_r, P_{w\_i}] \cdot INT_x \ldots \\ + V_q(z_r - H_r, z_r, P_{r\_e}) \cdot END_x + V_q(z_r - H_r, z_r, P_{r\_i}) \cdot INT_x \\ if(V_{wind} = 0, 0, 16 \cdot psf) \cdot L_{x1} \cdot (0.5 \cdot L_{wall} + t_{ceil}) + if(V_{wind} = 0, 0, 8 \cdot psf) \cdot L_{x1} \cdot H_r \end{bmatrix}$$

$$V_{x\_wind} := \begin{bmatrix} V_q[z_r - (0.5 \cdot L_{wall} + t_{ceil} + 0.5 \cdot H_r), z_r - 0.5 \cdot H_r, P_{w\_e}] \cdot END_y + V_q[z_r - (0.5 \cdot L_{wall} + t_{ceil} + 0.5 \cdot H_r), z_r - 0.5 \cdot H_r, P_{w\_i}] \cdot INT \\ if(V_{wind} = 0, 0, 16 \cdot psf) \cdot L_{y1} \cdot (0.5 \cdot L_{wall} + t_{ceil} + 0.5 \cdot H_r) \end{bmatrix}$$

$V_{y\_wind} = \begin{pmatrix} 11622 \\ 5684 \end{pmatrix} lbf$ y-direction wind diaphragm load

$V_{x\_wind} = \begin{pmatrix} 11492 \\ 17053 \end{pmatrix} lbf$ x-direction wind diaphragm load

Components and Cladding Loads

$A_r := \max\left(L_{ceil} \cdot B_p, \frac{L_{ceil}^2}{3}\right)$ $\quad A_r = 533\ ft^2$

$A_w := \max\left(H_{wall} \cdot B_p, \frac{H_{wall}^2}{3}\right)$ $\quad A_w = 38\ ft^2$

$A_{other} := \max\left(1 \cdot ft^2, 1 \cdot ft^2\right)$ $\quad A_{other} = 1\ ft^2$

$$GC(A, A_s, A_e, G_s, G_e) := \begin{vmatrix} m \leftarrow \dfrac{G_s - G_e}{\log\left(\dfrac{A_s}{A_e}\right)} \\ z \leftarrow G_e - m \cdot \log(A_e) \\ G_s \ \text{if} \ \dfrac{A}{ft^2} \le A_s \\ G_e \ \text{if} \ \dfrac{A}{ft^2} \ge A_e \\ m \cdot \log\left(\dfrac{A}{ft^2}\right) + z \ \text{otherwise} \end{vmatrix}$$

Hip/Gable Roof, 7 deg < θ ≤ 20 deg

$P_{Z\_pos}(z) := \max\left[q_z(z) \cdot \left(GC(A_r, 2, 100, 0.7, 0.3) - GC_{pi}\right), 16 \cdot psf\right]$

$P_{Z1\_neg}(z) := \min\left[q_z(z) \cdot \left(GC(A_r, 20, 100, -2.0, -0.5) - GC_{pi}\right), -16 \cdot psf\right]$ $\quad P_{Z2e\_neg}(z) := P_{Z1\_neg}(z)$

$P_{Z2r\_neg}(z) := \min\left[q_z(z) \cdot \left(GC(A_r, 10, 250, -3.0, -1.0) - GC_{pi}\right), -16 \cdot psf\right]$ $\quad P_{Z2n\_neg}(z) := P_{Z2r\_neg}(z)$

$P_{Z3r\_neg}(z) := \min\left[q_z(z) \cdot \left(GC(A_r, 10, 100, -3.6, -1.8) - GC_{pi}\right), -16 \cdot psf\right]$ $\quad P_{Z3e\_neg}(z) := P_{Z2r\_neg}(z)$

$P_{Z3r\_OH}(z) := \min\left[q_z(z) \cdot \left(GC(A_r, 10, 100, -4.7, -2.3) - GC_{pi}\right), -16 \cdot psf\right]$

$P_{Z3e\_OH}(z) := \min\left[q_z(z) \cdot \left(GC(A_r, 10, 250, -4.1, -1.5) - GC_{pi}\right), -16 \cdot psf\right]$

$P_{Z2r\_OH}(z) := \min\left[q_z(z) \cdot \left(GC(A_r, 10, 250, -3.5, -2.0) - GC_{pi}\right), -16 \cdot psf\right]$ $\quad P_{Z2n\_OH}(z) := P_{Z2r\_OH}(z)$

$P_{Z2e\_OH}(z) := \min\left[q_z(z) \cdot \left(GC(A_r, 20, 100, -2.5, -1.5) - GC_{pi}\right), -16 \cdot psf\right]$ $\quad P_{Z1\_OH}(z) := P_{Z2e\_OH}(z)$

$P_{Z2r\_other}(z) := \min\left[q_z(z) \cdot \left(GC(A_{other}, 10, 250, -3.0, -1.0) - GC_{pi}\right), -16 \cdot psf\right]$

$P_{Z3r\_other}(z) := \min\left[q_z(z) \cdot \left(GC(A_{other}, 10, 100, -3.6, -1.8) - GC_{pi}\right), -16 \cdot psf\right]$

Conservative roof pressures:

$P_{Z3\_OH}(z) := \min\left(P_{Z3r\_OH}(z), P_{Z3e\_OH}(z)\right)$

$P_{Z3\_neg}(z) := \min\left(P_{Z3r\_neg}(z), P_{Z3e\_neg}(z)\right)$

Wall Pressures - Figure 30.3-1

$\upsilon(\theta) := \text{if}(\theta \le 10 \cdot deg, 0.9, 1.0)$ $\quad$ Pressure reduction - Figure 30.3-1, Note 5

$P_{Z4\_pos}(z) := \max\left[q_z(z) \cdot \left(\upsilon(\theta_r) \cdot GC(A_w, 10, 500, 1.0, 0.7) - GC_{pi}\right), \text{if}\left(V_{wind} = 0, 0, 16 \cdot psf\right)\right]$ $\quad P_{Z4\_pos}(z_r) = 28 \cdot psf$

$P_{Z5\_pos}(z) := \max\left[q_z(z) \cdot \left(\upsilon(\theta_r) \cdot GC(A_w, 10, 500, 1.0, 0.7) - GC_{pi}\right), \text{if}\left(V_{wind} = 0, 0, 16 \cdot psf\right)\right]$ $\quad P_{Z5\_pos}(z_r) = 28 \cdot psf$

$P_{Z4\_neg}(z) := \min\left[q_z(z) \cdot \left(\upsilon(\theta_r) \cdot GC(A_w, 10, 500, -1.1, -0.8) - GC_{pi}\right), -\text{if}\left(V_{wind} = 0, 0, 16 \cdot psf\right)\right]$ $\quad P_{Z4\_neg}(z_r) = -30.5 \cdot psf$

$P_{Z5\_neg}(z) := \min\left[q_z(z) \cdot \left(\upsilon(\theta_r) \cdot GC(A_w, 10, 500, -1.4, -0.8) - GC_{pi}\right), -\text{if}\left(V_{wind} = 0, 0, 16 \cdot psf\right)\right]$ $\quad P_{Z5\_neg}(z_r) = -35.7 \cdot psf$

$P_{Z\_pos}(z_r) = 16 \cdot psf$	$P_{Z\_pos}(z_r) = 16 \cdot psf$	$P_{Z\_pos}(z_r) = 16 \cdot psf$	$P_{Z4\_pos}(z_r) = 28 \cdot psf$	$P_{Z5\_pos}(z_r) = 28 \cdot psf$
$P_{Z1\_neg}(z_r) = -17.6 \cdot psf$	$P_{Z2r\_neg}(z_r) = -30.6 \cdot psf$	$P_{Z3r\_neg}(z_r) = -51.4 \cdot psf$	$P_{Z4\_neg}(z_r) = -30.5 \cdot psf$	$P_{Z5\_neg}(z_r) = -35.7 \cdot psf$