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#### WIND LOAD BALAST CALCULATIONS:

This procedure for determining Design Wind Load is specified in ASCE 7-05 section 6.5.13 and referenced in the IBC 2006 Code.

$$q_h = \text{Velocity pressure due to wind} = 0.00256 \times K_z \times V^2$$

$K_z = 0.62$  for structures 20' high in Exposure B

$V = \text{Basic Wind Velocity} = 90 \text{ mph}$  from ASCE 7-05 nominal 3-sec gust at 33ft chart

$$q_h = 0.00256 \times 0.62 \times 90^2 = 12.9 \text{ lb/ft}^2$$

$$p = \text{Design Wind Pressure} = q_h \times G \times C_n \quad \text{where:}$$

$G = \text{Gust Effect Factor} = .85$  for stiff structures from ASCE 7-05 Section 6.5.8

$C_n = \text{Net Pressure Coefficient} = 0.9$  determined from ASCE 7-05 Fig 6-18A

$$p = 12.9 \times .85 \times 0.9 = 9.8 \text{ lb/ft}^2$$

$$W_{zu} = \text{Uplift wind load} = \text{Wind pressure} \times \text{horiz. profile} = p A \cos 30^\circ = 9.8 \times 17.6 \times 0.87 = 150 \text{ lb}$$

$$W_{yu} = \text{Drag wind load} = \text{Wind pressure} \times \text{vert. profile} = p A \sin 30^\circ = 9.8 \times 17.6 \times 0.50 = 87 \text{ lb}$$

CSI 220W module:  $39'' \times 65'' = 17.6 \text{ ft}^2$ , 30deg mount,  $D_1 = 55 \text{ lb}$  dead weight (not incl. ballast)

Ballast Weight Requirement per module in the Z (lift) direction.      ASCE 7-05, sec 2.4.1

$$BW_z = \text{Load Combination 4, LC4} = 0.6 D_1 + W = 0.6 \times 55 + 150 = 117 \text{ lb}$$

Ballast Weight Requirement per module in the Y (drag) direction.

$$(0.6 \times D_{total} + BW_y) \times C_{fric} = W_{yu} \text{ or}$$

$$0.6 (D_1 + BW_y) + BW_y = W_{yu} / C_{fric}$$

$$0.6 \times D_1 + 1.6 \times BW_y = W_{yu} / C_{fric}$$

$$\begin{aligned} BW_y &= (W_{yu} / C_f - 0.6 \times D_1) \times 0.625 \text{ where Coefficient of friction} = 0.4 \\ &= (87 \text{ lb} / 0.4 - 0.6 ( 55 + 150 \text{ lb} )) \times 0.625 = 115 \text{ lb} \end{aligned}$$

The Code Calculated Ballast Requirement =  $BW_c = BW_z + BW_y = 117 + 115 = 232 \text{ lb / module}$

Recommended Ballast Weight per module =  $BW_c \times F_{adj} \times F_x = 232 \times 0.43 \times 1.5 = 151 \text{ lb}$

$F_{adj} = \text{adjustment factor based on wind tunnel testing} = 0.43$

$F_x = \text{safety factor of 50\%}$

Ballast Blocks (6x8x16) per module =  $151 / 27 \text{ lb} = 5.6$  round up to 6 blocks per module.