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UNITS TO BE USED FOR FOLLOWING CALCULATIONS. $kip \equiv 1000 \cdot lb$ $sf \equiv ft^2$ $cf \equiv ft^3$

$pli \equiv \frac{lb}{in}$ $plf \equiv \frac{lb}{ft}$ $kli \equiv 1000 \cdot pli$ $klf \equiv 1000 \cdot plf$ $psi \equiv \frac{lb}{in^2}$ $psf \equiv \frac{lb}{ft^2}$ $ksi \equiv 1000 \cdot psi$ $ksf \equiv 1000 \cdot psf$

$pci \equiv \frac{lb}{in^3}$ $pcf \equiv \frac{lb}{ft^3}$ $kci \equiv 1000 \cdot pci$ $kcf \equiv 1000 \cdot pcf$

Burning man monolith. Job XXXX-09

$F_{wind} := 5407 \cdot lb$ $x_{uprights} := 8 \cdot in$ $Bolt_{parallel} := 1580 \cdot lb$ This is for 3/4"diameter bolts in DF.

$height := 132 \cdot in$ $C_D := 1.6$

$M := F_{wind} \cdot \frac{height}{2}$ $M = 29738.5\ lb \cdot ft$

$Tension := \frac{M}{x_{uprights}}$ $Tension = 44607.75\ lb$

$Sides := 2$

$Tension_{side} := \frac{Tension}{Sides}$ $Tension_{side} = 22303.875\ lb$

$Quantity_{bolts} := \frac{Tension_{side}}{Bolt_{parallel} \cdot C_D}$ $Quantity_{bolts} = 8.823$

Steel bracket in bending.

$height_{upright} := 27 \cdot in$ $quantity_{uprights} := 4$

$M_{upright} := \frac{M}{quantity_{uprights}}$ $M_{upright} = 7434.625\ lb \cdot ft$

If use steel plate.

$F_y := 36 \cdot ksi$ $\phi_y := 0.90$ $b := 3.5 \cdot in - \left(\frac{3}{4} + \frac{1}{8}\right) \cdot in$ $b = 2.625\ in$

$M_u := 1.6 \cdot M_{upright}$ $M_u = 11.895\ ft\ kip$

$Z_x := \frac{M_u}{\phi_y \cdot F_y}$ $Z_x = 4.406\ in^3$

$Z_x = \frac{b \cdot t^2}{4}$ $t := 2 \cdot \sqrt{\frac{Z_x}{b}}$ $t = 2.591\ in$

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If use steel tube.

$F_y := 46 \cdot ksi$ $\phi_y := 0.90$

$M_u := 1.6 \cdot M_{upright}$ $M_u = 11.895\,ft\,kip$

$Z_x := \frac{M_u}{\phi_y \cdot F_y}$ $Z_x = 3.448\,in^3$

Use 3-1/2 x 3-1/2 x 5/16 ASTM A500, Grade B steel tube, Z = 4.14
Use full penetration welding of tube to tube.

Estimate for rod uplift

$M = 29738.5\,lb \cdot ft$ $quantity_{outer.rods} := 4$ $L_{rod.arm} := 6 \cdot ft - 3 \cdot in$

$Uplift_{rod} := \frac{M}{L_{rod.arm} \cdot quantity_{outer.rods}}$ $Uplift_{rod} = 1292.978\,lb$

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$pci \equiv \frac{lb}{in^3}$ $pcf \equiv \frac{lb}{ft^3}$ $kci \equiv 1000 \cdot pci$ $kcf \equiv 1000 \cdot pcf$

Burning man monolith. Job 3001-08

Ambient vaporizer wind loads per 2007 CBC and ASCE/SEI 7-05

Using Exposure D $h := 132 \cdot in$

Importance Factor per 2007 CBC and ASCE/SEI 7-05

$I := 1.0$ Assuming catagory II per Table 6-1 in the ASCE/SEI 7-05

$F = q_z \cdot G \cdot C_f \cdot A_f$ Equation 6-28 ASCE/SEI 7-05. Velocity Pressure.

$q_z = 0.00256 \cdot K_z \cdot K_{zt} \cdot K_d \cdot V^2 \cdot I$ Equation 6-15 ASCE/SEI 7-05

$K_d := 0.90$ Table 6-4 (page 80) ASCE/SEI 7-05 I used the largest conservative value.

$K_z := 1.03$ Table 6-3 (page 79) ASCE/SEI 7-05

$K_{zt} = (1 + K_1 \cdot K_2 \cdot K_3)^3$ equation 6-3 ASCE/SEI 7-05. Topographic Factor.

Refer to Figure 6-4 in the ASCE/SEI 7-05 for values of K1, K2 and K3.

$H := 0 \cdot ft$ Height of hill or escarpment relative to the upwind terrain. Figure 6-4 ASCE/SEI 7-05 (page 45).

$L_h := 5000 \cdot ft$ Distance u pwind of crest to where the difference in ground elevation is half the height of hill or escarpment. Figure 6-4.

$x := 5000 \cdot ft$ Distance (upwind or downwind) from the crest to the building site. Figure 6-4 ASCE/SEI 7-05 (page 45).

$z := h$ Height above local ground level. Figure 6-4 ASCE/SEI 7-05 (page 45).

$\frac{H}{L_h} = 0$ $K_1 := 0.29$ using the worst case, since none of the situations seem applicable. Figure 6-4 ASCE/SEI 7-05 (page 45).

$\frac{x}{L_h} = 1$ $K_2 := 0.75$ using the worst case, since other data is uncertain. Figure 6-4 ASCE/SEI 7-05 (page 45).

$\frac{z}{L_h} = 0.002$ $K_3 := 1.00$ using the worst case, since other data is uncertain. Figure 6-4 ASCE/SEI 7-05 (page 45).

$K_{zt} := (1 + K_1 \cdot K_2 \cdot K_3)^3$ $K_{zt} = 1.805$ equation 6-3 ASCE/SEI 7-05. Topographic Factor.

$V := 90 \cdot mph$ Basic wind speed from Figure 6-1 of ASCE/SEI 7-05

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Velocity Pressure Value

$q_z := 0.00256 \cdot K_z \cdot K_{zt} \cdot K_d \cdot V^2 \cdot I \cdot \left(\frac{lb}{ft^4} \cdot sec^2 \right)$ $q_z = 74.623 \cdot psf$ Equation 6-15 ASCE/SEI 7-05

Gust Effect Factor for Rigid Structure.

$G := 0.85$ equation 6-8 ASCE/SEI 7-05 (page 26)

Force Coefficient. Figure 6-20, ASCE/SEI 7-05 (page 73)

$s := 132 \cdot in$ $B := 60 \cdot in$ $h = 11\,ft$ s is the depth, B is the width and h is the height from the ground

$\frac{s}{h} = 1$ $\frac{B}{s} = 0.455$ aspect ratio per figure 6-20

$C_f := 1.55$ Is the Force Coefficient for Case A based on B/s aspect ratio.

Design Wind Force is:

$F_{wind} := q_z \cdot G \cdot C_f$ $F_{wind} = 98.316 \cdot psf$ Equation 6-28 ASCE/SEI 7-05. Velocity Pressure.

$P_{wind} := F_{wind} \cdot s \cdot B$ $P_{wind} = 5407.391\,lb$