

# POST FRAME BUILDING STRUCTURAL CALCULATION

(This structure has been analyzed and designed for structural adequacy only.)

**PROJECT No.**  
**1200926**

These calculations must be on site and made  
available by the Permittee for all inspections.

**BUILDING OWNER / LOCATION:**  
**Puyallup Seventh Day Adventist Church**  
**902 Shaw Rd E**  
**Puyallup, WA 98372**

**City of Puyallup**  
**Building**  
**REVIEWED**  
**FOR**  
**COMPLIANCE**

BSnowden  
05/01/2026  
11:06:45 AM



**CLIENT:**  
**Abel Construction**  
**26020 Lawson St**  
**Black Diamond, WA 98010**

**ENGINEER:**

4/15/26



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## **POST FRAME BUILDING**

### **REFERENCES:**

1. 2021 Edition of the International Building Code
2. ASCE 7-16 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures, American Society of Civil Engineers, 2017
3. 2018 Edition, National Design Specification (NDS) For Wood Construction with 2018 Edition NDS Supplement, American Wood Council, 2018
4. 2021 Edition, Special Design Provisions for Wind and Seismic (SDPWS) American Wood Council, 2020
5. ASABE EP486.3 - Shallow Post and Pier Foundation Design American Society of Agricultural and Biological Engineers, 2017

**DESIGN INPUT VALUES:****Building Dimensions**

$W_{bldg} := 70 \cdot \text{ft}$       Width of Building  
 $L_{bldg} := 65 \cdot \text{ft}$       Length of Building  
 $H_{bldg} := 12 \cdot \text{ft}$       Eave Height of Building  
 $R_{pitch} := 4 / 12$  Roof pitch  
 $O_{verhang} := 12 \cdot \text{in}$       Length of Eave Overhang  
 $GO_{verhang} := 12 \cdot \text{in}$       Length of Gable Overhang  
 $B_{ay} := 11 \cdot \text{ft}$       Greatest tributary spacing between eave wall posts  
 $A_{pron} := 0 \cdot \text{ft}$       Height of Wall Apron Below Roof Line

**Design Loads for Building:**

Risk\_Category :=

**Wind Design Values:**

Wind Speed:      Wind Exposure:  
 $V_{wind} = 110 \text{ mph}$        $E_{xposure} :=$

**Seismic Design Values:**

Site\_class :=

$S_s := 1.254$       Mapped spectral acceleration for short period  
 $S_1 := 0.432$       Mapped spectral acceleration for 1 second period  
 $R_a := 1.5$       Response modification factor

**Roof Load Design Values:**

$p_g := 30 \cdot \text{psf}$       Ground snow load  
 $p_d = 5 \text{ psf}$       Roof dead load      Roof\_type\_is = "metal sheathing"  
 $p_{Lr} = 20 \text{ psf}$       Roof live load  
 $p_{d2} = 1 \text{ psf}$       Additional truss bottom chord dead load (if applicable)  
 $p_{La} = 0 \text{ psf}$       Ceiling live load at storage areas (if applicable, where 24" wide x 42" tall object will fit between (2) or more truss members. The width of the storage\_area\_is = 0 ft)

**DESIGN INPUT VALUES (Continued):****Structural Members for Building:****Eave Post Properties:** (Solid-sawn post unless otherwise specified)

$S_{\text{post}} :=$   
 $\text{Post Species} :=$   
 $\text{Post Grade} :=$

$\text{Post}_{\text{ts}} :=$

**Purlin Properties:**

$S_{\text{purlin}} :=$

$\text{Purlin}_{\text{species}} :=$

$\text{Purlin}_{\text{grade}} :=$   
 $\text{Purlin}_{\text{spacing}} := 24 \cdot \text{in}$

**Post Hole and Footing Design Values:**

$q_{\text{soil}} := 1500 \cdot \text{psf}$  Assumed soil vertical bearing capacity

$S_{\text{soil}} = 100 \text{ psf / ft}$  Assumed soil lateral bearing capacity

$d_{\text{ia\_footing}} := 2.50 \cdot \text{ft}$  Main eave post footing diameter

$t_{\text{CPfooting}} = 6 \text{ in}$  Thickness of post concrete footing

$\text{Backfill\_type} :=$    Main eave post hole backfill

**(GO TO LAST PAGE FOR SUMMARY OF RESULTS)**

**SNOW LOAD ANALYSIS:**

For roof slopes greater than 5 degrees, and less than 70 degrees.

$$p_g = 30 \text{ psf} \quad \text{Ground Snow Load (from above)}$$

$$R_{\text{angle}} = 18.43 \text{ deg} \quad \text{Angle of roof}$$

$$C_e = 1.00 \quad \text{Exposure factor}$$

$$C_t = 1.20 \quad \text{Thermal Factor}$$

$$C_s = 1.00 \quad \text{Roof slope factor}$$

$$I_s = 1.00 \quad \text{Importance factor}$$

1. Determine Roof Snow Loads:

$$p_f := 0.7 \cdot C_e \cdot C_t \cdot I_s \cdot p_g \quad \text{Equation 1}$$

$$p_f = 25.2 \text{ psf} \quad \text{Flat roof snow load; Roof\_slope} \leq 5 \text{ deg}$$

$$p_s := C_s \cdot p_f \quad \text{Equation 2}$$

$$p_s = 25.2 \text{ psf} \quad \text{Sloped roof (balanced) snow load}$$

2. Determine final snow load,  $p_{su}$

$$p_{su} = 26 \text{ psf} \quad \text{Final roof snow load}$$

**WIND ANALYSIS:**

$$V_{\text{wind}} = 110 \text{ mph} \quad \text{Wind Speed}$$

$$k_d = 0.85 \quad \text{Wind Directionality Factor}$$

$$k_{zt} = 1.0 \quad \text{Topographic Factor}$$

$$k_z = 0.849 \quad \text{Wind Exposure Factor (windward)}$$

$$k_{z_{cc}} = 0.849 \quad \text{Wind Exposure Factor (components \& cladding)}$$

$$I_w = 1.00 \quad \text{Importance factor}$$

$$q_z := 0.00256 \cdot k_z \cdot k_{zt} \cdot k_d \cdot V_{\text{wind}}^2$$

$$q_z = 22.35 \text{ psf} \quad \text{Velocity Pressure}$$

$$q_{z_{cc}} := 0.00256 \cdot k_{z_{cc}} \cdot k_{zt} \cdot k_d \cdot V_{\text{wind}}^2$$

$$q_{z_{cc}} = 22.35 \text{ psf} \quad \text{Velocity Pressure (Components \& Cladding)}$$

**Calculated Wind Pressures:****Roof Wind:**

$$q_{\text{roof}} := q_z \cdot G \cdot C_{Nrw}$$

$$q_{\text{roof}} = 22.80 \text{ psf}$$

**Roof Uplift:**

$$q_{\text{uplift}} := q_z \cdot G \cdot C_{Nuplift}$$

$$q_{\text{uplift}} = -31.27 \text{ psf}$$

**Windward Eave Wall:**

$$q_{lwe} := q_z \cdot G \cdot C_{pwe}$$

$$q_{lwe} = 15.20 \text{ psf}$$

**Leeward Eave Wall:**

$$q_{lwe} := q_z \cdot G \cdot C_{plwe}$$

$$q_{lwe} = -9.21 \text{ psf}$$

**Windward Gable Wall:**

$$q_{lwg} := q_z \cdot G \cdot C_{pwwg}$$

$$q_{lwg} = 15.20 \text{ psf}$$

**Leeward Gable Wall:**

$$q_{lwg} := q_z \cdot G \cdot C_{plwg}$$

$$q_{lwg} = -9.50 \text{ psf}$$

**Wall Elements:**

$$q_{we} := q_{z_{cc}} \cdot G \cdot C_{pwall}$$

$$q_{we} = -17.88 \text{ psf}$$

**Roof Elements:**

$$q_r := q_{z_{cc}} \cdot G \cdot C_{Nre}$$

$$q_r = -30.12 \text{ psf}$$

**Internal Wind Pressure (+/-):**

$$q_i := q_{z_{cc}} \cdot G \cdot C_{pi}$$

$$q_i = 4.02 \text{ psf}$$

**SEISMIC CALCULATIONS:**

- $S_s = 1.25$       Mapped spectral acceleration for short periods (from above)  
 $S_1 = 0.43$       Mapped spectral acceleration for 1-second period (from above)  
 $I_e = 1.0$       Importance factor  
 $R_a = 1.5$       Response modification factor (from above)

**1. Determine the Seismic Design Category****a. Calculate  $S_{DS}$  and  $S_{D1}$** For  $S_{DS}$ :For  $S_s = 1.25$ 

$$F_a = 1.20$$

$$S_{MS} := S_s \cdot F_a$$

$$S_{MS} = 1.50$$

$$S_{DS} := \left(\frac{2}{3}\right) \cdot S_{MS}$$

$$S_{DS} = 1.00$$

For  $S_{D1}$ :For  $S_1 = 0.43$ 

$$F_v = 1.57$$

$$S_{M1} := S_1 \cdot F_v$$

$$S_{M1} = 0.677$$

$$S_{D1} := \left(\frac{2}{3}\right) \cdot S_{M1}$$

$$S_{D1} = 0.45$$

Seismic\_Design\_Category = "D"

**2. Determine the building parameters**Building dead load weight,  $W_t$ :

$$p_{f\_s} := \text{if}(p_f > 30 \cdot \text{psf}, p_f, 0) \quad p_{f\_s} = 0 \text{ psf}$$

$$H_{\text{roof}} = 11.67 \text{ ft} \quad \text{Height of roof}$$

$$T_{\text{russ\_heel}} = 2.83 \text{ ft} \quad \text{Height of gable end truss heel}$$

$$W_t := [W_{\text{bldg}} + (2 \cdot O_{\text{verhang}})] \cdot [L_{\text{bldg}} + (2 \cdot G_{O_{\text{verhang}}})] \cdot [(p_{f\_s} \cdot 0.20) + p_d + p_{d2}] \dots$$

$$+ [W_{\text{attic}} \cdot L_{\text{bldg}} \cdot (0.25 \cdot p_{La})] + [(W_{\text{bldg}} - W_{\text{attic}}) \cdot L_{\text{bldg}} \cdot (0.25 \cdot p_{La2})] \dots$$

$$+ [(2 \cdot W_{\text{bldg}} \cdot \max(A_{\text{pron}}, T_{\text{russ\_heel}})) + (2 \cdot L_{\text{bldg}} \cdot A_{\text{pron}}) + (W_{\text{bldg}} \cdot H_{\text{roof}})] \cdot p_{Dw}$$

$$W_t = 32584 \text{ lb}$$

Building area,  $A_b$ :

$$A_b := L_{\text{bldg}} \cdot W_{\text{bldg}}$$

$$A_b = 4550 \text{ ft}^2$$

**Wall Load Design Values:**

$$p_{Dw} = 3 \text{ psf} \quad \text{Wall dead load (mean)}$$

$$A_{\text{pron}} = 0.00 \quad \text{Height of Wall Apron Below Roof Line (if applicable)}$$

**3. Determine the shear force to be applied**

a. Determine the fundamental period, T

 $C_u = 1.4$  sec Coefficient for Upper Limit on Calculated Period

$$T_a := 0.02 \cdot \left( \frac{H_{\text{bldg}} + \frac{H_{\text{roof}}}{2}}{\text{ft}} \right)^{0.75} \quad T_a = 0.174 \text{ sec}$$

$$T := \text{if}(T_a > C_u, C_u, T_a) \quad T = 0.174 \text{ sec} \quad \text{Fundamental period}$$

b. Determine the Seismic Response Coefficient,  $C_s$ : $T_L = 6$  Long-period transition period $C_s$  is calculated as:but  $C_s$  need not exceed:

$$C_{s1} := \frac{S_{DS}}{\frac{R_a}{I_e}} \quad C_{s1} = 0.669$$

$$C_{s2} := \text{if} \left[ T \leq T_L, \frac{S_{D1}}{T \cdot \left( \frac{R_a}{I_e} \right)}, \frac{S_{D1} \cdot T_L}{T^2 \cdot \left( \frac{R_a}{I_e} \right)} \right] \quad C_{s2} = 1.735$$

and  $C_s$  shall not be less than:

$$C_{s3} := \max \left[ \max(0.044 \cdot S_{DS} \cdot I_e, 0.01), \text{if} \left[ S_1 \geq 0.6, \frac{0.55 \cdot S_1}{\left( \frac{R_a}{I_e} \right)}, 0 \right] \right] \quad C_{s3} = 0.044$$

$$C_s := \text{if}(C_{s1} > C_{s2}, C_{s2}, \text{if}(C_{s1} < C_{s3}, C_{s3}, C_{s1}))$$

 $C_s = 0.669$  Seismic Response Coefficient to used in determination of seismic base shear

c. Determine the Seismic Base Shear:

$$V_{\text{base\_shear}} := C_s \cdot W_t \quad V_{\text{base\_shear}} = 21792 \text{ lb}$$

**4. Determine the seismic load on the building:**Since Seismic\_Design\_Category = "D" ,  $\rho = 1.30$   $\Omega_0 := 1.5$  Overstrength Factor

$$E := \max(\rho, \Omega_0) \cdot V_{\text{base\_shear}} \quad E = 32688 \text{ lb} \quad \text{Seismic load on building}$$

 $P_{\text{post\_number}} = 14$  Number of posts resisting seismic loads

$$f_{\text{bscismic\_eave}} := \frac{E \cdot L_{\text{xpost\_bndg}}}{(P_{\text{post\_number}} \cdot S_{\text{xpost}})} \quad f_{\text{bscismic\_eave}} = 1338 \text{ psi} \quad \text{This is the seismic load on one post}$$

$$f_{\text{bscismic\_gable}} := \frac{E \cdot L_{\text{ypost\_bndg}}}{(P_{\text{post\_number}} \cdot S_{\text{ypost}})} \quad f_{\text{bscismic\_gable}} = 2526 \text{ psi} \quad \text{This is the seismic load on one post}$$

**BUILDING MODEL:**

$$a := B_{ay} \quad a = 132 \text{ in} \quad \text{Bay spacing in inches} \quad H_{\text{roof}} = 11.667 \text{ f} \quad \text{Roof height}$$

$$\Theta = 18.43 \text{ deg} \quad \text{Roof angle from horizontal}$$

**CALCULATE WIND LOADS:**

Apply wind loads to the roof to determine moments and fiber stresses in the posts

**Eave Wind Calculations:**

Calculate the eave wind load on the roof in each bay.

$$q_{\text{roof}} = 22.8 \text{ psf} \quad \text{Roof wind pressure}$$

$$P_{\text{eave\_wind}} := H_{\text{roof}} \cdot B_{ay} \cdot q_{\text{roof}} \quad P_{\text{eave\_wind}} = 2926 \text{ lb}$$

Calculate the eave wind load on the eave wall aprons

$$q_e = 24.4 \text{ psf} \quad \text{Eave wall wind pressure}$$

$$P_{\text{eave\_apron}} := A_{\text{pron}} \cdot B_{ay} \cdot q_e \quad P_{\text{eave\_apron}} = 0 \text{ lb}$$

$$M_{\text{eave\_wind}} := (P_{\text{eave\_wind}} + P_{\text{eave\_apron}}) \cdot (H_{\text{bldg}}) \quad M_{\text{eave\_wind}} = 421303 \text{ in}\cdot\text{lb}$$

$$f_{\text{beave\_wind}} := \frac{M_{\text{eave\_wind}}}{2 \cdot S_{\text{xpost}}} \quad f_{\text{beave\_wind}} = 1097 \text{ psi}$$

**Gable Wind Calculations:**

Calculate the total gable roof/wall load

$$q_g = 24.7 \text{ psf} \quad \text{Gable wall wind pressure}$$

$$P_{\text{gable\_wind}} := \left[ \left( H_{\text{roof}} \cdot \frac{W_{\text{bldg}}}{2} \right) + W_{\text{bldg}} \cdot A_{\text{pron}} \right] \cdot q_g \quad P_{\text{gable\_wind}} = 10085 \text{ lb}$$

$$M_{\text{gable\_wind}} := P_{\text{gable\_wind}} \cdot H_{\text{bldg}} \quad M_{\text{gable\_wind}} = 1452220 \text{ in}\cdot\text{lb}$$

$$P_{\text{ost\_number}} = 14$$

$$f_{\text{bgable\_wind}} := \frac{M_{\text{gable\_wind}}}{(P_{\text{ost\_number}} \cdot S_{\text{ypost}})} \quad f_{\text{bgable\_wind}} = 810 \text{ psi}$$

**MAIN POST DESIGN FOR EAVE WIND:**Calculate allowable unit compression stress,  $F_{cc}$ .

$$F_{c1} = 750 \text{ psi} \quad F_c := F_{c1} \cdot C_{Mcpost} \cdot C_{tpost} \cdot C_{Fcpost} \cdot C_{ipost} \cdot C_{dASCE}$$

$$F_c = 900 \text{ psi} \quad \text{Allowable compression stress including load factors}$$

$$L_{xpost\_bndg} = 110 \text{ in} \quad \text{Bending length of post}$$

$$d_{post} = 8 \text{ in} \quad \text{Minimum unbraced dimension of post}$$

$$K_e := 1.2 \quad c := 0.8 \quad E_{min\_wood} = 470000 \text{ psi} \quad E'_{min} := E_{min\_wood} \cdot C_{MEpost} \cdot C_{tpostE} \cdot C_{ipostE}$$

$$I_e := K_e \cdot L_{xpost\_bndg} \quad I_e = 132.00 \text{ in} \quad E'_{min} = 470000 \text{ psi}$$

$$F_{cE} := \frac{0.822 \cdot E'_{min}}{\left( \frac{I_e}{d_{post}} \right)^2} \quad F_{cE} = 1419 \text{ psi}$$

Load duration factors ( $C_D$ ):

$$C_{Dconst} = 1.25 \quad C_{Dwind} = 1.60$$

$$C_{Dsnow} = 1.15 \quad C_{Dseismic} = 1.60$$

$$C_{Dlive} = 1.00$$

Calculate Column Stability Factor,  $C_p$ :

$$C_p := \left( \frac{1 + \frac{F_{cE}}{F_c \cdot C_D}}{2 \cdot c} \right) - \sqrt{\left( \frac{1 + \frac{F_{cE}}{F_c \cdot C_D}}{2 \cdot c} \right)^2 - \frac{F_{cE}}{F_c \cdot C_D}}$$

$$C_{p\_Lr} = 0.76 \quad C_{p\_L} = 0.82$$

$$C_{p\_S} = 0.79 \quad C_{p\_WorE} = 0.69$$

$$F_{cc\_L} := F_c \cdot C_{p\_L} \quad F_{cc\_L} = 739 \text{ psi} \quad \text{Allowable compression stress on the post; load case 1}$$

$$F_{cc\_Lr} := F_c \cdot C_{p\_Lr} \quad F_{cc\_Lr} = 688 \text{ psi} \quad \text{Allowable compression stress on the post; load case 2}$$

$$F_{cc\_S} := F_c \cdot C_{p\_S} \quad F_{cc\_S} = 709 \text{ psi} \quad \text{Allowable compression stress on the post; load case 3b \& 4b}$$

$$F_{cc\_WorE} := F_c \cdot C_{p\_WorE} \quad F_{cc\_WorE} = 617 \text{ psi} \quad \text{Allowable compression stress on the post; all load cases except as note above}$$

$$P_{deadpost} = 2365 \text{ lb} \quad \text{Axial loading per post due to roof dead load}$$

$$P_{livepost} = 0 \text{ lb} \quad \text{Axial loading per post due to live load}$$

$$P_{Lroofpost} = 7920 \text{ lb} \quad \text{Axial loading per post due to live roof load}$$

$$P_{snowpost} = 10564 \text{ lb} \quad \text{Axial loading per post due to roof snow load (load case 3b \& 4b)}$$

$$P_{snowpost\_fs} = 9979 \text{ lb} \quad \text{Axial loading per post due to roof snow load (load cases except as noted above)}$$

$$F_{b1} = 1050 \text{ psi} \quad F_b := F_{b1} \cdot C_{Dwind} \cdot C_{Mbpost} \cdot C_{tpost} \cdot C_{Lxpost} \cdot C_{Fbpost} \cdot C_{fupost} \cdot C_{ipost} \cdot C_{dASCE}$$

$$F_b = 2004 \text{ psi} \quad \text{Allowable bending stress per post including load factors}$$

**Check Eave Load Cases:****Load Case 1: Dead Load**

$$f_c := \frac{P_{\text{deadpost}}}{A_{\text{post}}}$$

$$f_c = 25 \text{ psi} \quad \text{Actual compression stress per post}$$

$$\text{CCFALI1} := \left( \frac{f_c}{F_{\text{cc\_L}}} \right)$$

$$\text{CCFALI1} = 0.03$$

**Load Case 2: Dead Load + Live Load**

$$f_c := \frac{P_{\text{deadpost}} + P_{\text{livepost}}}{A_{\text{post}}}$$

$$f_c = 25 \text{ psi} \quad \text{Actual compression stress per post}$$

$$\text{CCFALI2} := \left( \frac{f_c}{F_{\text{cc\_L}}} \right)$$

$$\text{CCFALI2} = 0.03$$

**Load Case 3a: Dead Load + Live Roof Load**

$$f_c := \frac{P_{\text{deadpost}} + P_{\text{Lroofpost}}}{A_{\text{post}}}$$

$$f_c = 107 \text{ psi} \quad \text{Actual compression stress per post}$$

$$\text{CCFALI3a} := \left( \frac{f_c}{F_{\text{cc\_Lr}}} \right)$$

$$\text{CCFALI3a} = 0.16$$

**Load Case 3b: Dead Load + Snow Load**

$$f_c := \frac{P_{\text{deadpost}} + P_{\text{snowpost}}}{A_{\text{post}}}$$

$$f_c = 135 \text{ psi} \quad \text{Actual compression stress per post}$$

$$\text{CCFALI3b} := \left( \frac{f_c}{F_{\text{cc\_S}}} \right)$$

$$\text{CCFALI3b} = 0.19$$

**Load Case 4a: Dead Load + 0.75 \* Live load + 0.75 \* Live Roof Load**

$$f_c := \frac{P_{\text{deadpost}} + 0.75 \cdot P_{\text{livepost}} + 0.75 \cdot P_{\text{Lroofpost}}}{A_{\text{post}}}$$

$$f_c = 87 \text{ psi} \quad \text{Actual compression stress per post}$$

$$\text{CCFALI4a} := \left( \frac{f_c}{F_{\text{cc\_Lr}}} \right)$$

$$\text{CCFALI4a} = 0.13$$

**Load Case 4b: Dead Load + 0.75 \* Live load + 0.75 \* Snow Load**

$$f_c := \frac{P_{\text{deadpost}} + 0.75 \cdot P_{\text{livepost}} + 0.75 \cdot P_{\text{snowpost}}}{A_{\text{post}}}$$

$$f_c = 107 \text{ psi} \quad \text{Actual compression stress per post}$$

$$\text{CCFALI4b} := \left( \frac{f_c}{F_{\text{cc\_S}}} \right)$$

$$\text{CCFALI4b} = 0.15$$

**Check Eave Load Cases - cont'd:****Load Case 5: Dead Load + 0.6 \* Wind Load**

$$f_{b1} := 0.6 \cdot f_{beave\_wind}$$

$$f_{b1} = 658 \text{ psi} \quad \text{Actual bending stress on post}$$

$$f_c := \frac{P_{deadpost}}{A_{post}}$$

$$f_c = 25 \text{ psi} \quad \text{Actual compression stress per post}$$

$$CCFALI5 := \left[ \left( \frac{f_c}{F_{cc\_WorE}} \right)^2 + \frac{f_{b1}}{F_b \cdot \left( 1 - \frac{f_c}{F_{cE}} \right)} \right]$$

$$CCFALI5 = 0.34$$

**Load Case 6a: Dead Load + 0.75 \* Live Load + 0.75 \* (0.6 \* Wind Load) + 0.75 \* Live Roof Load**

$$f_{b1} := 0.75 \cdot (0.6 \cdot f_{beave\_wind})$$

$$f_{b1} = 494 \text{ psi} \quad \text{Actual bending stress on post}$$

$$f_c := \frac{P_{deadpost} + 0.75 \cdot P_{livepost} + 0.75 \cdot P_{Lroofpost}}{A_{post}}$$

$$f_c = 87 \text{ psi} \quad \text{Actual compression stress per post}$$

$$CCFALI6a := \left[ \left( \frac{f_c}{F_{cc\_WorE}} \right)^2 + \frac{f_{b1}}{F_b \cdot \left( 1 - \frac{f_c}{F_{cE}} \right)} \right]$$

$$CCFALI6a = 0.28$$

**Load Case 6a: Dead Load + 0.75 \* Live Load + 0.75 \* (0.6 \* Wind Load) + 0.75 \* Snow Load**

$$f_{b1} := 0.75 \cdot (0.6 \cdot f_{beave\_wind})$$

$$f_{b1} = 494 \text{ psi} \quad \text{Actual bending stress on post}$$

$$f_c := \frac{P_{deadpost} + 0.75 \cdot P_{livepost} + 0.75 \cdot P_{snowpost\_fs}}{A_{post}}$$

$$f_c = 103 \text{ psi} \quad \text{Actual compression stress per post}$$

$$CCFALI6b := \left[ \left( \frac{f_c}{F_{cc\_WorE}} \right)^2 + \frac{f_{b1}}{F_b \cdot \left( 1 - \frac{f_c}{F_{cE}} \right)} \right]$$

$$CCFALI6b = 0.29$$

**Load Case 7: 0.6 \* Dead Load + 0.6 \* Wind Load**

$$f_{b1} := 0.6 \cdot f_{beave\_wind}$$

$$f_{b1} = 658 \text{ psi} \quad \text{Actual bending stress on post}$$

$$f_c := \frac{0.6 \cdot P_{deadpost}}{A_{post}}$$

$$f_c = 15 \text{ psi} \quad \text{Actual compression stress per post}$$

$$CCFALI7 := \left[ \left( \frac{f_c}{F_{cc\_WorE}} \right)^2 + \frac{f_{b1}}{F_b \cdot \left( 1 - \frac{f_c}{F_{cE}} \right)} \right]$$

$$CCFALI7 = 0.33$$

**Check Eave Load Cases - cont'd:**

$$E_{vpost} := 0.2 \cdot S_{DS} \cdot P_{deadpost} \quad E_{vpost} = 475 \text{ lb} \quad \text{Vertical seismic load}$$

**Load Case 8: Dead Load + 0.7 \* Vertical Seismic Load + 0.7 \* Horizontal Seismic Load**

$$f_{b1} := 0.7 \cdot f_{bseismic\_eave} \quad f_{b1} = 936 \text{ psi} \quad \text{Actual bending stress on post}$$

$$f_c := \frac{P_{deadpost} + 0.7 \cdot E_{vpost}}{A_{post}} \quad f_c = 28 \text{ psi} \quad \text{Actual compression stress per post}$$

$$CCFALI8 := \left[ \left( \frac{f_c}{F_{cc\_WorE}} \right)^2 + \frac{f_{b1}}{F_b \cdot \left( 1 - \frac{f_c}{F_{cE}} \right)} \right] \quad CCFALI8 = 0.48$$

**Load Case 9: Dead Load + 0.525 \* Vertical Seismic Load + 0.525 \* Horizontal Seismic Load + 0.75 \* Live Load + 0.75 \* Snow Load**

$$f_{b1} := 0.525 \cdot f_{bseismic\_eave} \quad f_{b1} = 702 \text{ psi} \quad \text{Actual bending stress on post}$$

$$f_c := \frac{P_{deadpost} + 0.525 \cdot E_{vpost} + 0.75 \cdot P_{livepost} + 0.75 \cdot P_{snowpost\_fs}}{A_{post}} \quad f_c = 105 \text{ psi} \quad \text{Actual compression stress per post}$$

$$CCFALI9 := \left[ \left( \frac{f_c}{F_{cc\_WorE}} \right)^2 + \frac{f_{b1}}{F_b \cdot \left( 1 - \frac{f_c}{F_{cE}} \right)} \right] \quad CCFALI9 = 0.41$$

**Load Case 10: Dead Load - 0.7 \* Vertical Seismic Load + 0.7 \* Horizontal Seismic Load**

$$f_{b1} := 0.7 \cdot f_{bseismic\_eave} \quad f_{b1} = 936 \text{ psi} \quad \text{Actual bending stress on post}$$

$$f_c := \frac{P_{deadpost} - 0.7 \cdot E_{vpost}}{A_{post}} \quad f_c = 21 \text{ psi} \quad \text{Actual compression stress per post}$$

$$CCFALI10 := \left[ \left( \frac{f_c}{F_{cc\_WorE}} \right)^2 + \frac{f_{b1}}{F_b \cdot \left( 1 - \frac{f_c}{F_{cE}} \right)} \right] \quad CCFALI10 = 0.48$$

CCFALI<sub>eave</sub> = 0.48 Less than or equal to 1.00 thus OK

**MAIN POST DESIGN FOR GABLE WIND:**Calculate allowable unit compression stress,  $F_{cc}$ .

$$F_{c1} = 850 \text{ psi} \quad F_c := F_{c1} \cdot C_{Mcpost} \cdot C_{tpost} \cdot C_{Fcpost} \cdot C_{ipost} \cdot C_{dASCE}$$

$$F_c = 1020 \text{ psi} \quad \text{Allowable compression stress including load factors}$$

$$L_{ypost\_bndg} = 138.5 \text{ in} \quad \text{Bending length of post}$$

$$d_{post} = 8 \text{ in} \quad \text{Minimum unbraced dimension of post}$$

$$K_e := 1.2 \quad c := 0.8 \quad E_{min\_wood} = 470000 \text{ psi} \quad E'_{min} := E_{min\_wood} \cdot C_{MEpost} \cdot C_{tpostE} \cdot C_{ipostE}$$

$$I_e := K_e \cdot L_{ypost\_bndg} \quad I_e = 166.2 \text{ in} \quad E'_{min} = 470000 \text{ psi}$$

$$F_{cE} := \frac{0.822 \cdot E'_{min}}{\left( \frac{I_e}{d_{post}} \right)^2} \quad F_{cE} = 895 \text{ psi}$$

Load duration factors ( $C_D$ ):

$$C_{Dconst} = 1.25 \quad C_{Dwind} = 1.60$$

$$C_{Dsnow} = 1.15 \quad C_{Dseismic} = 1.60$$

$$C_{Dlive} = 1.00$$

Calculate Column Stability Factor,  $C_p$ :

$$C_p := \left( \frac{1 + \frac{F_{cE}}{F_c \cdot C_D}}{2 \cdot c} \right) - \sqrt{\left( \frac{1 + \frac{F_{cE}}{F_c \cdot C_D}}{2 \cdot c} \right)^2 - \frac{F_{cE}}{F_c \cdot C_D} \cdot \frac{1}{c}} \quad C_{p\_Lr} = 0.56 \quad C_{p\_L} = 0.64$$

$$C_{p\_S} = 0.59 \quad C_{p\_WorE} = 0.47$$

$$F_{cc\_L} := F_c \cdot C_{p\_L} \quad F_{cc\_L} = 657 \text{ psi} \quad \text{Allowable compression stress on the post; load case 1}$$

$$F_{cc\_Lr} := F_c \cdot C_{p\_Lr} \quad F_{cc\_Lr} = 571 \text{ psi} \quad \text{Allowable compression stress on the post; load case 2}$$

$$F_{cc\_S} := F_c \cdot C_{p\_S} \quad F_{cc\_S} = 603 \text{ psi} \quad \text{Allowable compression stress on the post; load case 3b \& 4b}$$

$$F_{cc\_WorE} := F_c \cdot C_{p\_WorE} \quad F_{cc\_WorE} = 476 \text{ psi} \quad \text{Allowable compression stress on the post; all load cases except as note above}$$

$$P_{deadpost} = 2365 \text{ lb} \quad \text{Axial loading per post due to roof dead load}$$

$$P_{livepost} = 0 \text{ lb} \quad \text{Axial loading per post due to live load}$$

$$P_{Lroofpost} = 7920 \text{ lb} \quad \text{Axial loading per post due to live roof load}$$

$$P_{snowpost} = 10564 \text{ lb} \quad \text{Axial loading per post due to roof snow load (load case 3b \& 4b)}$$

$$P_{snowpost\_fs} = 9979 \text{ lb} \quad \text{Axial loading per post due to roof snow load (load cases except as noted above)}$$

$$F_{b1} = 975 \text{ psi} \quad F_b := F_{b1} \cdot C_{Dwind} \cdot C_{Mbpost} \cdot C_{tpost} \cdot C_{Lypost} \cdot C_{Fbpost} \cdot C_{fupost} \cdot C_{ipost} \cdot C_{dASCE}$$

$$F_b = 1872 \text{ psi} \quad \text{Allowable bending stress per post including load factors}$$

**Check Gable Load Cases:****Load Case 1: Dead Load**

$$f_c := \frac{P_{\text{deadpost}}}{A_{\text{post}}}$$

$$f_c = 25 \text{ psi} \quad \text{Actual compression stress per post}$$

$$\text{CCFALI1} := \left( \frac{f_c}{F_{\text{cc\_L}}} \right)$$

$$\text{CCFALI1} = 0.04$$

**Load Case 2: Dead Load + Live Load**

$$f_c := \frac{P_{\text{deadpost}} + P_{\text{livepost}}}{A_{\text{post}}}$$

$$f_c = 25 \text{ psi} \quad \text{Actual compression stress per post}$$

$$\text{CCFALI2} := \left( \frac{f_c}{F_{\text{cc\_L}}} \right)$$

$$\text{CCFALI2} = 0.04$$

**Load Case 3a: Dead Load + Live Roof Load**

$$f_c := \frac{P_{\text{deadpost}} + P_{\text{Lroofpost}}}{A_{\text{post}}}$$

$$f_c = 107 \text{ psi} \quad \text{Actual compression stress per post}$$

$$\text{CCFALI3a} := \left( \frac{f_c}{F_{\text{cc\_Lr}}} \right)$$

$$\text{CCFALI3a} = 0.19$$

**Load Case 3b: Dead Load + Snow Load**

$$f_c := \frac{P_{\text{deadpost}} + P_{\text{snowpost}}}{A_{\text{post}}}$$

$$f_c = 135 \text{ psi} \quad \text{Actual compression stress per post}$$

$$\text{CCFALI3b} := \left( \frac{f_c}{F_{\text{cc\_S}}} \right)$$

$$\text{CCFALI3b} = 0.22$$

**Load Case 4a: Dead Load + 0.75 \* Live load + 0.75 \* Live Roof Load**

$$f_c := \frac{P_{\text{deadpost}} + 0.75 \cdot P_{\text{livepost}} + 0.75 \cdot P_{\text{Lroofpost}}}{A_{\text{post}}}$$

$$f_c = 87 \text{ psi} \quad \text{Actual compression stress per post}$$

$$\text{CCFALI4a} := \left( \frac{f_c}{F_{\text{cc\_Lr}}} \right)$$

$$\text{CCFALI4a} = 0.15$$

**Load Case 4b: Dead Load + 0.75 \* Live load + 0.75 \* Snow Load**

$$f_c := \frac{P_{\text{deadpost}} + 0.75 \cdot P_{\text{livepost}} + 0.75 \cdot P_{\text{snowpost}}}{A_{\text{post}}}$$

$$f_c = 107 \text{ psi} \quad \text{Actual compression stress per post}$$

$$\text{CCFALI4b} := \left( \frac{f_c}{F_{\text{cc\_S}}} \right)$$

$$\text{CCFALI4b} = 0.18$$

**Check Gable Load Cases - cont'd:****Load Case 5: Dead Load + 0.6 \* Wind Load**

$$f_{b1} := 0.6 \cdot f_{bgable\_wind}$$

$$f_{b1} = 486 \text{ psi} \quad \text{Actual bending stress on post}$$

$$f_c := \frac{P_{deadpost}}{A_{post}}$$

$$f_c = 25 \text{ psi} \quad \text{Actual compression stress per post}$$

$$CCFALI5 := \left[ \left( \frac{f_c}{F_{cc\_WorE}} \right)^2 + \frac{f_{b1}}{F_b \cdot \left( 1 - \frac{f_c}{F_{cE}} \right)} \right]$$

$$CCFALI5 = 0.27$$

**Load Case 6a: Dead Load + 0.75 \* Live Load + 0.75 \* (0.6 \* Wind Load) + 0.75 \* Live Roof Load**

$$f_{b1} := 0.75 \cdot (0.6 \cdot f_{bgable\_wind})$$

$$f_{b1} = 365 \text{ psi} \quad \text{Actual bending stress on post}$$

$$f_c := \frac{P_{deadpost} + 0.75 \cdot P_{livepost} + 0.75 \cdot P_{Lroofpost}}{A_{post}}$$

$$f_c = 87 \text{ psi} \quad \text{Actual compression stress per post}$$

$$CCFALI6a := \left[ \left( \frac{f_c}{F_{cc\_WorE}} \right)^2 + \frac{f_{b1}}{F_b \cdot \left( 1 - \frac{f_c}{F_{cE}} \right)} \right]$$

$$CCFALI6a = 0.25$$

**Load Case 6a: Dead Load + 0.75 \* Live Load + 0.75 \* (0.6 \* Wind Load) + 0.75 \* Snow Load**

$$f_{b1} := 0.75 \cdot (0.6 \cdot f_{bgable\_wind})$$

$$f_{b1} = 365 \text{ psi} \quad \text{Actual bending stress on post}$$

$$f_c := \frac{P_{deadpost} + 0.75 \cdot P_{livepost} + 0.75 \cdot P_{snowpost\_fs}}{A_{post}}$$

$$f_c = 103 \text{ psi} \quad \text{Actual compression stress per post}$$

$$CCFALI6b := \left[ \left( \frac{f_c}{F_{cc\_WorE}} \right)^2 + \frac{f_{b1}}{F_b \cdot \left( 1 - \frac{f_c}{F_{cE}} \right)} \right]$$

$$CCFALI6b = 0.27$$

**Load Case 7: 0.6 \* Dead Load + 0.6 \* Wind Load**

$$f_{b1} := 0.6 \cdot f_{bgable\_wind}$$

$$f_{b1} = 486 \text{ psi} \quad \text{Actual bending stress on post}$$

$$f_c := \frac{0.6 \cdot P_{deadpost}}{A_{post}}$$

$$f_c = 15 \text{ psi} \quad \text{Actual compression stress per post}$$

$$CCFALI7 := \left[ \left( \frac{f_c}{F_{cc\_WorE}} \right)^2 + \frac{f_{b1}}{F_b \cdot \left( 1 - \frac{f_c}{F_{cE}} \right)} \right]$$

$$CCFALI7 = 0.27$$

**Check Gable Load Cases - cont'd:**

$$E_{vpost} := 0.2 \cdot S_{DS} \cdot P_{deadpost} \quad E_{vpost} = 475 \text{ lb} \quad \text{Vertical seismic load}$$

**Load Case 8: Dead Load + 0.7 \* Vertical Seismic Load + 0.7 \* Horizontal Seismic Load**

$$f_{b1} := 0.7 \cdot f_{bseismic\_gable} \quad f_{b1} = 1768 \text{ psi} \quad \text{Actual bending stress on post}$$

$$f_c := \frac{P_{deadpost} + 0.7 \cdot E_{vpost}}{A_{post}} \quad f_c = 28 \text{ psi} \quad \text{Actual compression stress per post}$$

$$CCFALI8 := \left[ \left( \frac{f_c}{F_{cc\_WorE}} \right)^2 + \frac{f_{b1}}{F_b \cdot \left( 1 - \frac{f_c}{F_{cE}} \right)} \right] \quad CCFALI8 = 0.98$$

**Load Case 9: Dead Load + 0.525 \* Vertical Seismic Load + 0.525 \* Horizontal Seismic Load + 0.75 \* Live Load + 0.75 \* Snow Load**

$$f_{b1} := 0.525 \cdot f_{bseismic\_gable} \quad f_{b1} = 1326 \text{ psi} \quad \text{Actual bending stress on post}$$

$$f_c := \frac{P_{deadpost} + 0.525 \cdot E_{vpost} + 0.75 \cdot P_{livepost} + 0.75 \cdot P_{snowpost\_fs}}{A_{post}} \quad f_c = 105 \text{ psi} \quad \text{Actual compression stress per post}$$

$$CCFALI9 := \left[ \left( \frac{f_c}{F_{cc\_WorE}} \right)^2 + \frac{f_{b1}}{F_b \cdot \left( 1 - \frac{f_c}{F_{cE}} \right)} \right] \quad CCFALI9 = 0.85$$

**Load Case 10: Dead Load - 0.7 \* Vertical Seismic Load + 0.7 \* Horizontal Seismic Load**

$$f_{b1} := 0.7 \cdot f_{bseismic\_gable} \quad f_{b1} = 1768 \text{ psi} \quad \text{Actual bending stress on post}$$

$$f_c := \frac{P_{deadpost} - 0.7 \cdot E_{vpost}}{A_{post}} \quad f_c = 21 \text{ psi} \quad \text{Actual compression stress per post}$$

$$CCFALI10 := \left[ \left( \frac{f_c}{F_{cc\_WorE}} \right)^2 + \frac{f_{b1}}{F_b \cdot \left( 1 - \frac{f_c}{F_{cE}} \right)} \right] \quad CCFALI10 = 0.97$$

CCFALI<sub>gable</sub> = 0.98 Less than or equal to 1.00 thus OK

**EMBEDMENT FOR MAIN EAVE POST:**

Calculate the minimum required post embedment depth for lateral loading for the main posts.

Post\_is = "not constrained by a concrete slab"

Backfill\_type = "Concrete"

$V_a = 1634 \text{ lb}$  Lateral shear load at the ground line

$M_a = 18864 \text{ lb}\cdot\text{ft}$  Moment at the ground line

$d_{\text{ia\_footing}} = 2.5 \text{ ft}$  Main post footing diameter, used with concrete backfill

$b_{\text{post}} = 14.4 \text{ in}$  Diagonal dimension of main post, used with granular backfill

$S_{\text{soil}} = 100 \text{ psf}$  Lateral capacity of soil

Trial depth = 1.5 ft.- The starting depth of the post hole depth. The final post hole depth is determined by iterating to a final depth.

$d_{\text{epth\_post}} = 4.1 \text{ ft}$  This is the minimum required post embedment depth for lateral loading

**FOOTING DESIGN FOR MAIN EAVE POST:**

Determine the footing size and depth for vertical bearing for the main posts.

$q_{\text{soil}} = 1500 \text{ psf}$  Soil bearing capacity for footing

$d_{\text{ia\_footing}} = 2.5 \text{ ft}$  Footing diameter

$$A_{\text{footing}} := \pi \cdot \left( \frac{d_{\text{ia\_footing}}^2}{4} \right) \quad A_{\text{footing}} = 4.91 \text{ ft}^2 \quad \text{Footing area}$$

$P_{\text{ost\_depth}} = 5.0 \text{ ft}$  Minimum required post embedment depth

$$P_{\text{ftg\_allow}} := A_{\text{footing}} \cdot q_{\text{soil}} \cdot d_{\text{factor}} + P_{\text{skin}}$$

$P_{\text{ftg\_allow}} = 13548 \text{ lb}$  Allowable end bearing capacity of footing

$P_{\text{ftg\_applied}} = 12929 \text{ lb}$  Total applied footing load

Note that the end bearing capacity ( $P_{\text{ftg\_allow}}$ ) is greater than the combined footing load ( $P_{\text{ftg\_applied}}$ ). This is OK.

**Next, check main eave post uplift:**

$$q_{\text{uplift}} = -31.27 \text{ psf} \quad \text{Wind uplift pressure}$$

$$P_{\text{ul}} := 0.6 \cdot \left[ \left( \frac{W_{\text{bldg}}}{2} + O_{\text{verhang}} \right) \cdot B_{\text{ay}} \cdot (|q_{\text{uplift}}|) \right]$$

$$P_{\text{ul}} = 7429 \text{ lb} \quad \text{This is the uplift on one eave post}$$

Assume a total weight of roof area to be  $0.6 \cdot \text{Dead Load } (p_d)$ . The area of the roof that will tend to keep the truss post in the ground will be as follows:

$$E_{\text{post\_hole}} := 150 \cdot \text{pcf} \cdot P_{\text{ost\_depth}} \cdot \left( \pi \cdot \frac{d_{\text{ia\_footing}}^2}{4} - A_{\text{post}} \right)$$

$$E_{\text{post\_hole}} = 3182 \text{ lb} \quad \text{Weight of concrete in post hole}$$

$$W_{\text{ulr}} := \left[ 0.6 \cdot \left[ \left( \frac{W_{\text{bldg}}}{2} + O_{\text{verhang}} \right) \cdot B_{\text{ay}} \cdot p_d \right] \right] + E_{\text{post\_hole}} + P_{\text{skinU}}$$

$$W_{\text{ulr}} = 7806 \text{ lb} \quad \text{Total uplift resistance}$$

Note that the total uplift resistance ( $W_{\text{ulr}}$ ) is greater than the uplift load ( $P_{\text{ul}}$ ). This is OK.

**PURLIN DESIGN: (Worst case shown)**

The purlins simply span between pairs of trusses or rafters. Determine the adequacy of the purlins.

$$\text{Purlins} = "2 \times 6 \text{ \#2 Doug-Fir}" \quad \text{Purlin}_{\text{spacing}} = 24 \text{ in} \quad \text{o.c.}$$

$$L_{\text{purlin\_span}} = 126.5 \text{ in} \quad \text{Bending length of purlin}$$

$$w_{\text{purlin}} = 4.9 \text{ pli} \quad \text{Maximum combined distributed roof load along top edge of purlin}$$

$$M_{\text{purlin}} := \frac{w_{\text{purlin}} \cdot L_{\text{purlin\_span}}^2}{8} \quad M_{\text{purlin}} = 9804 \text{ in}\cdot\text{lb} \quad \text{Bending moment in the purlin}$$

$$f_{\text{bpurlin}} := \frac{M_{\text{purlin}}}{S_{\text{purlin}}} \quad f_{\text{bpurlin}} = 1296 \text{ psi} \quad \text{Bending stress applied to the purlin}$$

Determine the allowable member stress including load factors

$$F_{\text{bPurlin}} = 900 \text{ psi} \quad C_{\text{Dsnow}} = 1.15 \quad C_{\text{Mburlin}} = 1.00 \quad C_{\text{tpurlin}} = 1.00 \quad C_{\text{LPurlin}} = 1.00$$

$$C_{\text{Fpurlin}} = 1.30 \quad C_{\text{fupurlin}} = 1.00 \quad C_{\text{rpurlin}} = 1.15$$

$$F_{\text{bpurlin}} := F_{\text{bPurlin}} \cdot C_{\text{Dsnow}} \cdot C_{\text{Mburlin}} \cdot C_{\text{tpurlin}} \cdot C_{\text{LPurlin}} \cdot C_{\text{Fpurlin}} \cdot C_{\text{fupurlin}} \cdot C_{\text{rpurlin}}$$

$$F_{\text{bpurlin}} = 1547 \text{ psi} > f_{\text{bpurlin}} \quad \text{This is OK}$$

## MAIN POST CORBEL BLOCK DESIGN: (Worst case shown)

Determine the required number and size of bolts required in the main post corbel block.

Allowable fastener shear capacities

|                                   |                                    |
|-----------------------------------|------------------------------------|
| $Z_{Tbolt\_58} = 1590 \text{ lb}$ | Shear capacity for 5/8" dia. bolts |
| $Z_{Tbolt\_34} = 2190 \text{ lb}$ | Shear capacity for 3/4" dia. bolts |
| $Z_{Tbolt\_10} = 3600 \text{ lb}$ | Shear capacity for 1" dia. bolts   |
| $Z_{Tnail\_16d} = 122 \text{ lb}$ | Shear capacity for 16d nails       |
| $Z_{Tnail\_20d} = 147 \text{ lb}$ | Shear capacity for 20d nails       |

$P_{Tcorbel} = 12929 \text{ lb}$  Combined dead, live roof or snow, and live (if applicable) loads on corbels

**If 5/8 dia. bolts are used:**

$N_{bolts58} = 7.1$  Number of 5/8" dia. bolts required in the corbel block, if used.

**If 3/4 dia. bolts are used:**

$N_{bolts34} = 5.1$  Number of 3/4" dia. bolts required in the corbel block, if used.

**If 1 dia. bolts are used:**

$N_{bolts10} = 3.1$  Number of 1" dia. bolts required in the corbel block, if used.

**If 20d nails are to be used:**

$N_{ails20d} = 38.2$  Number of 20d nails required in each corbel block, if used.

**If 16d nails are to be used:**

$N_{ails16d} = 46.1$  Number of 16d nails required in each corbel block, if used.

**SUMMARY OF RESULTS:****Building Dimensions**

$W_{bldg} = 70 \text{ ft}$       Width of Building  
 $L_{bldg} = 65 \text{ ft}$       Length of Building  
 $H_{bldg} = 12 \text{ ft}$       Eave Height of Building  
 $O_{verhang} = 12 \text{ in}$     Length of Eave Overhang  
 $R_{pitch} = 4$       / 12 Roof pitch

**Building Design Loads**

$Roof\_dead\_load = 5 \text{ psf}$   
 $Live\_roof\_load = 20 \text{ psf}$   
 $Ground\_snow\_load = 30 \text{ psf}$   
 $Roof\_snow\_load = 26 \text{ psf}$   
 $Wind\_speed = 110 \text{ mph}$   
 $Wind\_exposure = "C"$   
 $Seismic\_Design\_Category = "D"$

**Post Details**

$Post\_size = "8 \times 12"$   
 $Post\_grade = "#1 \text{ Hem-Fir}"$   
 $Post\_usage = 98$       % Combined stress  
                                  usage of post

**Footing Details:**

$d_{ia\_footing} = 2.5 \text{ ft}$       Design Footing Diameter  
 $Postdepth = 5.0 \text{ ft}$       Design Post Depth  
 $Footingusage = 95$       % Stress usage of footing  
 $Backfill\_type = "Concrete"$

**Purlin Details:**

$Purlin1\_usage = 84$       % Stress usage of roof purlin

**Corbel Block Bolts:**

$N_{bolts58} = 7.1$       Number of 5/8" dia. bolts required in the corbel block, if used.  
 $N_{bolts34} = 5.1$       Number of 3/4" dia. bolts required in the corbel block, if used.  
 $N_{bolts10} = 3.1$       Number of 1" dia. bolts required in the corbel block, if used.  
 $N_{ails20d} = 38.2$       Number of 20d nails required in each corbel block, if used.  
 $N_{ails16d} = 46.1$       Number of 16d nails required in each corbel block, if used.

**SPECIAL NOTE:**

The drawings attendant to this calculation shall not be modified by the builder unless authorized in writing by the engineer. No special inspections are required. No structural observation by the design engineer is required.