ASD Load Combos - 1.0D + 1.00LL + 0.00LR + 0.00SL + 0.00WL
1.0D + 0.00LL + 1.00LR + 0.00SL + 0.00WL
1.0D + 0.00LL + 0.00LR + 1.00SL + 0.00WL
1.0D + 0.75LL + 0.75LR + 0.00SL + 0.00WL
1.0D + 0.75LL + 0.00LR + 0.75SL + 0.00WL
1.0D + 0.00LL + 0.00LR + 0.00SL + 0.60WL
0.6D + 0.00LL + 0.00LR + 0.00SL + 0.60WL

2018

$$LoadFactors := \begin{pmatrix} 1 & 1 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 1 & 0 \\ 1 & 0.75 & 0.75 & 0 & 0 \\ 1 & 0.75 & 0 & 0.75 & 0 \\ 1 & 0.75 & 0 & 0 & 0.6\cdot 0.75 \\ 1 & 0 & 0 & 0 & 0.6 \\ 0.6 & 0 & 0 & 0 & 0.6 \end{pmatrix} \quad LC := \begin{pmatrix} \text{"1DL+1LL"} \\ \text{"1DL+1LR"} \\ \text{"1DL+1SL"} \\ \text{"1DL+0.75LL+0.75LR"} \\ \text{"1DL+0.75LL+0.75SL"} \\ \text{"1.0DL+0.75LL+0.75*0.6*WL"} \\ \text{"1DL+0.6WL"} \\ \text{"0.6DL+0.6WL"} \end{pmatrix}$$

$$LoadFactorsnoWL := \begin{pmatrix} 1 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 \\ 1 & 0.75 & 0.75 & 0 \\ 1 & 0.75 & 0 & 0.75 \\ 1 & 0.75 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0.6 & 0 & 0 & 0 \end{pmatrix}$$

$rows(LoadFactorsnoWL) = 8$

$rows(LoadFactors) = 8$

$spa := 12in$ Spacing of wall studs

ASCE 7-10 Loading

$DL_{stud} := 2.40 \frac{kip}{ft}$ $LL_{stud} := 1.2 \frac{kip}{ft}$ $LLR_{stud} := 0.6 \frac{kip}{ft}$ $SL_{stud} := 0.6 \frac{kip}{ft}$ $\sigma_{WL} := 33psf$

$DL_{axial} := DL_{stud} \cdot spa$ $LL_{axial} := LL_{stud} \cdot spa$ $LLR_{axial} := LLR_{stud} \cdot spa$ $SL_{axial} := SL_{stud} \cdot spa$

$$vector_{load} := \begin{pmatrix} DL_{axial} \\ LL_{axial} \\ LLR_{axial} \\ SL_{axial} \end{pmatrix}$$

$Values := \text{for } i \in 1..\text{rows}(LoadFactors)$

$$Values_i \leftarrow \left(LoadFactorsnoWL^T\right)^{\langle i \rangle} \cdot vector_{load}$$

$$Values = \begin{pmatrix} 3.6 \\ 3 \\ 3 \\ 3.75 \\ 3.75 \\ 3.3 \\ 2.4 \\ 1.44 \end{pmatrix} \cdot kip \quad WL := LoadFactors^{\langle 5 \rangle} \cdot \sigma_{WL} = \begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 14.85 \\ 19.8 \\ 19.8 \end{pmatrix} \cdot psf \quad LC = \begin{pmatrix} \text{"1DL+1LL"} \\ \text{"1DL+1LR"} \\ \text{"1DL+1SL"} \\ \text{"1DL+0.75LL+0.75LR"} \\ \text{"1DL+0.75LL+0.75SL"} \\ \text{"1.0DL+0.75LL+0.75*0.6*WL"} \\ \text{"1DL+0.6WL"} \\ \text{"0.6DL+0.6WL"} \end{pmatrix} \quad CdLC := \begin{pmatrix} 1.0 \\ 1.15 \\ 1.15 \\ 1.15 \\ 1.15 \\ 1.6 \\ 1.6 \\ 1.6 \end{pmatrix}$$

Choice of Wall Stud

$b_{beam} := 1.5in = 1.5 \cdot in$

$d_{beam} :=$

2x4
2x6
2x8
2x10
2x12

$Desc := \begin{pmatrix} "2x4" \\ "2x6" \\ "2x8" \\ "2x10" \\ "2x12" \end{pmatrix}$

$Grade_{lumber} :=$

Spruce Pine Fir Stud Grade
South Pine #1

$d_{beam} = 5.5$

$S_{beam} := \dfrac{b_{beam} \cdot (d_{beam} \cdot in)^2}{6} = 7.562 \cdot in^3$

$A_{beam} := d_{beam} \cdot in \cdot b_{beam} = 8.25 \cdot in^2$

$I_{beam} := \dfrac{1}{12} \cdot b_{beam} \cdot (d_{beam} \cdot in)^3 = 20.797 \cdot in^4$

$Q_{beam} := b_{beam} \cdot \dfrac{d_{beam} \cdot in}{2} \cdot \dfrac{d_{beam} \cdot in}{4} = 5.672 \cdot in^3$

$F_{blist} := \begin{pmatrix} 675 & 1500 \\ 675 & 1350 \\ 0 & 1250 \\ 0 & 1050 \\ 0 & 1000 \end{pmatrix} psi \qquad Desc = \begin{pmatrix} "2x4" \\ "2x6" \\ "2x8" \\ "2x10" \\ "2x12" \end{pmatrix}$

Bending Alllowables

SPF SP

$F_b := F_{blist_{Choice, Grade_{lumber}}} = 675 \cdot psi$

$C_{flist} := \begin{pmatrix} 1.1 & 1.0 \\ 1.1 & 1.0 \\ 1.0 & 1.0 \\ 1.0 & 1.0 \\ 1.0 & 1.0 \end{pmatrix} \quad Desc = \begin{pmatrix} "2x4" \\ "2x6" \\ "2x8" \\ "2x10" \\ "2x12" \end{pmatrix}$

For Spruce Pine Fir see page 30 of reference design values in NDS
For Souther Pine #1, see page C.f terms have already been accounted for

SPF SP

$$C_f := C_{flist_{Choice,\,Grade_{lumber}}} = 1.1$$

$$F_{tlist} := \begin{pmatrix} 350 & 1000 \\ 350 & 875 \\ 0 & 800 \\ 0 & 700 \\ 0 & 650 \end{pmatrix} psi \qquad Desc = \begin{pmatrix} "2x4" \\ "2x6" \\ "2x8" \\ "2x10" \\ "2x12" \end{pmatrix}$$

$$F_t := F_{tlist_{Choice, Grade_{lumber}}} = 350 \cdot psi$$

Tension parallel to the grain

$$F_{vlist} := \begin{pmatrix} 135 & 175 \\ 135 & 175 \\ 0 & 175 \\ 0 & 175 \\ 0 & 175 \end{pmatrix} psi \qquad Desc = \begin{pmatrix} "2x4" \\ "2x6" \\ "2x8" \\ "2x10" \\ "2x12" \end{pmatrix}$$

$$F_v := F_{vlist_{Choice, Grade_{lumber}}} = 135 \cdot psi$$

Shear parallel to grain

$$F_{cperplist} := \begin{pmatrix} 425 & 565 \\ 425 & 565 \\ 0 & 565 \\ 0 & 565 \\ 0 & 565 \end{pmatrix} psi \qquad Desc = \begin{pmatrix} "2x4" \\ "2x6" \\ "2x8" \\ "2x10" \\ "2x12" \end{pmatrix}$$

$$F_{cperp} := F_{cperplist_{Choice, Grade_{lumber}}} = 425 \cdot psi$$

Compression perpendicular to the grain

$$F_{clist} := \begin{pmatrix} 725 & 1650 \\ 725 & 1550 \\ 0 & 1500 \\ 0 & 1450 \\ 0 & 1400 \end{pmatrix} psi \qquad Desc = \begin{pmatrix} "2x4" \\ "2x6" \\ "2x8" \\ "2x10" \\ "2x12" \end{pmatrix}$$

$$F_c := F_{clist_{Choice, Grade_{lumber}}} = 725 \cdot psi$$

Compression parallel to grain

$$E_{list} := \begin{pmatrix} 1200000 & 1600000 \\ 1200000 & 1600000 \\ 0 & 1600000 \\ 0 & 1600000 \\ 0 & 1600000 \end{pmatrix} psi \qquad Desc = \begin{pmatrix} "2x4" \\ "2x6" \\ "2x8" \\ "2x10" \\ "2x12" \end{pmatrix}$$

$$E := E_{list_{Choice\,,\,Grade_{lumber}}} = 1200 \cdot ksi$$

MOE of the wood

$$E_{minlist} := \begin{pmatrix} 440000 & 580000 \\ 440000 & 580000 \\ 0 & 580000 \\ 0 & 580000 \\ 0 & 580000 \end{pmatrix} psi \qquad Desc = \begin{pmatrix} \text{"2x4"} \\ \text{"2x6"} \\ \text{"2x8"} \\ \text{"2x10"} \\ \text{"2x12"} \end{pmatrix}$$

$$E_{min} := E_{minlist_{Choice\,,\,Grade_{lumber}}} = 440 \cdot ksi$$

Min MOE

$$G_{woodlist} := \begin{pmatrix} 0.42 & 0.55 \\ 0.42 & 0.55 \\ 0 & 0.55 \\ 0 & 0.55 \\ 0 & 0.55 \end{pmatrix} \qquad Desc = \begin{pmatrix} \text{"2x4"} \\ \text{"2x6"} \\ \text{"2x8"} \\ \text{"2x10"} \\ \text{"2x12"} \end{pmatrix}$$

$$G_{wood} := G_{woodlist_{Choice\,,\,Grade_{lumber}}} = 0.42$$

Specific Gravity of wood

$$Design_{values} := \begin{pmatrix} F_b \\ F_t \\ F_v \\ F_{cperp} \\ F_c \\ E \\ E_{min} \end{pmatrix} \qquad C_{mtest} := \begin{pmatrix} 0.85 \\ 1.0 \\ 0.97 \\ 0.67 \\ 0.8 \\ 0.9 \\ 0.9 \end{pmatrix}$$

$Wet_{wood} :=$

Wood Dry
Wood Wet

$$C_m := \begin{cases} C_{mtest} & \text{if } Wet_{wood} = \text{"Wood Wet"} \\ \left(\begin{pmatrix} 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \end{pmatrix}\right) & \text{if } Wet_{wood} = \text{"Wood Dry"} \end{cases}$$

$$C_m = \begin{pmatrix} 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \end{pmatrix}$$

$$C_d := \begin{pmatrix} 0.9 \\ 1.0 \\ 1.15 \\ 1.25 \\ 1.6 \\ 2.0 \end{pmatrix} \qquad C_{ddescription} := \begin{pmatrix} \text{"Dead Load"} \\ \text{"Occupancy Live Load"} \\ \text{"Snow Load"} \\ \text{"Construction Load"} \\ \text{"Wind/Eq"} \\ \text{"Impact Load"} \end{pmatrix}$$

Beam Design

$l_u := 10ft = 10\,ft$ Unbraced legnth

$$l_e := \begin{cases} (2.06 \cdot l_u) & \text{if } \dfrac{l_u}{d_{beam} \cdot in} < 7 \\ (1.63 \cdot l_u + 3 \cdot d_{beam} \cdot in) & \text{if } \dfrac{l_u}{d_{beam} \cdot in} \ge 7 \end{cases}$$

This assumes a unfirmly distributed load on a simple span beam

$l_e = 17.675\,ft$ Effective Length

$$R_B := \sqrt{\frac{l_e \cdot d_{beam} \cdot in}{b_{beam}^2}} = 22.77$$

$$F_{be} := \frac{1.2 \cdot E_{min}}{R_B^2} = 1018.388 \cdot psi$$

$C_r := 1.15$ Repetive Member Factor

$C_i := 1.0$ Incising Factor

$C_{fu} := 1.0$ Flat use factor

$$F_{bstar} := \overrightarrow{\left(F_b \cdot C_d \cdot C_{m_1} \cdot C_t \cdot C_f \cdot C_i \cdot C_r\right)} = \begin{pmatrix} 768.487 \\ 853.875 \\ 981.956 \\ 1067.344 \\ 1366.2 \\ 1707.75 \end{pmatrix} \cdot psi$$

$$C_L := \frac{1 + \left(\frac{F_{be}}{F_{bstar}}\right)}{1.9} - \sqrt{\left[\frac{1 + \left(\frac{F_{be}}{F_{bstar}}\right)}{1.9}\right]^2 - \frac{\frac{F_{be}}{F_{bstar}}}{0.95}} = \begin{pmatrix} 0.903 \\ 0.878 \\ 0.832 \\ 0.797 \\ 0.675 \\ 0.561 \end{pmatrix}$$

Do you consider The Stud To be fully braced in bending (consider suction load on face that no sheathing existings)

$Stud_{bracing} :=$

Stud not fully brace

Stud fully braced

$$C_L = \begin{pmatrix} 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \end{pmatrix}$$

$$F_{bprime} := \overrightarrow{\left(F_b \cdot C_d \cdot C_{m_1} \cdot C_t \cdot C_L \cdot C_f \cdot C_{fu} \cdot C_i \cdot C_r\right)} = \begin{pmatrix} 768.487 \\ 853.875 \\ 981.956 \\ 1067.344 \\ 1366.2 \\ 1707.75 \end{pmatrix} \cdot psi$$

Bending allowable stress

$F_{cperp} = 425 \cdot psi$

$b_{beam} = 1.5 \cdot in$

$d_{beam} = 5.5$

$L_{bearing} := b_{beam}$

$$C_b := \frac{\dfrac{L_{bearing}}{in} + 0.375}{\dfrac{L_{bearing}}{in}} = 1.25$$

3.10.4 NDS

$F_{cperpprime} := F_{cperp} \cdot C_{m_4} \cdot C_t \cdot C_i \cdot C_b = 531.25 \cdot psi$

$A_{brg} := b_{beam} \cdot in \cdot d_{beam} = 8.25 \cdot in^2$

$Crushing_{load} := F_{cperpprime} \cdot A_{brg} = 4.383 \cdot kip$

Sill Plate Crushing loading

$l_e := l_u = 10\ ft$

$$F_{cstar} := F_c \cdot C_d \cdot C_{m_5} \cdot C_t \cdot C_f \cdot C_i = \begin{pmatrix} 717.75 \\ 797.5 \\ 917.125 \\ 996.875 \\ 1276 \\ 1595 \end{pmatrix} \cdot psi$$

$l_{e1} := l_u = 10\,ft$ Assume that the stud is not braced in the strong axis

$l_{e2} := 0.001in = 0\,ft$ Assume that sheathing fully braces the stud in the weak axis

$$F_{ce1} := \frac{0.822 \cdot E_{min}}{\left(\frac{l_{e1}}{d_{beam} \cdot in}\right)^2} = 0.76 \cdot ksi \qquad F_{ce2} := \frac{0.822 \cdot E_{min}}{\left(\frac{l_{e2}}{b_{beam}}\right)^2} = 8.138 \times 10^8 \cdot ksi$$

$c_{wood} := 0.8$ For Sawn lumber c = 0.8 per 3.7

$$C_{p1} := \frac{1 + \left(\frac{F_{ce1}}{F_{cstar}}\right)}{2 \cdot c_{wood}} - \sqrt{\left[\frac{1 + \left(\frac{F_{ce1}}{F_{cstar}}\right)}{2 \cdot c_{wood}}\right]^2 - \frac{\frac{F_{ce1}}{F_{cstar}}}{c_{wood}}} = \begin{pmatrix} 0.71 \\ 0.674 \\ 0.623 \\ 0.591 \\ 0.497 \\ 0.417 \end{pmatrix} \qquad C_{p2} := \frac{1 + \left(\frac{F_{ce2}}{F_{cstar}}\right)}{2 \cdot c_{wood}} - \sqrt{\left[\frac{1 + \left(\frac{F_{ce2}}{F_{cstar}}\right)}{2 \cdot c_{wood}}\right]^2 - \frac{\frac{F_{ce2}}{F_{cstar}}}{c_{wood}}} = \begin{pmatrix} 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \end{pmatrix}$$

$$C_{p1} = \begin{pmatrix} 0.71 \\ 0.674 \\ 0.623 \\ 0.591 \\ 0.497 \\ 0.417 \end{pmatrix}$$

$$F_{cPrime} := \overrightarrow{\left(F_c \cdot C_d \cdot C_{m_5} \cdot C_t \cdot C_f \cdot C_i \cdot C_{p1}\right)} = \begin{pmatrix} 509.806 \\ 537.516 \\ 571.174 \\ 589.335 \\ 634.352 \\ 664.767 \end{pmatrix} \cdot psi \qquad F_{cprime2} := \overrightarrow{\left(F_c \cdot C_d \cdot C_{m_5} \cdot C_t \cdot C_f \cdot C_i \cdot C_{p2}\right)} = \begin{pmatrix} 717.75 \\ 797.5 \\ 917.125 \\ 996.875 \\ 1276 \\ 1595 \end{pmatrix} psi$$

$$Axial_{allowableStuds} := \overrightarrow{\left(F_{cPrime} \cdot d_{beam} \cdot in \cdot b_{beam}\right)} = \begin{pmatrix} 4.206 \\ 4.435 \\ 4.712 \\ 4.862 \\ 5.233 \\ 5.484 \end{pmatrix} \cdot kip$$

Allowable Axial Load through the stud

Section 3.9.2 Bending and Axial Compression

$$F_{cPrime} = \begin{pmatrix} 509.806 \\ 537.516 \\ 571.174 \\ 589.335 \\ 634.352 \\ 664.767 \end{pmatrix} \cdot psi \qquad F_{bprime} = \begin{pmatrix} 768.487 \\ 853.875 \\ 981.956 \\ 1067.344 \\ 1366.2 \\ 1707.75 \end{pmatrix} \cdot psi \qquad C_d = \begin{pmatrix} 0.9 \\ 1 \\ 1.15 \\ 1.25 \\ 1.6 \\ 2 \end{pmatrix}$$

Compression values

Bending Values

$$Quantity := 100$$

$$f_c := \text{for } i \in 1..Quantity + 1$$
$$\quad f_{c_i} \leftarrow 0psi + \frac{F_{cPrime_1}}{Quantity} \cdot (i-1)$$

$$f_{ctemp} := \text{for } i \in 1..rows\left(F_{cPrime}\right)$$
$$\quad \text{for } j \in 1..Quantity + 1$$
$$\quad\quad f_{ctemp_{i,j}} \leftarrow 0psi + \frac{F_{cPrime_i}}{Quantity} \cdot (j-1)$$

$$f_{b1temp} := \text{for } i \in 1..rows\left(F_{cPrime}\right)$$
$$\quad \text{for } j \in 1..rows\left(f_c\right)$$
$$\quad\quad f_{b1temp_{i,j}} \leftarrow \left[1 - \left(\frac{f_{ctemp_{i,j}}}{F_{cPrime_i}}\right)^2\right] \cdot \left[F_{bprime_i} \cdot \left(1 - \frac{f_{ctemp_{i,j}}}{F_{ce1}}\right)\right]$$

$$f_{b2temp} := \text{for } i \in 1..rows\left(F_{cPrime}\right)$$
$$\quad \text{for } j \in 1..rows\left(f_c\right)$$
$$\quad\quad f_{b2temp_{i,j}} \leftarrow \sqrt{1 - \left(\frac{f_{ctemp_{i,j}}}{F_{ce2}}\right)} \cdot F_{be}$$

$$f_{cactual} := \frac{Values}{A_{beam}} = \begin{pmatrix} 436.364 \\ 363.636 \\ 363.636 \\ 454.545 \\ 454.545 \\ 400 \\ 290.909 \\ 174.545 \end{pmatrix} psi \qquad f_{bactual} := \frac{\frac{WL \cdot spa \cdot l_u^2}{8}}{S_{beam}} = \begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 294.545 \\ 392.727 \\ 392.727 \end{pmatrix} psi$$

$$F_{bprimeact} := \text{for } i \in 1..rows(LoadFactors)$$
$$\begin{aligned} & F_{bprimeact_i} \leftarrow 1 \text{ if } CdLC_i = 0.9 \\ & F_{bprimeact_i} \leftarrow 2 \text{ if } CdLC_i = 1.0 \\ & F_{bprimeact_i} \leftarrow 3 \text{ if } CdLC_i = 1.15 \\ & F_{bprimeact_i} \leftarrow 4 \text{ if } CdLC_i = 1.25 \\ & F_{bprimeact_i} \leftarrow 5 \text{ if } CdLC_i = 1.6 \\ & F_{bprimeact_i} \leftarrow 6 \text{ if } CdLC_i = 2.0 \end{aligned}$$

$$DCR_{loadcombination} := \text{for } i \in 1..rows(LoadFactors)$$
$$DCR_{loadcombination_i} \leftarrow \left[\frac{f_{cactual_i}}{F_{cPrime}\left(F_{bprimeact_i}\right)}\right]^2 + \frac{f_{bactual_i}}{F_{bprime}\left(F_{bprimeact_i}\right) \cdot \left(1 - \frac{f_{cactual_i}}{F_{ce1}}\right)}$$

$$DCR_{loadcombination} = \begin{pmatrix} 0.659 \\ 0.405 \\ 0.405 \\ 0.633 \\ 0.633 \\ 0.853 \\ 0.676 \\ 0.449 \end{pmatrix}$$

$f_{c1cd} := \left(f_{ctemp}{}^T\right)^{\langle 1 \rangle}$ $f_{c2cd} := \left(f_{ctemp}{}^T\right)^{\langle 2 \rangle}$ $f_{c3cd} := \left(f_{ctemp}{}^T\right)^{\langle 3 \rangle}$ $f_{c4cd} := \left(f_{ctemp}{}^T\right)^{\langle 4 \rangle}$ $f_{c5cd} := \left(f_{ctemp}{}^T\right)^{\langle 5 \rangle}$ $f_{c6cd} := \left(f_{ctemp}{}^T\right)^{\langle 6}$

$f_{b1cd} := \left(f_{b1temp}{}^T\right)^{\langle 1 \rangle}$ $f_{b2cd} := \left(f_{b1temp}{}^T\right)^{\langle 2 \rangle}$ $f_{b3cd} := \left(f_{b1temp}{}^T\right)^{\langle 3 \rangle}$ $f_{b4cd} := \left(f_{b1temp}{}^T\right)^{\langle 4 \rangle}$ $f_{b5cd} := \left(f_{b1temp}{}^T\right)^{\langle 5 \rangle}$ $f_{b6cd} := \left(f_{b1temp}{}^T\right)^{\langle}$

$f_{b1cd2} := \left(f_{b2temp}{}^{T}\right)^{\langle 1\rangle}$ $f_{b2cd2} := \left(f_{b2temp}{}^{T}\right)^{\langle 2\rangle}$ $f_{b3cd2} := \left(f_{b2temp}{}^{T}\right)^{\langle 3\rangle}$ $f_{b4cd2} := \left(f_{b2temp}{}^{T}\right)^{\langle 4\rangle}$ $f_{b5cd2} := \left(f_{b2temp}{}^{T}\right)^{\langle 5\rangle}$ $f_{b6cd2} := \left(f_{b2temp}{}^{T}\right.$

Now let's convert fb1 in applied wind pressure. we know the following

$$M = \frac{wl^2}{8} \qquad \sigma_{bending} = \frac{M}{S}$$

$$M = S \cdot \sigma_{bending}$$

$$\frac{wl^2}{8} = S \cdot \sigma_{bending}$$

$$w = \frac{8 \cdot S \cdot \sigma_{bending}}{l^2}$$

Applied Pressure

$$\begin{aligned} Wind_{pressuretemp} := \;& \text{for } i \in 1..\text{rows}(F_{cPrime}) \\ & \quad \text{for } j \in 1..\text{rows}(f_c) \\ & \quad\quad Wind_{pressuretemp_{i,j}} \leftarrow \frac{8 \cdot S_{beam} \cdot f_{b1temp_{i,j}}}{l_u{}^2 \cdot spa} \end{aligned}$$

$$\begin{aligned} Wind_{pressuretemp2} := \;& \text{for } i \in 1..\text{rows}(F_{cPrime}) \\ & \quad \text{for } j \in 1..\text{rows}(f_c) \\ & \quad\quad Wind_{pressuretemp2_{i,j}} \leftarrow \frac{8 \cdot S_{beam} \cdot f_{b2temp_{i,j}}}{l_u{}^2 \cdot spa} \end{aligned}$$

$$Deflection = \frac{5 \cdot Wind_{pressure} \cdot l_u{}^4}{384 \cdot E \cdot I}$$

$$Lover600 := \frac{l_u}{600} = 0.2 \cdot in \qquad Lover360 := \frac{l_u}{360} = 0.333 \cdot in \qquad Lover240 := \frac{l_u}{240} = 0.5 \cdot in$$

$$\sigma_{Lover600} := \frac{Lover600 \cdot 384 \cdot E \cdot I_{beam}}{5 \cdot l_u{}^4 \cdot spa} = 22.183 \cdot psf \qquad \sigma_{Lover360} := \frac{Lover360 \cdot 384 \cdot E \cdot I_{beam}}{5 \cdot l_u{}^4 \cdot spa} = 36.972 \cdot psf \qquad \sigma_{Lover240} := \frac{Lover240 \cdot 384 \cdot E \cdot I}{5 \cdot l_u{}^4 \cdot spa}$$

$Lover600 := \text{for } i \in 1..\text{rows}(f_c)$ $\quad Lover600_i \leftarrow \sigma_{Lover600}$

$Lover360 := \text{for } i \in 1..\text{rows}(f_c)$ $\quad Lover360_i \leftarrow \sigma_{Lover360}$

$Lover240 := \text{for } i \in 1..\text{rows}(f_c)$ $\quad Lover240_i \leftarrow \sigma_{Lover240}$

Now let's convert f.c into plf term

$$f_c = \frac{P_{load}}{A_{stud}}$$

$$PLF_{stud} := \text{for } i \in 1..\text{rows}(f_c) \quad PLF_{stud_i} \leftarrow \frac{f_{c_i} \cdot A_{beam}}{ft}$$

$$PLF_{studtemp} := \text{for } i \in 1..\text{rows}(F_{cPrime}) \quad \text{for } j \in 1..\text{rows}(f_c) \quad PLF_{studtemp_{i,j}} \leftarrow f_{ctemp_{i,j}} \cdot A_{beam}$$

$PLF1 := \left(PLF_{studtemp}^{T}\right)^{\langle 1 \rangle}$ $\quad PLF2 := \left(PLF_{studtemp}^{T}\right)^{\langle 2 \rangle}$ $\quad PLF3 := \left(PLF_{studtemp}^{T}\right)^{\langle 3 \rangle}$ $\quad PLF4 := \left(PLF_{studtemp}^{T}\right)^{\langle 4 \rangle}$ $\quad$ PI

$PSF1 := \left(Wind_{pressuretemp}^{T}\right)^{\langle 1 \rangle}$ $\quad PSF2 := \left(Wind_{pressuretemp}^{T}\right)^{\langle 2 \rangle}$ $\quad PSF3 := \left(Wind_{pressuretemp}^{T}\right)^{\langle 3 \rangle}$ $\quad PSF4 := \left(Wind_{pressuretemp}^{T}\right)^{\langle 4 \rangle}$

$PSF1_2 := \left(Wind_{pressuretemp2}^{T}\right)^{\langle 1 \rangle}$ $\quad PSF2_2 := \left(Wind_{pressuretemp2}^{T}\right)^{\langle 2 \rangle}$ $\quad PSF3_2 := \left(Wind_{pressuretemp2}^{T}\right)^{\langle 3 \rangle}$ $\quad PSF4_2 := \left(Wind_{pressuretemp2}^{T}\right)^{\langle 4 \rangle}$

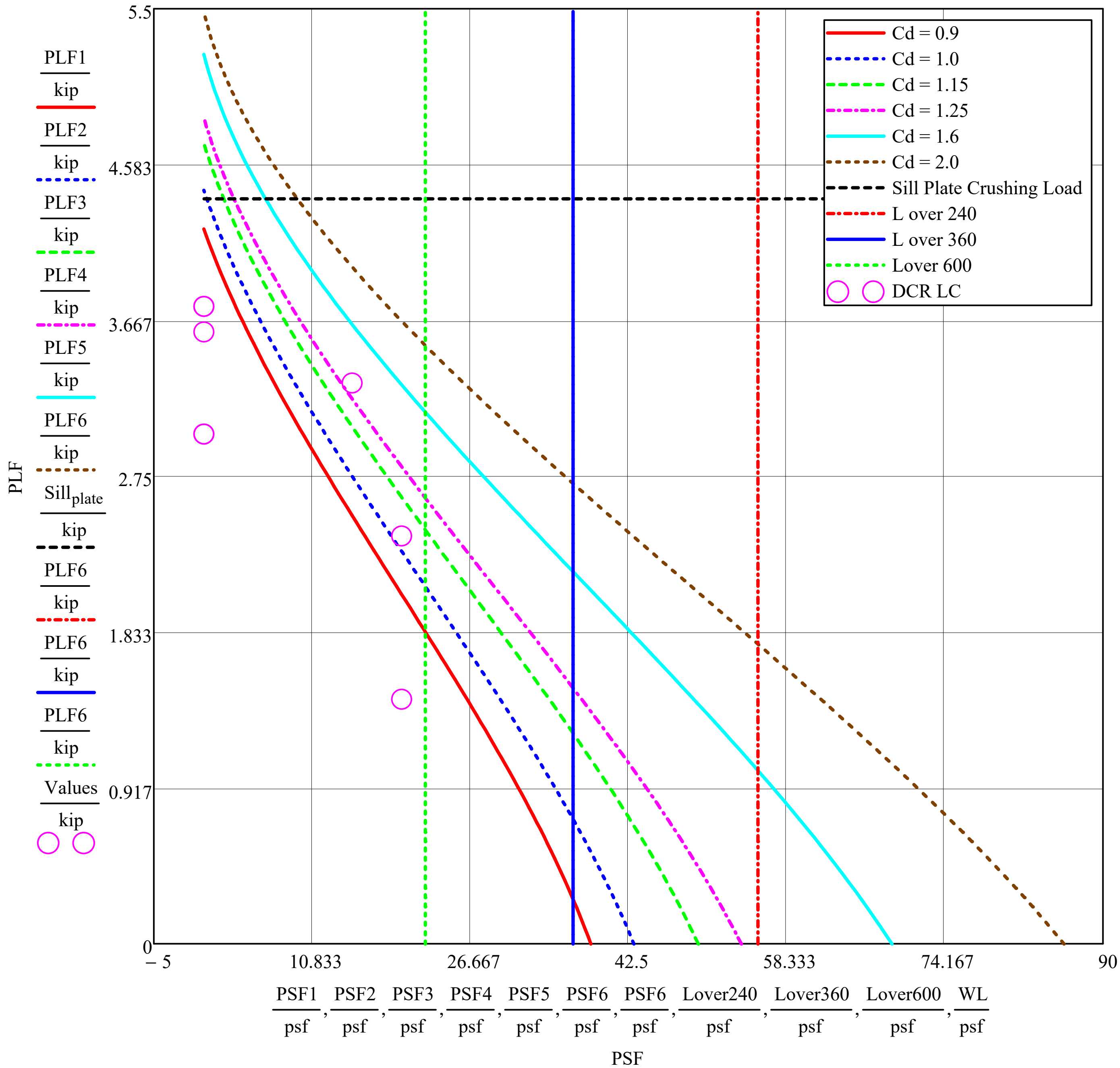
Sill Plate crushing

$Crushing_{load} = 4.383 \cdot kip$

$$Sill_{plate} := \begin{array}{l} \text{for } i \in 1..rows(f_c) \\ \quad Sill_{plate_i} \leftarrow Crushing_{load} \end{array}$$

$$Maxstud := ceil\left(\frac{\frac{max(PLF6)}{kip}}{0.5}\right) \cdot 0.5 = 5.5$$

$$Maxvalue := ceil\left(\frac{\frac{max(PSF6)}{psf}}{5}\right) \cdot 5 = 90$$



5.5
4.583
3.667
2.75
1.833
0.917
0
– 5
10.833
26.667
42.5
58.333
74.167
90
PLF
PLF1 / kip
PLF2 / kip
PLF3 / kip
PLF4 / kip
PLF5 / kip
PLF6 / kip
Sill plate / kip
PLF6 / kip
PLF6 / kip
PLF6 / kip
Values / kip
PSF1/psf, PSF2/psf, PSF3/psf, PSF4/psf, PSF5/psf, PSF6/psf, PSF6/psf, Lover240/psf, Lover360/psf, Lover600/psf, WL/psf
PSF
Cd = 0.9
Cd = 1.0
Cd = 1.15
Cd = 1.25
Cd = 1.6
Cd = 2.0
Sill Plate Crushing Load
L over 240
L over 360
Lover 600
DCR LC

$$DCR_{loadcombination} = \begin{pmatrix} 65.904 \\ 40.532 \\ 40.532 \\ 63.331 \\ 63.331 \\ 85.29 \\ 67.612 \\ 44.89 \end{pmatrix} \%$$

$$LC = \begin{pmatrix} \text{"1DL+1LL"} \\ \text{"1DL+1LR"} \\ \text{"1DL+1SL"} \\ \text{"1DL+0.75LL+0.75LR"} \\ \text{"1DL+0.75LL+0.75SL"} \\ \text{"1.0DL+0.75LL+0.75*0.6*WL"} \\ \text{"1DL+0.6WL"} \\ \text{"0.6DL+0.6WL"} \end{pmatrix}$$

$$CdLC = \begin{pmatrix} 1 \\ 1.15 \\ 1.15 \\ 1.15 \\ 1.15 \\ 1.6 \\ 1.6 \\ 1.6 \end{pmatrix}$$

$spa = 12\,in$ $\quad l_u = 10\,ft$

$$Values = \begin{pmatrix} 3.6 \\ 3 \\ 3 \\ 3.75 \\ 3.75 \\ 3.3 \\ 2.4 \\ 1.44 \end{pmatrix} \cdot kip \quad WL = \begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 14.85 \\ 19.8 \\ 19.8 \end{pmatrix} \cdot psf$$