



canyons STRUCTURAL CONSULTING

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STRUCTURAL CALCULATIONS

A NEW DESIGN FOR: BROWNING SKI LODGE
SEPTEMBER 2017

7977 HEARTWOOD DRIVE
EDEN, WEBER COUNTY, UT

PROJECT ARCHITECT OR DESIGNER

P+K DESIGNERS



Sep 29, 2017

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GRAVITY LOADS - flat warm roof, worst case

Roof Snow Load:

Elevation := 8800 $A_o := 4.5$ $P_o := 43$ $A := \frac{\text{Elevation}}{1000}$

$$P_g := \text{if} \left[A \leq A_o, P_o, \left[P_o^2 + (S)^2 \cdot (A - A_o)^2 \right]^{\frac{1}{2}} \right] \cdot \text{psf}$$

Ground Snow Load $P_g = 274 \text{ psf}$

rise := 5·in run := 12·in

Roof temp (ASCE 7-05, t7-3) $C_t := 1.0$

Ct 1.0 if warm
1.1 if cold vented
1.2 if cold unvented

Roofing is "metal" or "other" surface := metal

Snow Exposure Factor $C_e := 1.0$

Importance Factor $I := 1.0$

Roof Snow (ASCE-7) $P_f := 0.7 C_e \cdot C_t \cdot I \cdot P_g$

$$C_s := \begin{cases} \text{if surface} = \text{other} \\ \left| \begin{array}{l} a \leftarrow \begin{cases} (\text{ang1} \cdot \text{deg}) & \text{if pitch} < \text{ang1} \cdot \text{deg} \\ (70 \cdot \text{deg}) & \text{if pitch} > 70 \cdot \text{deg} \\ \text{pitch} & \text{otherwise} \end{cases} \\ \frac{70 \cdot \text{deg} - a}{\text{ang2} \cdot \text{deg}} \\ \text{break} \end{array} \right. \\ a \leftarrow \text{if}(\text{pitch} > 70 \cdot \text{deg}, 70 \cdot \text{deg}, \text{pitch}) \\ \frac{65 \cdot \text{deg} - a}{\text{ang3} \cdot \text{deg}} & \text{if surface} = \text{metal} \end{cases}$$

ang1 = 30

ang2 = 40

ang3 = 65

$P_g = 274 \text{ psf}$

$P_f = 192 \text{ psf}$

$C_s = 0.652$

$P_s := \text{if}(C_s \cdot P_f \leq 30 \cdot \text{psf}, 30 \cdot \text{psf}, C_s \cdot P_f)$

$P_s = 125.187 \text{ psf}$

| County | Po (psf) | Ao (ft./1000) |
|------------|----------|---------------|
| BEAVER | 71 | 6.2 |
| BOX ELDER | 43 | 5.2 |
| CACHE | 50 | 4.5 |
| CARBON | 43 | 5.2 |
| DAGGETT 43 | 6.5 | |
| DAVIS | 43 | 4.5 |
| DUCHESNE | 43 | 66.5 |
| EMERY | 43 | 66.0 |
| GARFIELD | 43 | 6.0 |
| GRAND | 36 | 6.5 |
| IRON | 43 | 5.8 |
| JUAB | 43 | 5.2 |
| KANE | 36 | 5.7 |
| MILLARD | 43 | 5.3 |
| MORGAN | 57 | 4.5 |
| PIUTE | 43 | 6.2 |
| RICH | 57 | 4.1 |
| SALT LAKE | 43 | 4.5 |
| SAN JUAN | 43 | 6.5 |
| SANPETE | 43 | 5.2 |
| SEVIER | 43 | 6.0 |
| SUMMIT | 86 | 5.0 |
| TOOELE | 43 | 4.5 |
| UINTAH | 43 | 7.0 |
| UTAH | 43 | 4.5 |
| WASATCH86 | 5.0 | |
| WASHINGTON | 29 | 6.0 |
| WAYNE | 36 | 6.5 |
| WEBER | 43 | 4.5 |

ROOF Snow is $P_s = 125 \text{ psf}$ (192 psf for flat roof)

FLOOR LL is 40 psf; BALCONY LL is 60 psf (when applicable)

ROOF DL's

Roofing ----- $R_{rf} := 5 \cdot \text{psf}$

Sheathing ----- $S_{rf} := 2.2 \cdot \text{psf}$

Insulation ----- $I_{rf} := 0.5 \cdot \text{psf}$

Fixtures ----- $E_{rf} := 0.5 \cdot \text{psf}$

Ceiling ----- $C_{rf} := 2.2 \cdot \text{psf}$

Rafters ----- $SP_{rf} := 2.5 \cdot \text{psf}$

Beams ----- $P_{rf} := 2.0 \cdot \text{psf}$

TOTAL ROOF DL

$$TL_{rf} := R_{rf} + S_{rf} + I_{rf} + E_{rf} + C_{rf} + SP_{rf} + P_{rf}$$

$$TL_{rf} = 14.9 \text{ psf}$$

FLOOR DL's

Floor Finish ----- $F_{flr} := 2.5 \cdot \text{psf}$

Sheathing ----- $S_{flr} := 2.5 \cdot \text{psf}$

Insulation ----- $I_{flr} := 0.5 \cdot \text{psf}$

Mech. & Elec. ---- $E_{flr} := 0.8 \cdot \text{psf}$

Ceiling ----- $C_{flr} := 2.2 \cdot \text{psf}$

Joists ----- $J_{flr} := 2.5 \cdot \text{psf}$

1.5" Conc. Fill ----- $CF_{flr} := 13.75 \cdot \text{psf}$

TOTAL FLOOR DL

$$TL_{flr} := F_{flr} + S_{flr} + I_{flr} + E_{flr} + C_{flr} + J_{flr} + CF_{flr}$$

$$TL_{flr} = 24.75 \text{ psf}$$

Use a typ. roof DL of 15 psf

Use a floor DL of 25 psf

CONCRETE DECK DL's

Finishes----- $F_{flr} := 2.3 \cdot \text{psf}$

Insulation----- $I_{flr} := 0.5 \cdot \text{psf}$

Fixtures----- $E_{flr} := 0.5 \cdot \text{psf}$

Ceiling----- $C_{flr} := 2.2 \cdot \text{psf}$

Joists----- $J_{flr} := 2.0 \cdot \text{psf}$

4" Concrete Slab----- $CS_{flr} := 48.33 \cdot \text{psf}$

Sheathing----- $S_{flr} := 2.5 \cdot \text{psf}$

TOTAL TERRACE DL

$TL_{flr} := F_{flr} + I_{flr} + E_{flr} + C_{flr} + J_{flr} + CS_{flr} + S_{flr}$

$TL_{flr} = 58.33 \text{ psf}$

Exterior Concrete DECK DL @ 60 psf

Exterior Concrete DECK SL @ 98 psf (cold unvented snow load)

GREEN ROOF DL's

Roofing (12" soil or 2" pavers)--- $R_{rf} := 60 \cdot \text{psf}$

Sheathing----- $S_{rf} := 2.5 \cdot \text{psf}$

Insulation----- $I_{rf} := 0.5 \cdot \text{psf}$

Fixtures----- $F_{rf} := 0.5 \cdot \text{psf}$

Ceiling----- $C_{rf} := 0 \cdot \text{psf}$

Joists----- $J_{rf} := 2.5 \cdot \text{psf}$

Electrical/Mech----- $EM_{rf} := 0.8 \cdot \text{psf}$

TOTAL ROOF DL

$TL_{rf} := R_{rf} + S_{rf} + I_{rf} + F_{rf} + C_{rf} + J_{rf} + EM_{rf}$

$TL_{rf} = 66.8 \text{ psf}$

Roof DL of 70 psf for 12" green roof

Steel Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTE-ZBB2XMC-F.Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9

Lic. #: KW-0609078

Licensee : Canyons Structural Inc

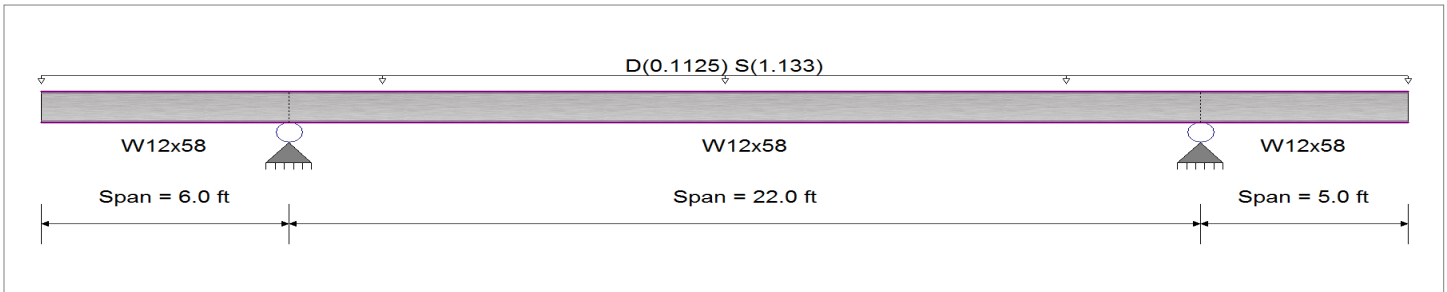
Description : RB7- Major Roof Members

CODE REFERENCES

Calculations per AISC 360-10, IBC 2015, ASCE 7-10
 Load Combination Set : IBC 2015

Material Properties

Analysis Method : Allowable Strength Design
 Beam Bracing : Beam is Fully Braced against lateral-torsional buckling
 Bending Axis : Major Axis Bending
 Fy : Steel Yield : 50.0 ksi
 E : Modulus : 29,000.0 ksi



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loading
 Loads on all spans...
 Uniform Load on ALL spans : D = 0.0150, S = 0.1510 ksf, Tributary Width = 7.50 ft

DESIGN SUMMARY

Design OK

| | | | |
|-----------------------------------|------------------|------------------------------|------------------|
| Maximum Bending Stress Ratio = | 0.274 : 1 | Maximum Shear Stress Ratio = | 0.167 : 1 |
| Section used for this span | W12x58 | Section used for this span | W12x58 |
| Ma : Applied | 59.000 k-ft | Va : Applied | 14.659 k |
| Mn / Omega : Allowable | 215.569 k-ft | Vn/Omega : Allowable | 87.840 k |
| Load Combination | +D+S+H | Load Combination | +D+S+H |
| Location of maximum on span | 11.293ft | Location of maximum on span | 6.000 ft |
| Span # where maximum occurs | Span # 2 | Span # where maximum occurs | Span # 1 |
| Maximum Deflection | | | |
| Max Downward Transient Deflection | 0.305 in | Ratio = | 865 >=480. |
| Max Upward Transient Deflection | -0.192 in | Ratio = | 624 >=480. |
| Max Downward Total Deflection | 0.351 in | Ratio = | 752 >=360. |
| Max Upward Total Deflection | -0.221 in | Ratio = | 543 >=360. |

Maximum Forces & Stresses for Load Combinations

| Load Combination | Segment Length | Span # | Max Stress Ratios | | Summary of Moment Values | | | | | | Summary of Shear Values | | | | |
|---------------------|----------------|--------|-------------------|-------|--------------------------|--------|--------|--------|-----------|------|-------------------------|--------|--------|-----------|--|
| | | | M | V | Mmax + | Mmax - | Ma Max | Mnx | Mnx/Omega | Cb | Rm | Va Max | Vnx | Vnx/Omega | |
| +D+H | | | | | | | | | | | | | | | |
| Dsgn. L = 6.00 ft | 6.00 ft | 1 | 0.014 | 0.022 | | -3.07 | 3.07 | 360.00 | 215.57 | 1.00 | 1.00 | 1.92 | 131.76 | 87.84 | |
| Dsgn. L = 22.00 ft | 22.00 ft | 2 | 0.036 | 0.022 | 7.72 | -3.07 | 7.72 | 360.00 | 215.57 | 1.00 | 1.00 | 1.92 | 131.76 | 87.84 | |
| Dsgn. L = 5.00 ft | 5.00 ft | 3 | 0.010 | 0.010 | | -2.13 | 2.13 | 360.00 | 215.57 | 1.00 | 1.00 | 0.85 | 131.76 | 87.84 | |
| +D+L+H | | | | | | | | | | | | | | | |
| Dsgn. L = 6.00 ft | 6.00 ft | 1 | 0.014 | 0.022 | | -3.07 | 3.07 | 360.00 | 215.57 | 1.00 | 1.00 | 1.92 | 131.76 | 87.84 | |
| Dsgn. L = 22.00 ft | 22.00 ft | 2 | 0.036 | 0.022 | 7.72 | -3.07 | 7.72 | 360.00 | 215.57 | 1.00 | 1.00 | 1.92 | 131.76 | 87.84 | |
| Dsgn. L = 5.00 ft | 5.00 ft | 3 | 0.010 | 0.010 | | -2.13 | 2.13 | 360.00 | 215.57 | 1.00 | 1.00 | 0.85 | 131.76 | 87.84 | |
| +D+Lr+H | | | | | | | | | | | | | | | |
| Dsgn. L = 6.00 ft | 6.00 ft | 1 | 0.014 | 0.022 | | -3.07 | 3.07 | 360.00 | 215.57 | 1.00 | 1.00 | 1.92 | 131.76 | 87.84 | |
| Dsgn. L = 22.00 ft | 22.00 ft | 2 | 0.036 | 0.022 | 7.72 | -3.07 | 7.72 | 360.00 | 215.57 | 1.00 | 1.00 | 1.92 | 131.76 | 87.84 | |
| Dsgn. L = 5.00 ft | 5.00 ft | 3 | 0.010 | 0.010 | | -2.13 | 2.13 | 360.00 | 215.57 | 1.00 | 1.00 | 0.85 | 131.76 | 87.84 | |
| +D+S+H | | | | | | | | | | | | | | | |
| Dsgn. L = 6.00 ft | 6.00 ft | 1 | 0.109 | 0.167 | | -23.45 | 23.45 | 360.00 | 215.57 | 1.00 | 1.00 | 14.66 | 131.76 | 87.84 | |
| Dsgn. L = 22.00 ft | 22.00 ft | 2 | 0.274 | 0.167 | 59.00 | -23.45 | 59.00 | 360.00 | 215.57 | 1.00 | 1.00 | 14.66 | 131.76 | 87.84 | |
| Dsgn. L = 5.00 ft | 5.00 ft | 3 | 0.076 | 0.074 | | -16.29 | 16.29 | 360.00 | 215.57 | 1.00 | 1.00 | 6.52 | 131.76 | 87.84 | |
| +D+0.750Lr+0.750L+H | | | | | | | | | | | | | | | |
| Dsgn. L = 6.00 ft | 6.00 ft | 1 | 0.014 | 0.022 | | -3.07 | 3.07 | 360.00 | 215.57 | 1.00 | 1.00 | 1.92 | 131.76 | 87.84 | |
| Dsgn. L = 22.00 ft | 22.00 ft | 2 | 0.036 | 0.022 | 7.72 | -3.07 | 7.72 | 360.00 | 215.57 | 1.00 | 1.00 | 1.92 | 131.76 | 87.84 | |
| Dsgn. L = 5.00 ft | 5.00 ft | 3 | 0.010 | 0.010 | | -2.13 | 2.13 | 360.00 | 215.57 | 1.00 | 1.00 | 0.85 | 131.76 | 87.84 | |
| +D+0.750L+0.750S+H | | | | | | | | | | | | | | | |
| Dsgn. L = 6.00 ft | 6.00 ft | 1 | 0.085 | 0.131 | | -18.36 | 18.36 | 360.00 | 215.57 | 1.00 | 1.00 | 11.47 | 131.76 | 87.84 | |
| Dsgn. L = 22.00 ft | 22.00 ft | 2 | 0.214 | 0.131 | 46.18 | -18.36 | 46.18 | 360.00 | 215.57 | 1.00 | 1.00 | 11.47 | 131.76 | 87.84 | |
| Dsgn. L = 5.00 ft | 5.00 ft | 3 | 0.059 | 0.058 | | -12.75 | 12.75 | 360.00 | 215.57 | 1.00 | 1.00 | 5.10 | 131.76 | 87.84 | |

Steel Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTE-ZBB2XMC-F.Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9

Lic. #: KW-06009078

Licensee: Canyons Structural Inc

Description: RB7- Major Roof Members

| Load Combination Segment Length | Span # | Max Stress Ratios | | Summary of Moment Values | | | | | | Summary of Shear Values | | | |
|------------------------------------|--------|-------------------|-------|--------------------------|--------|--------|--------|-----------|------|-------------------------|--------|--------|-----------|
| | | M | V | Mmax + | Mmax - | Ma Max | Mnx | Mnx/Omega | Cb | Rm | Va Max | Vnx | Vnx/Omega |
| +D+0.60W+H | | | | | | | | | | | | | |
| Dsgn. L = 6.00 ft | 1 | 0.014 | 0.022 | | -3.07 | 3.07 | 360.00 | 215.57 | 1.00 | 1.00 | 1.92 | 131.76 | 87.84 |
| Dsgn. L = 22.00 ft | 2 | 0.036 | 0.022 | 7.72 | -3.07 | 7.72 | 360.00 | 215.57 | 1.00 | 1.00 | 1.92 | 131.76 | 87.84 |
| Dsgn. L = 5.00 ft | 3 | 0.010 | 0.010 | | -2.13 | 2.13 | 360.00 | 215.57 | 1.00 | 1.00 | 0.85 | 131.76 | 87.84 |
| +D+0.70E+H | | | | | | | | | | | | | |
| Dsgn. L = 6.00 ft | 1 | 0.014 | 0.022 | | -3.07 | 3.07 | 360.00 | 215.57 | 1.00 | 1.00 | 1.92 | 131.76 | 87.84 |
| Dsgn. L = 22.00 ft | 2 | 0.036 | 0.022 | 7.72 | -3.07 | 7.72 | 360.00 | 215.57 | 1.00 | 1.00 | 1.92 | 131.76 | 87.84 |
| Dsgn. L = 5.00 ft | 3 | 0.010 | 0.010 | | -2.13 | 2.13 | 360.00 | 215.57 | 1.00 | 1.00 | 0.85 | 131.76 | 87.84 |
| +D+0.750Lr+0.750L+0.450W+H | | | | | | | | | | | | | |
| Dsgn. L = 6.00 ft | 1 | 0.014 | 0.022 | | -3.07 | 3.07 | 360.00 | 215.57 | 1.00 | 1.00 | 1.92 | 131.76 | 87.84 |
| Dsgn. L = 22.00 ft | 2 | 0.036 | 0.022 | 7.72 | -3.07 | 7.72 | 360.00 | 215.57 | 1.00 | 1.00 | 1.92 | 131.76 | 87.84 |
| Dsgn. L = 5.00 ft | 3 | 0.010 | 0.010 | | -2.13 | 2.13 | 360.00 | 215.57 | 1.00 | 1.00 | 0.85 | 131.76 | 87.84 |
| +D+0.750L+0.750S+0.450W+H | | | | | | | | | | | | | |
| Dsgn. L = 6.00 ft | 1 | 0.085 | 0.131 | | -18.36 | 18.36 | 360.00 | 215.57 | 1.00 | 1.00 | 11.47 | 131.76 | 87.84 |
| Dsgn. L = 22.00 ft | 2 | 0.214 | 0.131 | 46.18 | -18.36 | 46.18 | 360.00 | 215.57 | 1.00 | 1.00 | 11.47 | 131.76 | 87.84 |
| Dsgn. L = 5.00 ft | 3 | 0.059 | 0.058 | | -12.75 | 12.75 | 360.00 | 215.57 | 1.00 | 1.00 | 5.10 | 131.76 | 87.84 |
| +D+0.750L+0.750S+0.5250E+H | | | | | | | | | | | | | |
| Dsgn. L = 6.00 ft | 1 | 0.085 | 0.131 | | -18.36 | 18.36 | 360.00 | 215.57 | 1.00 | 1.00 | 11.47 | 131.76 | 87.84 |
| Dsgn. L = 22.00 ft | 2 | 0.214 | 0.131 | 46.18 | -18.36 | 46.18 | 360.00 | 215.57 | 1.00 | 1.00 | 11.47 | 131.76 | 87.84 |
| Dsgn. L = 5.00 ft | 3 | 0.059 | 0.058 | | -12.75 | 12.75 | 360.00 | 215.57 | 1.00 | 1.00 | 5.10 | 131.76 | 87.84 |
| +0.60D+0.60W+0.60H | | | | | | | | | | | | | |
| Dsgn. L = 6.00 ft | 1 | 0.009 | 0.013 | | -1.84 | 1.84 | 360.00 | 215.57 | 1.00 | 1.00 | 1.15 | 131.76 | 87.84 |
| Dsgn. L = 22.00 ft | 2 | 0.021 | 0.013 | 4.63 | -1.84 | 4.63 | 360.00 | 215.57 | 1.00 | 1.00 | 1.15 | 131.76 | 87.84 |
| Dsgn. L = 5.00 ft | 3 | 0.006 | 0.006 | | -1.28 | 1.28 | 360.00 | 215.57 | 1.00 | 1.00 | 0.51 | 131.76 | 87.84 |
| +0.60D+0.70E+0.60H | | | | | | | | | | | | | |
| Dsgn. L = 6.00 ft | 1 | 0.009 | 0.013 | | -1.84 | 1.84 | 360.00 | 215.57 | 1.00 | 1.00 | 1.15 | 131.76 | 87.84 |
| Dsgn. L = 22.00 ft | 2 | 0.021 | 0.013 | 4.63 | -1.84 | 4.63 | 360.00 | 215.57 | 1.00 | 1.00 | 1.15 | 131.76 | 87.84 |
| Dsgn. L = 5.00 ft | 3 | 0.006 | 0.006 | | -1.28 | 1.28 | 360.00 | 215.57 | 1.00 | 1.00 | 0.51 | 131.76 | 87.84 |

Overall Maximum Deflections

| Load Combination | Span | Max. "-" Defl | Location in Span | Load Combination | Max. "+" Defl | Location in Span |
|------------------|------|---------------|------------------|------------------|---------------|------------------|
| | 1 | 0.0000 | 0.000 | +D+S+H | -0.2341 | 0.000 |
| +D+S+H | 2 | 0.3510 | 11.147 | | 0.0000 | 0.000 |
| | 3 | 0.0000 | 11.147 | +D+S+H | -0.2210 | 5.000 |

Vertical Reactions

| Load Combination | Support notation : Far left is #1 | | | | Values in KIPS |
|----------------------------|-----------------------------------|-----------|-----------|-----------|----------------|
| | Support 1 | Support 2 | Support 3 | Support 4 | |
| Overall MAXimum | | 22.477 | 20.522 | | |
| Overall MINimum | | 1.765 | 1.611 | | |
| +D+H | | 2.941 | 2.685 | | |
| +D+L+H | | 2.941 | 2.685 | | |
| +D+Lr+H | | 2.941 | 2.685 | | |
| +D+S+H | | 22.477 | 20.522 | | |
| +D+0.750Lr+0.750L+H | | 2.941 | 2.685 | | |
| +D+0.750L+0.750S+H | | 17.593 | 16.063 | | |
| +D+0.60W+H | | 2.941 | 2.685 | | |
| +D+0.70E+H | | 2.941 | 2.685 | | |
| +D+0.750Lr+0.750L+0.450W+H | | 2.941 | 2.685 | | |
| +D+0.750L+0.750S+0.450W+H | | 17.593 | 16.063 | | |
| +D+0.750L+0.750S+0.5250E+H | | 17.593 | 16.063 | | |
| +0.60D+0.60W+0.60H | | 1.765 | 1.611 | | |
| +0.60D+0.70E+0.60H | | 1.765 | 1.611 | | |
| D Only | | 2.941 | 2.685 | | |
| Lr Only | | | | | |
| L Only | | | | | |
| S Only | | 19.536 | 17.837 | | |
| W Only | | | | | |
| E Only | | | | | |
| H Only | | | | | |

Steel Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTE-ZBB2XMC-F.Calcs\beams.ec6
ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9

Lic. #: KW-0609078

Licensee : Canyons Structural Inc

Description : RB9- Eave Beam (shallow profile max)

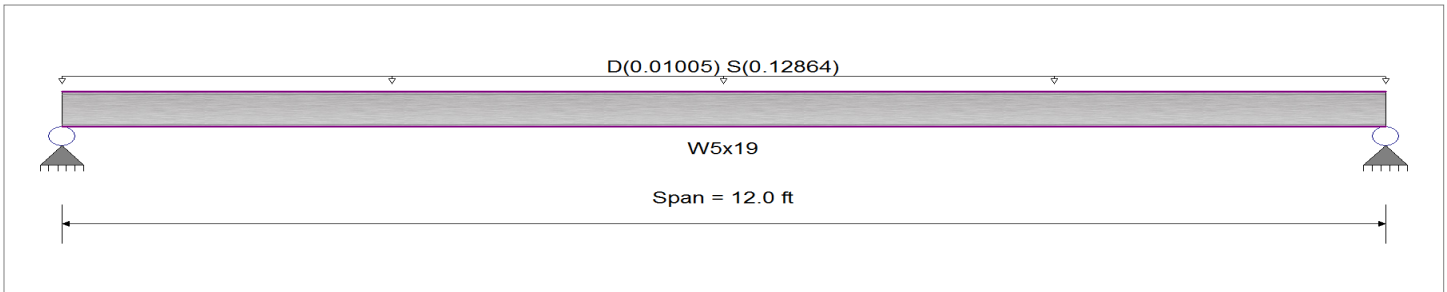
CODE REFERENCES

Calculations per AISC 360-10, IBC 2015, ASCE 7-10
Load Combination Set : IBC 2015

Material Properties

Analysis Method : Allowable Strength Design
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling
Bending Axis : Major Axis Bending

Fy : Steel Yield : 50.0 ksi
E: Modulus : 29,000.0 ksi



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loading
Uniform Load : D = 0.0150, S = 0.1920 ksf, Tributary Width = 0.670 ft

DESIGN SUMMARY

Design OK

| | | | |
|-----------------------------------|------------------|------------------------------|------------------|
| Maximum Bending Stress Ratio = | 0.098 : 1 | Maximum Shear Stress Ratio = | 0.034 : 1 |
| Section used for this span | W5x19 | Section used for this span | W5x19 |
| Ma : Applied | 2.838 k-ft | Va : Applied | 0.9461 k |
| Mn / Omega : Allowable | 28.942 k-ft | Vn/Omega : Allowable | 27.810 k |
| Load Combination | +D+S+H | Load Combination | +D+S+H |
| Location of maximum on span | 6.000ft | Location of maximum on span | 0.000 ft |
| Span # where maximum occurs | Span # 1 | Span # where maximum occurs | Span # 1 |
| Maximum Deflection | | | |
| Max Downward Transient Deflection | 0.079 in | Ratio = | 1,821 >=360 |
| Max Upward Transient Deflection | 0.000 in | Ratio = | 0 <360 |
| Max Downward Total Deflection | 0.097 in | Ratio = | 1486 >=240. |
| Max Upward Total Deflection | 0.000 in | Ratio = | 0 <240.0 |

Maximum Forces & Stresses for Load Combinations

| Load Combination | Segment Length | Span # | Max Stress Ratios | | Summary of Moment Values | | | | | | Summary of Shear Values | | | |
|----------------------------|--------------------|--------|-------------------|-------|--------------------------|--------|--------|-------|-----------|------|-------------------------|--------|-------|-----------|
| | | | M | V | Mmax + | Mmax - | Ma Max | Mnx | Mnx/Omega | Cb | Rm | Va Max | Vnx | Vnx/Omega |
| +D+H | Dsgn. L = 12.00 ft | 1 | 0.018 | 0.006 | 0.52 | | 0.52 | 48.33 | 28.94 | 1.00 | 1.00 | 0.17 | 41.72 | 27.81 |
| +D+L+H | Dsgn. L = 12.00 ft | 1 | 0.018 | 0.006 | 0.52 | | 0.52 | 48.33 | 28.94 | 1.00 | 1.00 | 0.17 | 41.72 | 27.81 |
| +D+Lr+H | Dsgn. L = 12.00 ft | 1 | 0.018 | 0.006 | 0.52 | | 0.52 | 48.33 | 28.94 | 1.00 | 1.00 | 0.17 | 41.72 | 27.81 |
| +D+S+H | Dsgn. L = 12.00 ft | 1 | 0.098 | 0.034 | 2.84 | | 2.84 | 48.33 | 28.94 | 1.00 | 1.00 | 0.95 | 41.72 | 27.81 |
| +D+0.750Lr+0.750L+H | Dsgn. L = 12.00 ft | 1 | 0.018 | 0.006 | 0.52 | | 0.52 | 48.33 | 28.94 | 1.00 | 1.00 | 0.17 | 41.72 | 27.81 |
| +D+0.750L+0.750S+H | Dsgn. L = 12.00 ft | 1 | 0.078 | 0.027 | 2.26 | | 2.26 | 48.33 | 28.94 | 1.00 | 1.00 | 0.75 | 41.72 | 27.81 |
| +D+0.60W+H | Dsgn. L = 12.00 ft | 1 | 0.018 | 0.006 | 0.52 | | 0.52 | 48.33 | 28.94 | 1.00 | 1.00 | 0.17 | 41.72 | 27.81 |
| +D+0.70E+H | Dsgn. L = 12.00 ft | 1 | 0.018 | 0.006 | 0.52 | | 0.52 | 48.33 | 28.94 | 1.00 | 1.00 | 0.17 | 41.72 | 27.81 |
| +D+0.750Lr+0.750L+0.450W+H | Dsgn. L = 12.00 ft | 1 | 0.018 | 0.006 | 0.52 | | 0.52 | 48.33 | 28.94 | 1.00 | 1.00 | 0.17 | 41.72 | 27.81 |
| +D+0.750L+0.750S+0.450W+H | Dsgn. L = 12.00 ft | 1 | 0.078 | 0.027 | 2.26 | | 2.26 | 48.33 | 28.94 | 1.00 | 1.00 | 0.75 | 41.72 | 27.81 |
| +D+0.750L+0.750S+0.5250E+H | Dsgn. L = 12.00 ft | 1 | 0.078 | 0.027 | 2.26 | | 2.26 | 48.33 | 28.94 | 1.00 | 1.00 | 0.75 | 41.72 | 27.81 |
| +0.60D+0.60W+0.60H | Dsgn. L = 12.00 ft | 1 | 0.011 | 0.004 | 0.31 | | 0.31 | 48.33 | 28.94 | 1.00 | 1.00 | 0.10 | 41.72 | 27.81 |
| +0.60D+0.70E+0.60H | | | | | | | | | | | | | | |

Steel Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTE-ZBB2XMC-F.Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9

Lic. #: KW-06009078

Licensee: Canyons Structural Inc

Description: RB9- Eave Beam (shallow profile max)

| Load Combination | Segment Length | Span # | Max Stress Ratios | | Summary of Moment Values | | | | | | Summary of Shear Values | | | |
|------------------|----------------|--------|-------------------|-------|--------------------------|--------|--------|-------|-----------|------|-------------------------|--------|-------|-----------|
| | | | M | V | Mmax + | Mmax - | Ma Max | Mnx | Mnx/Omega | Cb | Rm | Va Max | Vnx | Vnx/Omega |
| Dsgn. L = | 12.00 ft | 1 | 0.011 | 0.004 | 0.31 | | 0.31 | 48.33 | 28.94 | 1.00 | 1.00 | 0.10 | 41.72 | 27.81 |

Overall Maximum Deflections

| Load Combination | Span | Max. "-" Defl | Location in Span | Load Combination | Max. "+" Defl | Location in Span |
|------------------|------|---------------|------------------|------------------|---------------|------------------|
| +D+S+H | 1 | 0.0969 | 6.034 | | 0.0000 | 0.000 |

Vertical Reactions

| Load Combination | Support 1 | Support 2 |
|----------------------------|-----------|-----------|
| Overall MAXimum | 0.946 | 0.946 |
| Overall MINimum | 0.105 | 0.105 |
| +D+H | 0.174 | 0.174 |
| +D+L+H | 0.174 | 0.174 |
| +D+Lr+H | 0.174 | 0.174 |
| +D+S+H | 0.946 | 0.946 |
| +D+0.750Lr+0.750L+H | 0.174 | 0.174 |
| +D+0.750L+0.750S+H | 0.753 | 0.753 |
| +D+0.60W+H | 0.174 | 0.174 |
| +D+0.70E+H | 0.174 | 0.174 |
| +D+0.750Lr+0.750L+0.450W+H | 0.174 | 0.174 |
| +D+0.750L+0.750S+0.450W+H | 0.753 | 0.753 |
| +D+0.750L+0.750S+0.5250E+H | 0.753 | 0.753 |
| +0.60D+0.60W+0.60H | 0.105 | 0.105 |
| +0.60D+0.70E+0.60H | 0.105 | 0.105 |
| D Only | 0.174 | 0.174 |
| Lr Only | | |
| L Only | | |
| S Only | 0.772 | 0.772 |
| W Only | | |
| E Only | | |
| H Only | | |

Steel Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTE-ZBB2XMC-F.Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9

Lic. #: KW-06009078

Licensee: Canyons Structural Inc

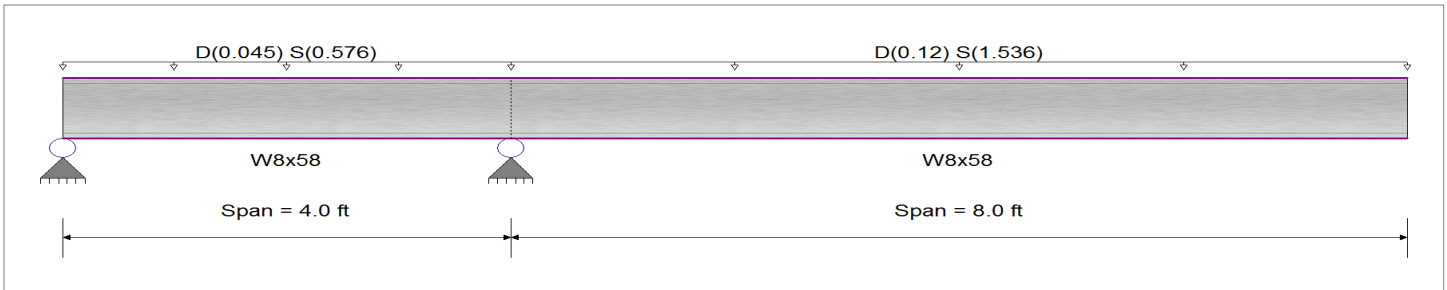
Description: RB6- Catilevered Hip Beams supporting eave (worst case)

CODE REFERENCES

Calculations per AISC 360-10, IBC 2015, ASCE 7-10
 Load Combination Set: IBC 2015

Material Properties

Analysis Method: Allowable Strength Design
 Beam Bracing: Beam is Fully Braced against lateral-torsional buckling
 Bending Axis: Major Axis Bending
 Fy: Steel Yield: 50.0 ksi
 E: Modulus: 29,000.0 ksi



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loading
 Load for Span Number 1
 Uniform Load: D = 0.0150, S = 0.1920 ksf, Tributary Width = 3.0 ft
 Load for Span Number 2
 Uniform Load: D = 0.0150, S = 0.1920 ksf, Tributary Width = 8.0 ft

DESIGN SUMMARY

Design OK

| | | | |
|-----------------------------------|------------------|------------------------------|---------------------|
| Maximum Bending Stress Ratio = | 0.368 : 1 | Maximum Shear Stress Ratio = | 0.169 : 1 |
| Section used for this span | W8x58 | Section used for this span | W8x58 |
| Ma: Applied | 54.848 k-ft | Va: Applied | 15.070 k |
| Mn / Omega: Allowable | 149.202 k-ft | Vn/Omega: Allowable | 89.250 k |
| Load Combination | +D+S+H | Load Combination | +D+S+H |
| Location of maximum on span | 4.000ft | Location of maximum on span | 4.000 ft |
| Span # where maximum occurs | Span # 1 | Span # where maximum occurs | Span # 1 |
| Maximum Deflection | | | |
| Max Downward Transient Deflection | 0.339 in | Ratio = | 566 >=480. |
| Max Upward Transient Deflection | -0.013 in | Ratio = | 3,760 >=480. |
| Max Downward Total Deflection | 0.378 in | Ratio = | 508 >=360. |
| Max Upward Total Deflection | -0.014 in | Ratio = | 3378 >=360. |

Maximum Forces & Stresses for Load Combinations

| Load Combination | Segment Length | Span # | Max Stress Ratios | | Summary of Moment Values | | | | | | Summary of Shear Values | | | |
|---------------------|----------------|--------|-------------------|-------|--------------------------|--------|--------|--------|-----------|------|-------------------------|--------|--------|-----------|
| | | | M | V | Mmax + | Mmax - | Ma Max | Mnx | Mnx/Omega | Cb | Rm | Va Max | Vnx | Vnx/Omega |
| +D+H | | | | | | | | | | | | | | |
| Dsgn. L = 4.00 ft | | 1 | 0.038 | 0.018 | | -5.70 | 5.70 | 249.17 | 149.20 | 1.00 | 1.00 | 1.63 | 133.88 | 89.25 |
| Dsgn. L = 8.00 ft | | 2 | 0.038 | 0.016 | | -5.70 | 5.70 | 249.17 | 149.20 | 1.00 | 1.00 | 1.42 | 133.88 | 89.25 |
| +D+L+H | | | | | | | | | | | | | | |
| Dsgn. L = 4.00 ft | | 1 | 0.038 | 0.018 | | -5.70 | 5.70 | 249.17 | 149.20 | 1.00 | 1.00 | 1.63 | 133.88 | 89.25 |
| Dsgn. L = 8.00 ft | | 2 | 0.038 | 0.016 | | -5.70 | 5.70 | 249.17 | 149.20 | 1.00 | 1.00 | 1.42 | 133.88 | 89.25 |
| +D+Lr+H | | | | | | | | | | | | | | |
| Dsgn. L = 4.00 ft | | 1 | 0.038 | 0.018 | | -5.70 | 5.70 | 249.17 | 149.20 | 1.00 | 1.00 | 1.63 | 133.88 | 89.25 |
| Dsgn. L = 8.00 ft | | 2 | 0.038 | 0.016 | | -5.70 | 5.70 | 249.17 | 149.20 | 1.00 | 1.00 | 1.42 | 133.88 | 89.25 |
| +D+S+H | | | | | | | | | | | | | | |
| Dsgn. L = 4.00 ft | | 1 | 0.368 | 0.169 | | -54.85 | 54.85 | 249.17 | 149.20 | 1.00 | 1.00 | 15.07 | 133.88 | 89.25 |
| Dsgn. L = 8.00 ft | | 2 | 0.368 | 0.154 | | -54.85 | 54.85 | 249.17 | 149.20 | 1.00 | 1.00 | 13.71 | 133.88 | 89.25 |
| +D+0.750Lr+0.750L+H | | | | | | | | | | | | | | |
| Dsgn. L = 4.00 ft | | 1 | 0.038 | 0.018 | | -5.70 | 5.70 | 249.17 | 149.20 | 1.00 | 1.00 | 1.63 | 133.88 | 89.25 |
| Dsgn. L = 8.00 ft | | 2 | 0.038 | 0.016 | | -5.70 | 5.70 | 249.17 | 149.20 | 1.00 | 1.00 | 1.42 | 133.88 | 89.25 |
| +D+0.750L+0.750S+H | | | | | | | | | | | | | | |
| Dsgn. L = 4.00 ft | | 1 | 0.285 | 0.131 | | -42.56 | 42.56 | 249.17 | 149.20 | 1.00 | 1.00 | 11.71 | 133.88 | 89.25 |
| Dsgn. L = 8.00 ft | | 2 | 0.285 | 0.119 | | -42.56 | 42.56 | 249.17 | 149.20 | 1.00 | 1.00 | 10.64 | 133.88 | 89.25 |
| +D+0.60W+H | | | | | | | | | | | | | | |
| Dsgn. L = 4.00 ft | | 1 | 0.038 | 0.018 | | -5.70 | 5.70 | 249.17 | 149.20 | 1.00 | 1.00 | 1.63 | 133.88 | 89.25 |
| Dsgn. L = 8.00 ft | | 2 | 0.038 | 0.016 | | -5.70 | 5.70 | 249.17 | 149.20 | 1.00 | 1.00 | 1.42 | 133.88 | 89.25 |
| +D+0.70E+H | | | | | | | | | | | | | | |

Steel Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTE-ZBB2XMC-F.Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9

Lic. #: KW-06009078

Licensee: Canyons Structural Inc

Description: RB6- Cantilevered Hip Beams supporting eave (worst case)

| Load Combination | Segment Length | Span # | Max Stress Ratios | | Summary of Moment Values | | | | | | Summary of Shear Values | | | |
|----------------------------|----------------|--------|-------------------|-------|--------------------------|--------|--------|--------|-----------|------|-------------------------|--------|--------|-----------|
| | | | M | V | Mmax + | Mmax - | Ma Max | Mnx | Mnx/Omega | Cb | Rm | Va Max | Vnx | Vnx/Omega |
| Dsgn. L = 4.00 ft | | 1 | 0.038 | 0.018 | | -5.70 | 5.70 | 249.17 | 149.20 | 1.00 | 1.00 | 1.63 | 133.88 | 89.25 |
| Dsgn. L = 8.00 ft | | 2 | 0.038 | 0.016 | | -5.70 | 5.70 | 249.17 | 149.20 | 1.00 | 1.00 | 1.42 | 133.88 | 89.25 |
| +D+0.750Lr+0.750L+0.450W+H | | | | | | | | | | | | | | |
| Dsgn. L = 4.00 ft | | 1 | 0.038 | 0.018 | | -5.70 | 5.70 | 249.17 | 149.20 | 1.00 | 1.00 | 1.63 | 133.88 | 89.25 |
| Dsgn. L = 8.00 ft | | 2 | 0.038 | 0.016 | | -5.70 | 5.70 | 249.17 | 149.20 | 1.00 | 1.00 | 1.42 | 133.88 | 89.25 |
| +D+0.750L+0.750S+0.450W+H | | | | | | | | | | | | | | |
| Dsgn. L = 4.00 ft | | 1 | 0.285 | 0.131 | | -42.56 | 42.56 | 249.17 | 149.20 | 1.00 | 1.00 | 11.71 | 133.88 | 89.25 |
| Dsgn. L = 8.00 ft | | 2 | 0.285 | 0.119 | | -42.56 | 42.56 | 249.17 | 149.20 | 1.00 | 1.00 | 10.64 | 133.88 | 89.25 |
| +D+0.750L+0.750S+0.5250E+H | | | | | | | | | | | | | | |
| Dsgn. L = 4.00 ft | | 1 | 0.285 | 0.131 | | -42.56 | 42.56 | 249.17 | 149.20 | 1.00 | 1.00 | 11.71 | 133.88 | 89.25 |
| Dsgn. L = 8.00 ft | | 2 | 0.285 | 0.119 | | -42.56 | 42.56 | 249.17 | 149.20 | 1.00 | 1.00 | 10.64 | 133.88 | 89.25 |
| +0.60D+0.60W+0.60H | | | | | | | | | | | | | | |
| Dsgn. L = 4.00 ft | | 1 | 0.023 | 0.011 | | -3.42 | 3.42 | 249.17 | 149.20 | 1.00 | 1.00 | 0.98 | 133.88 | 89.25 |
| Dsgn. L = 8.00 ft | | 2 | 0.023 | 0.010 | | -3.42 | 3.42 | 249.17 | 149.20 | 1.00 | 1.00 | 0.85 | 133.88 | 89.25 |
| +0.60D+0.70E+0.60H | | | | | | | | | | | | | | |
| Dsgn. L = 4.00 ft | | 1 | 0.023 | 0.011 | | -3.42 | 3.42 | 249.17 | 149.20 | 1.00 | 1.00 | 0.98 | 133.88 | 89.25 |
| Dsgn. L = 8.00 ft | | 2 | 0.023 | 0.010 | | -3.42 | 3.42 | 249.17 | 149.20 | 1.00 | 1.00 | 0.85 | 133.88 | 89.25 |

Overall Maximum Deflections

| Load Combination | Span | Max. "-" Defl | Location in Span | Load Combination | Max. "+" Defl | Location in Span |
|------------------|------|---------------|------------------|------------------|---------------|------------------|
| | 1 | 0.0000 | 0.000 | +D+S+H | -0.0142 | 2.336 |
| +D+S+H | 2 | 0.3778 | 8.000 | | 0.0000 | 2.336 |

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

| Load Combination | Support 1 | Support 2 | Support 3 |
|----------------------------|-----------|-----------|-----------|
| Overall MAXimum | -12.354 | 28.782 | |
| Overall MINimum | -0.731 | 1.832 | |
| +D+H | -1.218 | 3.054 | |
| +D+L+H | -1.218 | 3.054 | |
| +D+Lr+H | -1.218 | 3.054 | |
| +D+S+H | -12.354 | 28.782 | |
| +D+0.750Lr+0.750L+H | -1.218 | 3.054 | |
| +D+0.750L+0.750S+H | -9.570 | 22.350 | |
| +D+0.60W+H | -1.218 | 3.054 | |
| +D+0.70E+H | -1.218 | 3.054 | |
| +D+0.750Lr+0.750L+0.450W+H | -1.218 | 3.054 | |
| +D+0.750L+0.750S+0.450W+H | -9.570 | 22.350 | |
| +D+0.750L+0.750S+0.5250E+H | -9.570 | 22.350 | |
| +0.60D+0.60W+0.60H | -0.731 | 1.832 | |
| +0.60D+0.70E+0.60H | -0.731 | 1.832 | |
| D Only | -1.218 | 3.054 | |
| Lr Only | | | |
| L Only | | | |
| S Only | -11.136 | 25.728 | |
| W Only | | | |
| E Only | | | |
| H Only | | | |

Steel Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTE-ZBB2XMC-F.Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9

Lic. #: KW-06009078

Licensee : Canyons Structural Inc

Description : RB6- Cantilevered picking up hip beams

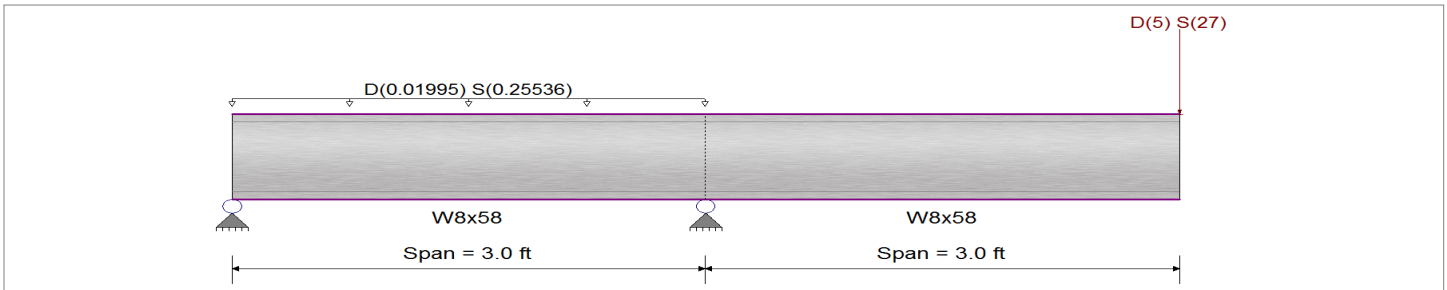
CODE REFERENCES

Calculations per AISC 360-10, IBC 2015, ASCE 7-10
 Load Combination Set : IBC 2015

Material Properties

Analysis Method : Allowable Strength Design
 Beam Bracing : Beam is Fully Braced against lateral-torsional buckling
 Bending Axis : Major Axis Bending

Fy : Steel Yield : 50.0 ksi
 E: Modulus : 29,000.0 ksi



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loading
 Load for Span Number 1
 Uniform Load : D = 0.0150, S = 0.1920 ksf, Tributary Width = 1.330 ft
 Load(s) for Span Number 2
 Point Load : D = 5.0, S = 27.0 k @ 3.0 ft

DESIGN SUMMARY

Design OK

| | | | |
|-----------------------------------|------------------|------------------------------|---------------------|
| Maximum Bending Stress Ratio = | 0.645 : 1 | Maximum Shear Stress Ratio = | 0.365 : 1 |
| Section used for this span | W8x58 | Section used for this span | W8x58 |
| Ma : Applied | 96.261 k-ft | Va : Applied | 32.587 k |
| Mn / Omega : Allowable | 149.202 k-ft | Vn/Omega : Allowable | 89.250 k |
| Load Combination | +D+S+H | Load Combination | +D+S+H |
| Location of maximum on span | 3.000ft | Location of maximum on span | 3.000 ft |
| Span # where maximum occurs | Span # 1 | Span # where maximum occurs | Span # 1 |
| Maximum Deflection | | | |
| Max Downward Transient Deflection | 0.127 in | Ratio = | 568 >=480. |
| Max Upward Transient Deflection | -0.012 in | Ratio = | 2,946 >=480. |
| Max Downward Total Deflection | 0.150 in | Ratio = | 479 >=360. |
| Max Upward Total Deflection | -0.015 in | Ratio = | 2481 >=360. |

Maximum Forces & Stresses for Load Combinations

| Load Combination | Segment Length | Span # | Max Stress Ratios | | Summary of Moment Values | | | | | | Summary of Shear Values | | | |
|---------------------|----------------|--------|-------------------|-------|--------------------------|--------|--------|--------|-----------|------|-------------------------|--------|--------|-----------|
| | | | M | V | Mmax + | Mmax - | Ma Max | Mnx | Mnx/Omega | Cb | Rm | Va Max | Vnx | Vnx/Omega |
| +D+H | | | | | | | | | | | | | | |
| Dsgn. L = 3.00 ft | 3.00 ft | 1 | 0.102 | 0.058 | | -15.26 | 15.26 | 249.17 | 149.20 | 1.00 | 1.00 | 5.20 | 133.88 | 89.25 |
| Dsgn. L = 3.00 ft | 3.00 ft | 2 | 0.102 | 0.058 | | -15.26 | 15.26 | 249.17 | 149.20 | 1.00 | 1.00 | 5.17 | 133.88 | 89.25 |
| +D+L+H | | | | | | | | | | | | | | |
| Dsgn. L = 3.00 ft | 3.00 ft | 1 | 0.102 | 0.058 | | -15.26 | 15.26 | 249.17 | 149.20 | 1.00 | 1.00 | 5.20 | 133.88 | 89.25 |
| Dsgn. L = 3.00 ft | 3.00 ft | 2 | 0.102 | 0.058 | | -15.26 | 15.26 | 249.17 | 149.20 | 1.00 | 1.00 | 5.17 | 133.88 | 89.25 |
| +D+Lr+H | | | | | | | | | | | | | | |
| Dsgn. L = 3.00 ft | 3.00 ft | 1 | 0.102 | 0.058 | | -15.26 | 15.26 | 249.17 | 149.20 | 1.00 | 1.00 | 5.20 | 133.88 | 89.25 |
| Dsgn. L = 3.00 ft | 3.00 ft | 2 | 0.102 | 0.058 | | -15.26 | 15.26 | 249.17 | 149.20 | 1.00 | 1.00 | 5.17 | 133.88 | 89.25 |
| +D+S+H | | | | | | | | | | | | | | |
| Dsgn. L = 3.00 ft | 3.00 ft | 1 | 0.645 | 0.365 | | -96.26 | 96.26 | 249.17 | 149.20 | 1.00 | 1.00 | 32.59 | 133.88 | 89.25 |
| Dsgn. L = 3.00 ft | 3.00 ft | 2 | 0.645 | 0.360 | | -96.26 | 96.26 | 249.17 | 149.20 | 1.00 | 1.00 | 32.17 | 133.88 | 89.25 |
| +D+0.750Lr+0.750L+H | | | | | | | | | | | | | | |
| Dsgn. L = 3.00 ft | 3.00 ft | 1 | 0.102 | 0.058 | | -15.26 | 15.26 | 249.17 | 149.20 | 1.00 | 1.00 | 5.20 | 133.88 | 89.25 |
| Dsgn. L = 3.00 ft | 3.00 ft | 2 | 0.102 | 0.058 | | -15.26 | 15.26 | 249.17 | 149.20 | 1.00 | 1.00 | 5.17 | 133.88 | 89.25 |
| +D+0.750L+0.750S+H | | | | | | | | | | | | | | |
| Dsgn. L = 3.00 ft | 3.00 ft | 1 | 0.509 | 0.288 | | -76.01 | 76.01 | 249.17 | 149.20 | 1.00 | 1.00 | 25.74 | 133.88 | 89.25 |
| Dsgn. L = 3.00 ft | 3.00 ft | 2 | 0.509 | 0.285 | | -76.01 | 76.01 | 249.17 | 149.20 | 1.00 | 1.00 | 25.42 | 133.88 | 89.25 |
| +D+0.60W+H | | | | | | | | | | | | | | |
| Dsgn. L = 3.00 ft | 3.00 ft | 1 | 0.102 | 0.058 | | -15.26 | 15.26 | 249.17 | 149.20 | 1.00 | 1.00 | 5.20 | 133.88 | 89.25 |
| Dsgn. L = 3.00 ft | 3.00 ft | 2 | 0.102 | 0.058 | | -15.26 | 15.26 | 249.17 | 149.20 | 1.00 | 1.00 | 5.17 | 133.88 | 89.25 |
| +D+0.70E+H | | | | | | | | | | | | | | |

Steel Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTE-ZBB2XMC-F.Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9

Lic. #: KW-06009078

Licensee: Canyons Structural Inc

Description: RB6- Cantilevered picking up hip beams

| Load Combination | Segment Length | Span # | Max Stress Ratios | | Summary of Moment Values | | | | | | Summary of Shear Values | | | |
|-----------------------------------|----------------|--------|-------------------|-------|--------------------------|--------|--------|--------|-----------|------|-------------------------|--------|--------|-----------|
| | | | M | V | Mmax + | Mmax - | Ma Max | Mnx | Mnx/Omega | Cb | Rm | Va Max | Vnx | Vnx/Omega |
| Dsgn. L = 3.00 ft | 3.00 ft | 1 | 0.102 | 0.058 | | -15.26 | 15.26 | 249.17 | 149.20 | 1.00 | 1.00 | 5.20 | 133.88 | 89.25 |
| Dsgn. L = 3.00 ft | 3.00 ft | 2 | 0.102 | 0.058 | | -15.26 | 15.26 | 249.17 | 149.20 | 1.00 | 1.00 | 5.17 | 133.88 | 89.25 |
| +D+0.750Lr+0.750L+0.450W+H | | | | | | | | | | | | | | |
| Dsgn. L = 3.00 ft | 3.00 ft | 1 | 0.102 | 0.058 | | -15.26 | 15.26 | 249.17 | 149.20 | 1.00 | 1.00 | 5.20 | 133.88 | 89.25 |
| Dsgn. L = 3.00 ft | 3.00 ft | 2 | 0.102 | 0.058 | | -15.26 | 15.26 | 249.17 | 149.20 | 1.00 | 1.00 | 5.17 | 133.88 | 89.25 |
| +D+0.750L+0.750S+0.450W+H | | | | | | | | | | | | | | |
| Dsgn. L = 3.00 ft | 3.00 ft | 1 | 0.509 | 0.288 | | -76.01 | 76.01 | 249.17 | 149.20 | 1.00 | 1.00 | 25.74 | 133.88 | 89.25 |
| Dsgn. L = 3.00 ft | 3.00 ft | 2 | 0.509 | 0.285 | | -76.01 | 76.01 | 249.17 | 149.20 | 1.00 | 1.00 | 25.42 | 133.88 | 89.25 |
| +D+0.750L+0.750S+0.5250E+H | | | | | | | | | | | | | | |
| Dsgn. L = 3.00 ft | 3.00 ft | 1 | 0.509 | 0.288 | | -76.01 | 76.01 | 249.17 | 149.20 | 1.00 | 1.00 | 25.74 | 133.88 | 89.25 |
| Dsgn. L = 3.00 ft | 3.00 ft | 2 | 0.509 | 0.285 | | -76.01 | 76.01 | 249.17 | 149.20 | 1.00 | 1.00 | 25.42 | 133.88 | 89.25 |
| +0.60D+0.60W+0.60H | | | | | | | | | | | | | | |
| Dsgn. L = 3.00 ft | 3.00 ft | 1 | 0.061 | 0.035 | | -9.16 | 9.16 | 249.17 | 149.20 | 1.00 | 1.00 | 3.12 | 133.88 | 89.25 |
| Dsgn. L = 3.00 ft | 3.00 ft | 2 | 0.061 | 0.035 | | -9.16 | 9.16 | 249.17 | 149.20 | 1.00 | 1.00 | 3.10 | 133.88 | 89.25 |
| +0.60D+0.70E+0.60H | | | | | | | | | | | | | | |
| Dsgn. L = 3.00 ft | 3.00 ft | 1 | 0.061 | 0.035 | | -9.16 | 9.16 | 249.17 | 149.20 | 1.00 | 1.00 | 3.12 | 133.88 | 89.25 |
| Dsgn. L = 3.00 ft | 3.00 ft | 2 | 0.061 | 0.035 | | -9.16 | 9.16 | 249.17 | 149.20 | 1.00 | 1.00 | 3.10 | 133.88 | 89.25 |

Overall Maximum Deflections

| Load Combination | Span | Max. "-" Defl | Location in Span | Load Combination | Max. "+" Defl | Location in Span |
|------------------|------|---------------|------------------|------------------|---------------|------------------|
| +D+S+H | 1 | 0.0000 | 0.000 | +D+S+H | -0.0145 | 1.740 |
| | 2 | 0.1504 | 3.000 | | 0.0000 | 1.740 |

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

| Load Combination | Support 1 | Support 2 | Support 3 |
|----------------------------|-----------|-----------|-----------|
| Overall MAXimum | -31.587 | 64.761 | |
| Overall MINimum | -2.982 | 6.227 | |
| +D+H | -4.970 | 10.378 | |
| +D+L+H | -4.970 | 10.378 | |
| +D+Lr+H | -4.970 | 10.378 | |
| +D+S+H | -31.587 | 64.761 | |
| +D+0.750Lr+0.750L+H | -4.970 | 10.378 | |
| +D+0.750L+0.750S+H | -24.933 | 51.165 | |
| +D+0.60W+H | -4.970 | 10.378 | |
| +D+0.70E+H | -4.970 | 10.378 | |
| +D+0.750Lr+0.750L+0.450W+H | -4.970 | 10.378 | |
| +D+0.750L+0.750S+0.450W+H | -24.933 | 51.165 | |
| +D+0.750L+0.750S+0.5250E+H | -24.933 | 51.165 | |
| +0.60D+0.60W+0.60H | -2.982 | 6.227 | |
| +0.60D+0.70E+0.60H | -2.982 | 6.227 | |
| D Only | -4.970 | 10.378 | |
| Lr Only | | | |
| L Only | | | |
| S Only | -26.617 | 54.383 | |
| W Only | | | |
| E Only | | | |
| H Only | | | |

Steel Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTE-ZBB2XMC-F.Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9
 Licensee : Canyons Structural Inc

Lic. # : KW-06009078

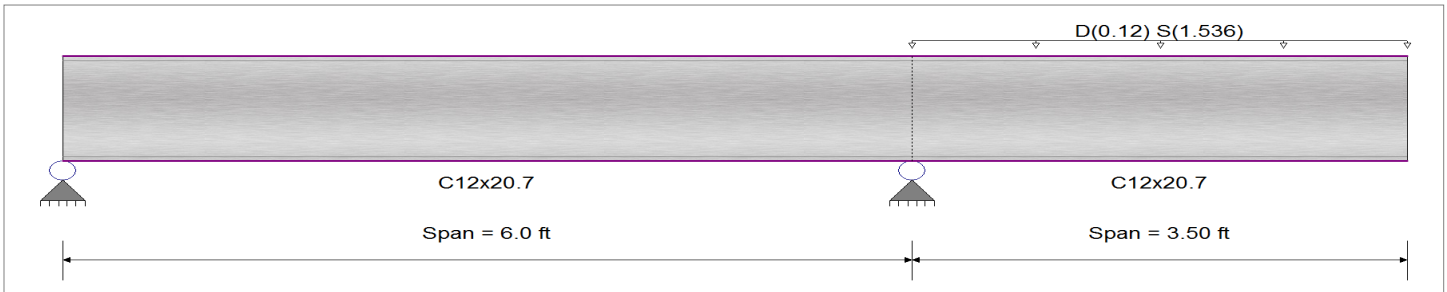
Description : RB4- Catleveres Channels off Fireplace

CODE REFERENCES

Calculations per AISC 360-10, IBC 2015, ASCE 7-10
 Load Combination Set : IBC 2015

Material Properties

Analysis Method : Allowable Strength Design
 Beam Bracing : Beam is Fully Braced against lateral-torsional buckling
 Bending Axis : Major Axis Bending
 Fy : Steel Yield : 50.0 ksi
 E : Modulus : 29,000.0 ksi



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loading
 Load for Span Number 2
 Uniform Load : D = 0.0150, S = 0.1920 ksf, Tributary Width = 8.0 ft

DESIGN SUMMARY

Design OK

| | | | |
|-----------------------------------|------------------|------------------------------|------------------|
| Maximum Bending Stress Ratio = | 0.161 : 1 | Maximum Shear Stress Ratio = | 0.097 : 1 |
| Section used for this span | C12x20.7 | Section used for this span | C12x20.7 |
| Ma : Applied | 10.270 k-ft | Va : Applied | 5.868 k |
| Mn / Omega : Allowable | 63.872 k-ft | Vn/Omega : Allowable | 60.790 k |
| Load Combination | +D+S+H | Load Combination | +D+S+H |
| Location of maximum on span | 6.000ft | Location of maximum on span | 6.000 ft |
| Span # where maximum occurs | Span # 1 | Span # where maximum occurs | Span # 1 |
| Maximum Deflection | | | |
| Max Downward Transient Deflection | 0.044 in | Ratio = | 1,922 >=360. |
| Max Upward Transient Deflection | -0.010 in | Ratio = | 7,137 >=360. |
| Max Downward Total Deflection | 0.047 in | Ratio = | 1772 >=240. |
| Max Upward Total Deflection | -0.011 in | Ratio = | 6633 >=240. |

Maximum Forces & Stresses for Load Combinations

| Load Combination | Segment Length | Span # | Max Stress Ratios | | Summary of Moment Values | | | | | | Summary of Shear Values | | | |
|---------------------|----------------|--------|-------------------|-------|--------------------------|--------|--------|--------|-----------|------|-------------------------|--------|--------|-----------|
| | | | M | V | Mmax + | Mmax - | Ma Max | Mnx | Mnx/Omega | Cb | Rm | Va Max | Vnx | Vnx/Omega |
| +D+H | | | | | | | | | | | | | | |
| Dsgn. L = | 6.00 ft | 1 | 0.013 | 0.008 | | -0.86 | 0.86 | 106.67 | 63.87 | 1.00 | 1.00 | 0.49 | 101.52 | 60.79 |
| Dsgn. L = | 3.50 ft | 2 | 0.013 | 0.008 | | -0.86 | 0.86 | 106.67 | 63.87 | 1.00 | 1.00 | 0.49 | 101.52 | 60.79 |
| +D+L+H | | | | | | | | | | | | | | |
| Dsgn. L = | 6.00 ft | 1 | 0.013 | 0.008 | | -0.86 | 0.86 | 106.67 | 63.87 | 1.00 | 1.00 | 0.49 | 101.52 | 60.79 |
| Dsgn. L = | 3.50 ft | 2 | 0.013 | 0.008 | | -0.86 | 0.86 | 106.67 | 63.87 | 1.00 | 1.00 | 0.49 | 101.52 | 60.79 |
| +D+Lr+H | | | | | | | | | | | | | | |
| Dsgn. L = | 6.00 ft | 1 | 0.013 | 0.008 | | -0.86 | 0.86 | 106.67 | 63.87 | 1.00 | 1.00 | 0.49 | 101.52 | 60.79 |
| Dsgn. L = | 3.50 ft | 2 | 0.013 | 0.008 | | -0.86 | 0.86 | 106.67 | 63.87 | 1.00 | 1.00 | 0.49 | 101.52 | 60.79 |
| +D+S+H | | | | | | | | | | | | | | |
| Dsgn. L = | 6.00 ft | 1 | 0.161 | 0.097 | | -10.27 | 10.27 | 106.67 | 63.87 | 1.00 | 1.00 | 5.87 | 101.52 | 60.79 |
| Dsgn. L = | 3.50 ft | 2 | 0.161 | 0.097 | | -10.27 | 10.27 | 106.67 | 63.87 | 1.00 | 1.00 | 5.87 | 101.52 | 60.79 |
| +D+0.750Lr+0.750L+H | | | | | | | | | | | | | | |
| Dsgn. L = | 6.00 ft | 1 | 0.013 | 0.008 | | -0.86 | 0.86 | 106.67 | 63.87 | 1.00 | 1.00 | 0.49 | 101.52 | 60.79 |
| Dsgn. L = | 3.50 ft | 2 | 0.013 | 0.008 | | -0.86 | 0.86 | 106.67 | 63.87 | 1.00 | 1.00 | 0.49 | 101.52 | 60.79 |
| +D+0.750L+0.750S+H | | | | | | | | | | | | | | |
| Dsgn. L = | 6.00 ft | 1 | 0.124 | 0.074 | | -7.92 | 7.92 | 106.67 | 63.87 | 1.00 | 1.00 | 4.52 | 101.52 | 60.79 |
| Dsgn. L = | 3.50 ft | 2 | 0.124 | 0.074 | | -7.92 | 7.92 | 106.67 | 63.87 | 1.00 | 1.00 | 4.52 | 101.52 | 60.79 |
| +D+0.60W+H | | | | | | | | | | | | | | |
| Dsgn. L = | 6.00 ft | 1 | 0.013 | 0.008 | | -0.86 | 0.86 | 106.67 | 63.87 | 1.00 | 1.00 | 0.49 | 101.52 | 60.79 |
| Dsgn. L = | 3.50 ft | 2 | 0.013 | 0.008 | | -0.86 | 0.86 | 106.67 | 63.87 | 1.00 | 1.00 | 0.49 | 101.52 | 60.79 |
| +D+0.70E+H | | | | | | | | | | | | | | |
| Dsgn. L = | 6.00 ft | 1 | 0.013 | 0.008 | | -0.86 | 0.86 | 106.67 | 63.87 | 1.00 | 1.00 | 0.49 | 101.52 | 60.79 |
| Dsgn. L = | 3.50 ft | 2 | 0.013 | 0.008 | | -0.86 | 0.86 | 106.67 | 63.87 | 1.00 | 1.00 | 0.49 | 101.52 | 60.79 |

Steel Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTE-ZBB2XMC-F.Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9

Lic. # : KW-06009078

Licensee : Canyons Structural Inc

Description : RB4- Catileveres Channels off Fireplace

| Load Combination | Segment Length | Span # | Max Stress Ratios | | Summary of Moment Values | | | | | | Summary of Shear Values | | | |
|----------------------------|----------------|--------|-------------------|-------|--------------------------|--------|--------|--------|-----------|------|-------------------------|--------|--------|-----------|
| | | | M | V | Mmax + | Mmax - | Ma Max | Mnx | Mnx/Omega | Cb | Rm | Va Max | Vnx | Vnx/Omega |
| +D+0.750L+0.750L+0.450W+H | | | | | | | | | | | | | | |
| Dsgn. L = 6.00 ft | | 1 | 0.013 | 0.008 | | -0.86 | 0.86 | 106.67 | 63.87 | 1.00 | 1.00 | 0.49 | 101.52 | 60.79 |
| Dsgn. L = 3.50 ft | | 2 | 0.013 | 0.008 | | -0.86 | 0.86 | 106.67 | 63.87 | 1.00 | 1.00 | 0.49 | 101.52 | 60.79 |
| +D+0.750L+0.750S+0.450W+H | | | | | | | | | | | | | | |
| Dsgn. L = 6.00 ft | | 1 | 0.124 | 0.074 | | -7.92 | 7.92 | 106.67 | 63.87 | 1.00 | 1.00 | 4.52 | 101.52 | 60.79 |
| Dsgn. L = 3.50 ft | | 2 | 0.124 | 0.074 | | -7.92 | 7.92 | 106.67 | 63.87 | 1.00 | 1.00 | 4.52 | 101.52 | 60.79 |
| +D+0.750L+0.750S+0.5250E+H | | | | | | | | | | | | | | |
| Dsgn. L = 6.00 ft | | 1 | 0.124 | 0.074 | | -7.92 | 7.92 | 106.67 | 63.87 | 1.00 | 1.00 | 4.52 | 101.52 | 60.79 |
| Dsgn. L = 3.50 ft | | 2 | 0.124 | 0.074 | | -7.92 | 7.92 | 106.67 | 63.87 | 1.00 | 1.00 | 4.52 | 101.52 | 60.79 |
| +0.60D+0.60W+0.60H | | | | | | | | | | | | | | |
| Dsgn. L = 6.00 ft | | 1 | 0.008 | 0.005 | | -0.52 | 0.52 | 106.67 | 63.87 | 1.00 | 1.00 | 0.30 | 101.52 | 60.79 |
| Dsgn. L = 3.50 ft | | 2 | 0.008 | 0.005 | | -0.52 | 0.52 | 106.67 | 63.87 | 1.00 | 1.00 | 0.30 | 101.52 | 60.79 |
| +0.60D+0.70E+0.60H | | | | | | | | | | | | | | |
| Dsgn. L = 6.00 ft | | 1 | 0.008 | 0.005 | | -0.52 | 0.52 | 106.67 | 63.87 | 1.00 | 1.00 | 0.30 | 101.52 | 60.79 |
| Dsgn. L = 3.50 ft | | 2 | 0.008 | 0.005 | | -0.52 | 0.52 | 106.67 | 63.87 | 1.00 | 1.00 | 0.30 | 101.52 | 60.79 |

Overall Maximum Deflections

| Load Combination | Span | Max. "-" Defl | Location in Span | Load Combination | Max. "+" Defl | Location in Span |
|------------------|------|---------------|------------------|------------------|---------------|------------------|
| | 1 | 0.0000 | 0.000 | | | |
| +D+S+H | 2 | 0.0474 | 3.500 | +D+S+H | -0.0109 | 3.480 |
| | | | | | 0.0000 | 3.480 |

Vertical Reactions

| Load Combination | Support notation : Far left is #1 | | | Values in KIPS |
|----------------------------|-----------------------------------|-----------|-----------|----------------|
| | Support 1 | Support 2 | Support 3 | |
| Overall MAXimum | -1.650 | 7.642 | | |
| Overall MINimum | -0.049 | 0.419 | | |
| +D+H | -0.082 | 0.698 | | |
| +D+L+H | -0.082 | 0.698 | | |
| +D+Lr+H | -0.082 | 0.698 | | |
| +D+S+H | -1.650 | 7.642 | | |
| +D+0.750Lr+0.750L+H | -0.082 | 0.698 | | |
| +D+0.750L+0.750S+H | -1.258 | 5.906 | | |
| +D+0.60W+H | -0.082 | 0.698 | | |
| +D+0.70E+H | -0.082 | 0.698 | | |
| +D+0.750Lr+0.750L+0.450W+H | -0.082 | 0.698 | | |
| +D+0.750L+0.750S+0.450W+H | -1.258 | 5.906 | | |
| +D+0.750L+0.750S+0.5250E+H | -1.258 | 5.906 | | |
| +0.60D+0.60W+0.60H | -0.049 | 0.419 | | |
| +0.60D+0.70E+0.60H | -0.049 | 0.419 | | |
| D Only | -0.082 | 0.698 | | |
| Lr Only | | | | |
| L Only | | | | |
| S Only | -1.568 | 6.944 | | |
| W Only | | | | |
| E Only | | | | |
| H Only | | | | |

Wood Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTE-ZBB2XMC-F.Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9
 Licensee : Canyons Structural Inc

Lic. # : KW-0609078

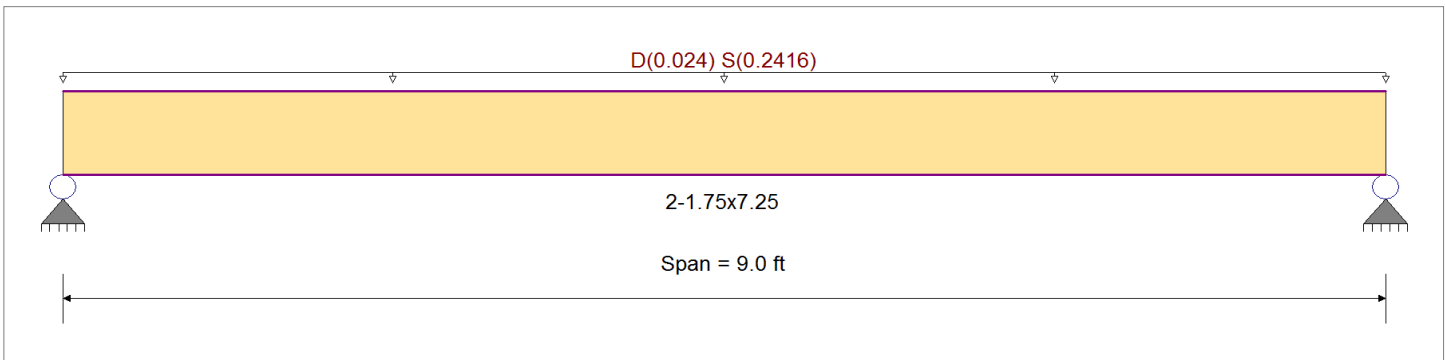
Description : RB2- Roof Eave Rafter

CODE REFERENCES

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10
 Load Combination Set : IBC 2015

Material Properties

| | | | |
|--|-----------|-------------|---------------------------|
| Analysis Method : Allowable Stress Design | Fb + | 2,600.0 psi | E : Modulus of Elasticity |
| Load Combination IBC 2015 | Fb - | 2,600.0 psi | Ebend- xx |
| Wood Species : Trus Joist | Fc - Prll | 2,510.0 psi | Eminbend - xx |
| Wood Grade : MicroLam LVL 2.0 E | Fc - Perp | 750.0 psi | |
| Beam Bracing : Beam is Fully Braced against lateral-torsional buckling | Fv | 285.0 psi | Density |
| | Ft | 1,555.0 psi | 42.0pcf |



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loads
 Uniform Load : D = 0.0150, S = 0.1510 ksf, Tributary Width = 1.60 ft

DESIGN SUMMARY

Design OK

| | | | | | | | |
|-----------------------------------|---|--------------------|---------|-----------------------------|----|--------------------|-----|
| Maximum Bending Stress Ratio | = | 0.362 | 1 | Maximum Shear Stress Ratio | = | 0.192 | : 1 |
| Section used for this span | | 2-1.75x7.25 | | Section used for this span | | 2-1.75x7.25 | |
| fb : Actual | = | 1,081.80psi | | fv : Actual | = | 63.08 psi | |
| FB : Allowable | = | 2,990.00psi | | Fv : Allowable | = | 327.75 psi | |
| Load Combination | | +D+S+H | | Load Combination | | +D+S+H | |
| Location of maximum on span | = | 4.500ft | | Location of maximum on span | = | 8.409ft | |
| Span # where maximum occurs | = | Span # 1 | | Span # where maximum occurs | = | Span # 1 | |
| Maximum Deflection | | | | | | | |
| Max Downward Transient Deflection | | 0.161 in | Ratio = | 669 | >= | 360 | |
| Max Upward Transient Deflection | | 0.000 in | Ratio = | 0 | < | 360 | |
| Max Downward Total Deflection | | 0.182 in | Ratio = | 592 | >= | 240. | |
| Max Upward Total Deflection | | 0.000 in | Ratio = | 0 | < | 240.0 | |

Maximum Forces & Stresses for Load Combinations

| Load Combination Segment Length | Span # | Max Stress Ratios | | | | | | | | | Moment Values | | | Shear Values | | |
|--|--------|-------------------|-------|----------------|------------------|----------------|----------------|----------------|----------------|----------------|---------------|----------|---------|--------------|------|------|
| | | M | V | C _d | C _{F/V} | C _i | C _r | C _m | C _t | C _L | M | fb | F'b | V | fv | F'v |
| +D+H Length = 9.0 ft | 1 | 0.053 | 0.028 | 0.90 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.32 | 124.43 | 2340.00 | 0.00 | 0.00 | 0.00 |
| +D+L+H Length = 9.0 ft | 1 | 0.048 | 0.025 | 1.00 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.32 | 124.43 | 2600.00 | 0.00 | 0.00 | 0.00 |
| +D+Lr+H Length = 9.0 ft | 1 | 0.038 | 0.020 | 1.25 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.32 | 124.43 | 3250.00 | 0.00 | 0.00 | 0.00 |
| +D+S+H Length = 9.0 ft | 1 | 0.362 | 0.192 | 1.15 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 2.76 | 1,081.80 | 2990.00 | 0.00 | 0.00 | 0.00 |
| +D+0.750Lr+0.750L+H Length = 9.0 ft | 1 | 0.038 | 0.020 | 1.25 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.32 | 124.43 | 3250.00 | 0.00 | 0.00 | 0.00 |
| +D+0.750L+0.750S+H | | | | | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.00 | 0.00 | 0.00 | 0.00 |

Wood Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNT-E-ZBB2XMC-F.Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9

Lic. #: KW-0609078

Licensee : Canyons Structural Inc

Description : RB2- Roof Eave Rafter

| Load Combination | Segment Length | Span # | Max Stress Ratios | | | | | | | | Moment Values | | | Shear Values | | |
|----------------------------|----------------|--------|-------------------|------|----------------|------------------|----------------|----------------|----------------|----------------|----------------|--------|---------|--------------|-------|--------|
| | | | M | V | C _d | C _{F/V} | C _i | C _r | C _m | C _t | C _L | M | fb | F'b | V | fv |
| Length = 9.0 ft | 1 | 0.282 | 0.150 | 1.15 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 2.15 | 842.46 | 2990.00 | 0.83 | 49.12 | 327.75 |
| +D+0.60W+H | | | | | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.00 | 0.00 | 0.00 | 0.00 |
| Length = 9.0 ft | 1 | 0.030 | 0.016 | 1.60 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.32 | 124.43 | 4160.00 | 0.12 | 7.26 | 456.00 |
| +D+0.70E+H | | | | | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.00 | 0.00 | 0.00 | 0.00 |
| Length = 9.0 ft | 1 | 0.030 | 0.016 | 1.60 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.32 | 124.43 | 4160.00 | 0.12 | 7.26 | 456.00 |
| +D+0.750L+0.750L+0.450W+H | | | | | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.00 | 0.00 | 0.00 | 0.00 |
| Length = 9.0 ft | 1 | 0.030 | 0.016 | 1.60 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.32 | 124.43 | 4160.00 | 0.12 | 7.26 | 456.00 |
| +D+0.750L+0.750S+0.450W+H | | | | | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.00 | 0.00 | 0.00 | 0.00 |
| Length = 9.0 ft | 1 | 0.203 | 0.108 | 1.60 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 2.15 | 842.46 | 4160.00 | 0.83 | 49.12 | 456.00 |
| +D+0.750L+0.750S+0.5250E+H | | | | | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.00 | 0.00 | 0.00 | 0.00 |
| Length = 9.0 ft | 1 | 0.203 | 0.108 | 1.60 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 2.15 | 842.46 | 4160.00 | 0.83 | 49.12 | 456.00 |
| +0.60D+0.60W+0.60H | | | | | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.00 | 0.00 | 0.00 | 0.00 |
| Length = 9.0 ft | 1 | 0.018 | 0.010 | 1.60 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.19 | 74.66 | 4160.00 | 0.07 | 4.35 | 456.00 |
| +0.60D+0.70E+0.60H | | | | | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.00 | 0.00 | 0.00 | 0.00 |
| Length = 9.0 ft | 1 | 0.018 | 0.010 | 1.60 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.19 | 74.66 | 4160.00 | 0.07 | 4.35 | 456.00 |

Overall Maximum Deflections

| Load Combination | Span | Max. "-" Defl | Location in Span | Load Combination | Max. "+" Defl | Location in Span |
|------------------|------|---------------|------------------|------------------|---------------|------------------|
| +D+S+H | 1 | 0.1824 | 4.533 | | 0.0000 | 0.000 |

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

| Load Combination | Support 1 | Support 2 |
|----------------------------|-----------|-----------|
| Overall MAXimum | 1.229 | 1.229 |
| Overall MINimum | 1.087 | 1.087 |
| +D+H | 0.141 | 0.141 |
| +D+L+H | 0.141 | 0.141 |
| +D+Lr+H | 0.141 | 0.141 |
| +D+S+H | 1.229 | 1.229 |
| +D+0.750Lr+0.750L+H | 0.141 | 0.141 |
| +D+0.750L+0.750S+H | 0.957 | 0.957 |
| +D+0.60W+H | 0.141 | 0.141 |
| +D+0.70E+H | 0.141 | 0.141 |
| +D+0.750Lr+0.750L+0.450W+H | 0.141 | 0.141 |
| +D+0.750L+0.750S+0.450W+H | 0.957 | 0.957 |
| +D+0.750L+0.750S+0.5250E+H | 0.957 | 0.957 |
| +0.60D+0.60W+0.60H | 0.085 | 0.085 |
| +0.60D+0.70E+0.60H | 0.085 | 0.085 |
| D Only | 0.141 | 0.141 |
| Lr Only | | |
| L Only | | |
| S Only | 1.087 | 1.087 |
| W Only | | |
| E Only | | |
| H Only | | |

Wood Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTE-ZBB2XMC-F.Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9
 Licensee : Canyons Structural Inc

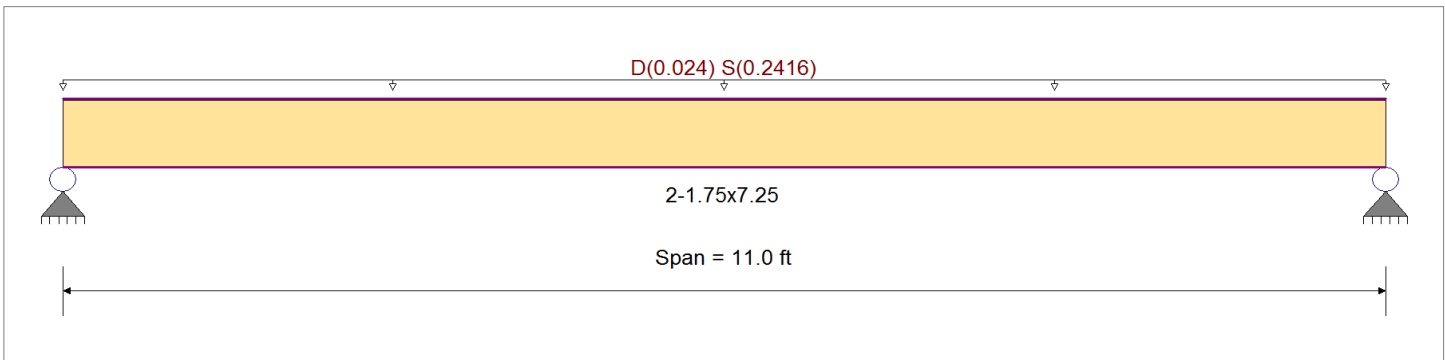
Lic. #: KW-0609078
 Description: RB10- Roof Eave Rafter

CODE REFERENCES

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10
 Load Combination Set : IBC 2015

Material Properties

| | | | |
|--|-----------|-------------|---------------------------|
| Analysis Method : Allowable Stress Design | Fb + | 2,600.0 psi | E : Modulus of Elasticity |
| Load Combination IBC 2015 | Fb - | 2,600.0 psi | Ebend- xx |
| Wood Species : Trus Joist | Fc - Prll | 2,510.0 psi | Eminbend - xx |
| Wood Grade : MicroLam LVL 2.0 E | Fc - Perp | 750.0 psi | |
| Beam Bracing : Beam is Fully Braced against lateral-torsional buckling | Fv | 285.0 psi | Density |
| | Ft | 1,555.0 psi | 42.0pcf |



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loads
 Uniform Load : D = 0.0150, S = 0.1510 ksf, Tributary Width = 1.60 ft

DESIGN SUMMARY

Design OK

| | | | |
|-----------------------------------|--------------------|------------------------------|--------------------|
| Maximum Bending Stress Ratio = | 0.540 : 1 | Maximum Shear Stress Ratio = | 0.241 : 1 |
| Section used for this span | 2-1.75x7.25 | Section used for this span | 2-1.75x7.25 |
| fb : Actual = | 1,616.03psi | fv : Actual = | 79.04 psi |
| FB : Allowable = | 2,990.00psi | Fv : Allowable = | 327.75 psi |
| Load Combination | +D+S+H | Load Combination | +D+S+H |
| Location of maximum on span | 5.500ft | Location of maximum on span | 10.398 ft |
| Span # where maximum occurs | Span # 1 | Span # where maximum occurs | Span # 1 |
| Maximum Deflection | | | |
| Max Downward Transient Deflection | 0.360 in | Ratio = | 366 >=360 |
| Max Upward Transient Deflection | 0.000 in | Ratio = | 0 <360 |
| Max Downward Total Deflection | 0.407 in | Ratio = | 324 >=240. |
| Max Upward Total Deflection | 0.000 in | Ratio = | 0 <240.0 |

Maximum Forces & Stresses for Load Combinations

| Load Combination | Segment Length | Span # | Max Stress Ratios | | | | | | | | Moment Values | | | Shear Values | | | | | | | |
|---------------------|------------------|--------|-------------------|-------|----------------|------------------|----------------|----------------|----------------|----------------|----------------|------|------|--------------|---------|------|------|------|------|-------|--------|
| | | | M | V | C _d | C _{F/V} | C _i | C _r | C _m | C _t | C _L | M | fb | F'b | V | fv | F'v | | | | |
| +D+H | Length = 11.0 ft | 1 | 0.079 | 0.035 | 0.90 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.47 | 185.88 | 2340.00 | 0.00 | 0.00 | 0.00 | 0.15 | 9.09 | 256.50 |
| +D+L+H | Length = 11.0 ft | 1 | 0.071 | 0.032 | 1.00 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.47 | 185.88 | 2600.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| +D+Lr+H | Length = 11.0 ft | 1 | 0.057 | 0.026 | 1.25 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.47 | 185.88 | 3250.00 | 0.00 | 0.00 | 0.00 | 0.15 | 9.09 | 356.25 |
| +D+S+H | Length = 11.0 ft | 1 | 0.540 | 0.241 | 1.15 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 4.13 | 1,616.03 | 2990.00 | 0.00 | 0.00 | 0.00 | 1.34 | 79.04 | 327.75 |
| +D+0.750Lr+0.750L+H | Length = 11.0 ft | 1 | 0.057 | 0.026 | 1.25 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.47 | 185.88 | 3250.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| +D+0.750L+0.750S+H | | | | | | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.00 | | | 0.00 | 0.00 | 0.00 | 0.00 |

Wood Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTE-ZBB2XMC-F.Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9

Lic. #: KW-0609078

Licensee : Canyons Structural Inc

Description : RB10- Roof Eave Rafter

| Load Combination | Segment Length | Span # | Max Stress Ratios | | | | | | | | Moment Values | | | Shear Values | | |
|----------------------------|----------------|--------|-------------------|------|----------------|------------------|----------------|----------------|----------------|----------------|----------------|----------|---------|--------------|-------|--------|
| | | | M | V | C _d | C _{F/V} | C _i | C _r | C _m | C _t | C _L | M | fb | F'b | V | fv |
| Length = 11.0 ft | 1 | 0.421 | 0.188 | 1.15 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 3.22 | 1,258.49 | 2990.00 | 1.04 | 61.55 | 327.75 |
| +D+0.60W+H | | | | | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.00 | 0.00 | 0.00 | 0.00 |
| Length = 11.0 ft | 1 | 0.045 | 0.020 | 1.60 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.47 | 185.88 | 4160.00 | 0.15 | 9.09 | 456.00 |
| +D+0.70E+H | | | | | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.00 | 0.00 | 0.00 | 0.00 |
| Length = 11.0 ft | 1 | 0.045 | 0.020 | 1.60 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.47 | 185.88 | 4160.00 | 0.15 | 9.09 | 456.00 |
| +D+0.750L+0.750L+0.450W+H | | | | | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.00 | 0.00 | 0.00 | 0.00 |
| Length = 11.0 ft | 1 | 0.045 | 0.020 | 1.60 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.47 | 185.88 | 4160.00 | 0.15 | 9.09 | 456.00 |
| +D+0.750L+0.750S+0.450W+H | | | | | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.00 | 0.00 | 0.00 | 0.00 |
| Length = 11.0 ft | 1 | 0.303 | 0.135 | 1.60 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 3.22 | 1,258.49 | 4160.00 | 1.04 | 61.55 | 456.00 |
| +D+0.750L+0.750S+0.5250E+H | | | | | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.00 | 0.00 | 0.00 | 0.00 |
| Length = 11.0 ft | 1 | 0.303 | 0.135 | 1.60 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 3.22 | 1,258.49 | 4160.00 | 1.04 | 61.55 | 456.00 |
| +0.60D+0.60W+0.60H | | | | | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.00 | 0.00 | 0.00 | 0.00 |
| Length = 11.0 ft | 1 | 0.027 | 0.012 | 1.60 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.28 | 111.53 | 4160.00 | 0.09 | 5.45 | 456.00 |
| +0.60D+0.70E+0.60H | | | | | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 0.00 | 0.00 | 0.00 | 0.00 |
| Length = 11.0 ft | 1 | 0.027 | 0.012 | 1.60 | 1.000 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.28 | 111.53 | 4160.00 | 0.09 | 5.45 | 456.00 |

Overall Maximum Deflections

| Load Combination | Span | Max. "-" Defl | Location in Span | Load Combination | Max. "+" Defl | Location in Span |
|------------------|------|---------------|------------------|------------------|---------------|------------------|
| +D+S+H | 1 | 0.4069 | 5.540 | | 0.0000 | 0.000 |

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

| Load Combination | Support 1 | Support 2 |
|----------------------------|-----------|-----------|
| Overall MAXimum | 1.502 | 1.502 |
| Overall MINimum | 1.329 | 1.329 |
| +D+H | 0.173 | 0.173 |
| +D+L+H | 0.173 | 0.173 |
| +D+Lr+H | 0.173 | 0.173 |
| +D+S+H | 1.502 | 1.502 |
| +D+0.750Lr+0.750L+H | 0.173 | 0.173 |
| +D+0.750L+0.750S+H | 1.169 | 1.169 |
| +D+0.60W+H | 0.173 | 0.173 |
| +D+0.70E+H | 0.173 | 0.173 |
| +D+0.750Lr+0.750L+0.450W+H | 0.173 | 0.173 |
| +D+0.750L+0.750S+0.450W+H | 1.169 | 1.169 |
| +D+0.750L+0.750S+0.5250E+H | 1.169 | 1.169 |
| +0.60D+0.60W+0.60H | 0.104 | 0.104 |
| +0.60D+0.70E+0.60H | 0.104 | 0.104 |
| D Only | 0.173 | 0.173 |
| Lr Only | | |
| L Only | | |
| S Only | 1.329 | 1.329 |
| W Only | | |
| E Only | | |
| H Only | | |

Steel Column

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTE-ZBB2XMC-F.Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9

Lic. #: KW-06009078

Licensee : Canyons Structural Inc

Description : SC1- Lateral Resisting cantilevered columns at clear story windows, front face of structure

Code References

Calculations per AISC 360-10, IBC 2015, CBC 2016, ASCE 7-10
 Load Combinations Used : IBC 2015

General Information

| | | | |
|-----------------------------|--------------------|---|--|
| Steel Section Name : | HSS5x5x1/2 | Overall Column Height | 11.0 ft |
| Analysis Method : | Allowable Strength | Top & Bottom Fixity | Top Fixed, Bottom Pinned |
| Steel Stress Grade | | Brace condition for deflection (buckling) along columns : | |
| Fy : Steel Yield | 36.0 ksi | X-X (width) axis : | |
| E : Elastic Bending Modulus | 29,000.0 ksi | Lu for X-X Axis buckling : | 8 ft, K = 0.80 |
| | | Y-Y (depth) axis : | Fully braced against buckling along Y-Y Axis |

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Column self weight included : 312.730 lbs * Dead Load Factor
 AXIAL LOADS . . .
 Axial Load at 11.0 ft, Yecc = 60.0 in, D = 1.950, L = 2.60, S = 16.30 k
 BENDING LOADS . . .
 Lat. Point Load at 9.50 ft creating Mx-x, E = 6.650 k

DESIGN SUMMARY

Bending & Shear Check Results

| | | | |
|---|-------------------|--------------------------------|-----------------------------------|
| PASS Max. Axial+Bending Stress Ratio = | 0.2451 : 1 | Maximum Load Reactions . . | |
| Load Combination | +D+0.70E | Top along X-X | 0.0 k |
| Location of max.above base | 11.0 ft | Bottom along X-X | 0.0 k |
| At maximum location values are . . . | | Top along Y-Y | 6.473 k |
| Pa : Axial | 1.950 k | Bottom along Y-Y | 0.1771 k |
| Pn / Omega : Allowable | 154.668 k | Maximum Load Deflections . . . | |
| Ma-x : Applied | -5.619 k-ft | Along Y-Y | 0.03009 in at 6.054 ft above base |
| Mn-x / Omega : Allowable | 23.533 k-ft | for load combination : E Only | |
| Ma-y : Applied | 0.0 k-ft | Along X-X | 0.0 in at 0.0 ft above base |
| Mn-y / Omega : Allowable | 23.533 k-ft | for load combination : | |
| PASS Maximum Shear Stress Ratio = | 0.1045 : 1 | | |
| Load Combination | +D+0.70E | | |
| Location of max.above base | 9.523 ft | | |
| At maximum location values are . . . | | | |
| Va : Applied | 4.531 k | | |
| Vn / Omega : Allowable | 43.364 k | | |

Load Combination Results

| Load Combination | Maximum Axial + Bending Stress Ratios | | | Maximum Shear Ratios | | |
|--------------------------|---------------------------------------|--------|----------|----------------------|--------|----------|
| | Stress Ratio | Status | Location | Stress Ratio | Status | Location |
| D Only | 0.015 | PASS | 0.00 ft | 0.000 | PASS | 0.00 ft |
| +D+L | 0.031 | PASS | 0.00 ft | 0.000 | PASS | 0.00 ft |
| +D+S | 0.120 | PASS | 0.00 ft | 0.000 | PASS | 0.00 ft |
| +D+0.750L | 0.027 | PASS | 0.00 ft | 0.000 | PASS | 0.00 ft |
| +D+0.750L+0.750S | 0.106 | PASS | 0.00 ft | 0.000 | PASS | 0.00 ft |
| +D+0.70E | 0.245 | PASS | 11.00 ft | 0.104 | PASS | 9.52 ft |
| +D-0.70E | 0.245 | PASS | 11.00 ft | 0.104 | PASS | 9.52 ft |
| +D+0.750L+0.750S+0.5250E | 0.231 | PASS | 11.00 ft | 0.078 | PASS | 9.52 ft |
| +D+0.750L+0.750S-0.5250E | 0.231 | PASS | 11.00 ft | 0.078 | PASS | 9.52 ft |
| +0.60D | 0.009 | PASS | 0.00 ft | 0.000 | PASS | 0.00 ft |
| +0.60D+0.70E | 0.243 | PASS | 11.00 ft | 0.104 | PASS | 9.52 ft |
| +0.60D-0.70E | 0.243 | PASS | 11.00 ft | 0.104 | PASS | 9.52 ft |

Steel Column

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTE-ZBB2XMC-F.Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9

Lic. #: KW-06009078

Licensee: Canyons Structural Inc

Description: SC1- Lateral Resisting cantileverd columns at clear story windows, front face of structure

Maximum Reactions

Note: Only non-zero reactions are listed.

| Load Combination | Axial Reaction | | X-X Axis Reaction | | k | Y-Y Axis Reaction | | Mx - End Moments | | k-ft | My - End Moments | |
|--------------------------|----------------|--|-------------------|-------|---|-------------------|-------|------------------|-------|------|------------------|-------|
| | @ Base | | @ Base | @ Top | | @ Base | @ Top | @ Base | @ Top | | @ Base | @ Top |
| D Only | 2.263 | | | | | -0.000 | 0.000 | | | | -0.000 | |
| +D+L | 4.863 | | | | | -0.000 | 0.000 | | | | -0.000 | |
| +D+S | 18.563 | | | | | -0.000 | 0.000 | | | | -0.000 | |
| +D+0.750L | 4.213 | | | | | -0.000 | 0.000 | | | | -0.000 | |
| +D+0.750L+0.750S | 16.438 | | | | | -0.000 | 0.000 | | | | -0.000 | |
| +D+0.70E | 2.263 | | | | | 0.124 | 4.531 | | | | -5.619 | |
| +D+0.750L+0.750S+0.5250E | 16.438 | | | | | 0.093 | 3.398 | | | | -4.214 | |
| +0.60D | 1.358 | | | | | -0.000 | 0.000 | | | | -0.000 | |
| +0.60D+0.70E | 1.358 | | | | | 0.124 | 4.531 | | | | -5.619 | |
| L Only | 2.600 | | | | | -0.000 | 0.000 | | | | -0.000 | |
| S Only | 16.300 | | | | | -0.000 | 0.000 | | | | -0.000 | |
| E Only | | | | | | 0.177 | 6.473 | | | | -8.027 | |

Extreme Reactions

| Item | Extreme Value | Axial Reaction | | X-X Axis Reaction | | k | Y-Y Axis Reaction | | Mx - End Moments | | k-ft | My - End Moments | |
|-------------------------|---------------|----------------|--|-------------------|-------|---|-------------------|-------|------------------|-------|------|------------------|--------|
| | | @ Base | | @ Base | @ Top | | @ Base | @ Top | @ Base | @ Top | | @ Base | @ Top |
| Axial @ Base | Maximum | 18.563 | | | | | -0.000 | 0.000 | | | | -0.000 | |
| " | Minimum | | | | | | 0.177 | 6.473 | | | | -8.027 | |
| Reaction, X-X Axis Base | Maximum | 2.263 | | | | | -0.000 | 0.000 | | | | -0.000 | |
| " | Minimum | 2.263 | | | | | -0.000 | 0.000 | | | | -0.000 | |
| Reaction, Y-Y Axis Base | Maximum | | | | | | 0.177 | 6.473 | | | | -8.027 | |
| " | Minimum | 18.563 | | | | | -0.000 | 0.000 | | | | -0.000 | |
| Reaction, X-X Axis Top | Maximum | 2.263 | | | | | -0.000 | 0.000 | | | | -0.000 | |
| " | Minimum | 2.263 | | | | | -0.000 | 0.000 | | | | -0.000 | |
| Reaction, Y-Y Axis Top | Maximum | 2.263 | | | | | -0.000 | 0.000 | | | | -0.000 | |
| " | Minimum | | | | | | 0.177 | 6.473 | | | | -8.027 | |
| Moment, X-X Axis Base | Maximum | 2.263 | | | | | -0.000 | 0.000 | | | | -0.000 | |
| " | Minimum | 2.263 | | | | | -0.000 | 0.000 | | | | -0.000 | |
| Moment, Y-Y Axis Base | Maximum | 2.263 | | | | | -0.000 | 0.000 | | | | -0.000 | -0.000 |
| " | Minimum | 2.263 | | | | | -0.000 | 0.000 | | | | -0.000 | -0.000 |
| Moment, X-X Axis Top | Maximum | 1.358 | | | | | -0.000 | 0.000 | | | | -0.000 | |
| " | Minimum | | | | | | 0.177 | 6.473 | | | | -8.027 | |
| Moment, Y-Y Axis Top | Maximum | 2.263 | | | | | -0.000 | 0.000 | | | | -0.000 | |
| " | Minimum | 2.263 | | | | | -0.000 | 0.000 | | | | -0.000 | |

Maximum Deflections for Load Combinations

| Load Combination | Max. X-X Deflection | | Distance | | Max. Y-Y Deflection | | Distance | |
|--------------------------|---------------------|----|----------|----|---------------------|----|----------|----|
| | | | | | | | | |
| D Only | 0.0000 | in | 0.000 | ft | 0.000 | in | 0.000 | ft |
| +D+L | 0.0000 | in | 0.000 | ft | 0.000 | in | 0.000 | ft |
| +D+S | 0.0000 | in | 0.000 | ft | 0.000 | in | 0.000 | ft |
| +D+0.750L | 0.0000 | in | 0.000 | ft | 0.000 | in | 0.000 | ft |
| +D+0.750L+0.750S | 0.0000 | in | 0.000 | ft | 0.000 | in | 0.000 | ft |
| +D+0.70E | 0.0000 | in | 0.000 | ft | 0.021 | in | 6.054 | ft |
| +D+0.750L+0.750S+0.5250E | 0.0000 | in | 0.000 | ft | 0.016 | in | 6.054 | ft |
| +0.60D | 0.0000 | in | 0.000 | ft | 0.000 | in | 0.000 | ft |
| +0.60D+0.70E | 0.0000 | in | 0.000 | ft | 0.021 | in | 6.054 | ft |
| L Only | 0.0000 | in | 0.000 | ft | 0.000 | in | 0.000 | ft |
| S Only | 0.0000 | in | 0.000 | ft | 0.000 | in | 0.000 | ft |
| E Only | 0.0000 | in | 0.000 | ft | 0.030 | in | 6.054 | ft |

Steel Section Properties : HSS5x5x1/2

Steel Column

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTE-ZBB2XMC-F.Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9

Lic. # : KW-06009078

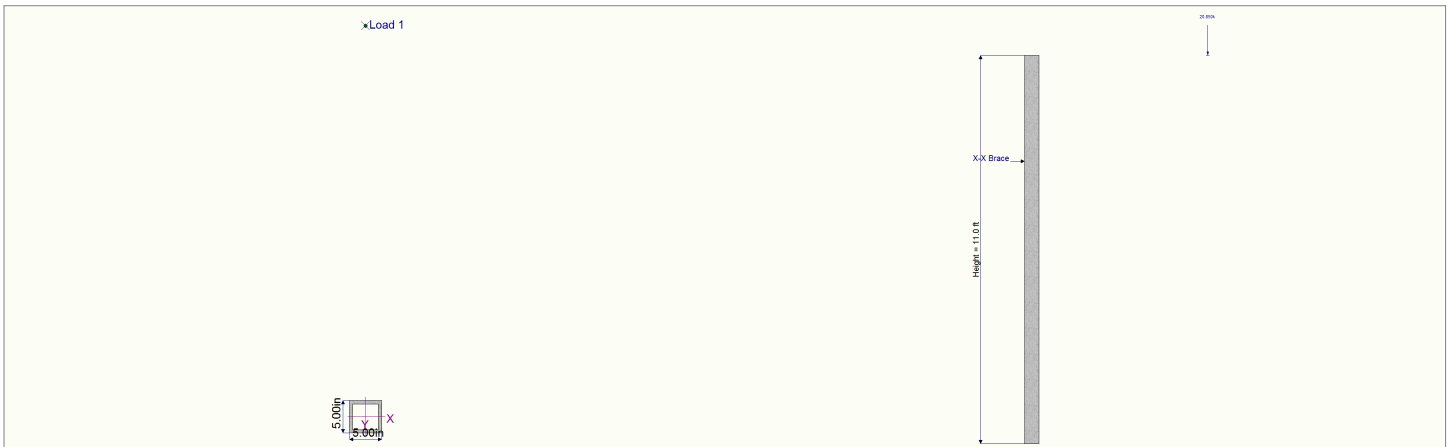
Licensee : Canyons Structural Inc

Description : SC1- Lateral Resisting cantileverd columns at clear story windows, front face of structure

Steel Section Properties : HSS5x5x1/2

| | | | | | | | | |
|--------------|---|-----------------------|------|---|------------------------|---|---|------------------------|
| Depth | = | 5.000 in | I xx | = | 26.00 in ⁴ | J | = | 44.600 in ⁴ |
| Design Thick | = | 0.465 in | S xx | = | 10.40 in ³ | | | |
| Width | = | 5.000 in | R xx | = | 1.820 in | | | |
| Wall Thick | = | 0.500 in | Zx | = | 13.100 in ³ | | | |
| Area | = | 7.880 in ² | I yy | = | 26.000 in ⁴ | C | = | 18.700 in ³ |
| Weight | = | 28.430 plf | S yy | = | 10.400 in ³ | | | |
| | | | R yy | = | 1.820 in | | | |

Ycg = 0.000 in



Steel Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTE-ZBB2XMC-F.Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9

Lic. #: KW-06009078

Licensee : Canyons Structural Inc

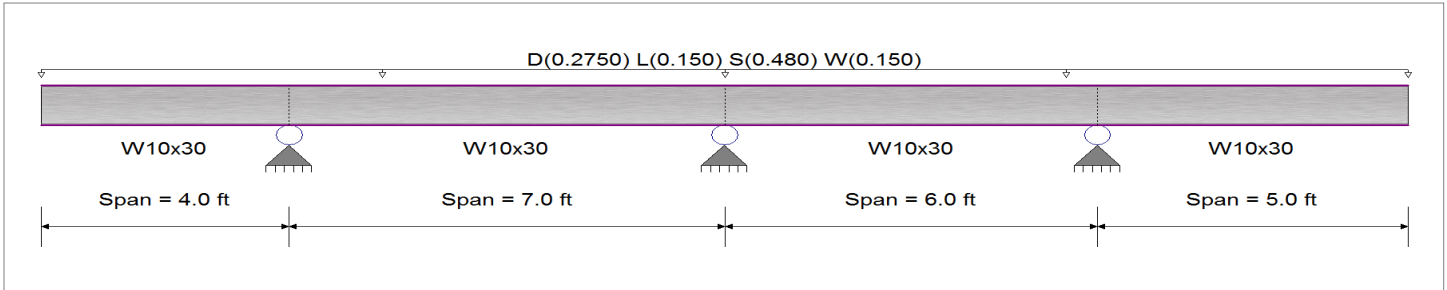
Description : FB5- B-Deck edge beam w/planter box abv

CODE REFERENCES

Calculations per AISC 360-10, IBC 2015, ASCE 7-10
 Load Combination Set : IBC 2015

Material Properties

Analysis Method : Allowable Strength Design
 Beam Bracing : Beam is Fully Braced against lateral-torsional buckling
 Bending Axis : Major Axis Bending
 Fy : Steel Yield : 50.0 ksi
 E : Modulus : 29,000.0 ksi



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loading
 Loads on all spans...

Uniform Load on ALL spans : D = 0.110, L = 0.060, S = 0.1920, W = 0.060 ksf, Tributary Width = 2.50 ft

DESIGN SUMMARY

Design OK

| | | | |
|-----------------------------------|---------------------------|------------------------------|---------------------------|
| Maximum Bending Stress Ratio = | 0.116 : 1 | Maximum Shear Stress Ratio = | 0.067 : 1 |
| Section used for this span | W10x30 | Section used for this span | W10x30 |
| Ma : Applied | 10.563 k-ft | Va : Applied | 4.248 k |
| Mn / Omega : Allowable | 91.317 k-ft | Vn/Omega : Allowable | 63.0 k |
| Load Combination | +D+0.750L+0.750S+0.450W+H | Load Combination | +D+0.750L+0.750S+0.450W+H |
| Location of maximum on span | 6.000ft | Location of maximum on span | 6.000 ft |
| Span # where maximum occurs | Span # 3 | Span # where maximum occurs | Span # 3 |
| Maximum Deflection | | | |
| Max Downward Transient Deflection | 0.027 in | Ratio = | 4,472 >=600. |
| Max Upward Transient Deflection | -0.002 in | Ratio = | 31,028 >=600. |
| Max Downward Total Deflection | 0.047 in | Ratio = | 2541 >=480. |
| Max Upward Total Deflection | -0.004 in | Ratio = | 17625 >=480. |

Maximum Forces & Stresses for Load Combinations

| Load Combination | Segment Length | Span # | Max Stress Ratios | | Summary of Moment Values | | | | | | Summary of Shear Values | | | |
|----------------------------|----------------|--------|-------------------|-------|--------------------------|--------|--------|--------|-----------|------|-------------------------|--------|-------|-----------|
| | | | M | V | Mmax + | Mmax - | Ma Max | Mnx | Mnx/Omega | Cb | Rm | Va Max | Vnx | Vnx/Omega |
| +D+H | | | | | | | | | | | | | | |
| Dsgn. L = 4.00 ft | | 1 | 0.027 | 0.022 | | -2.44 | 2.44 | 152.50 | 91.32 | 1.00 | 1.00 | 1.40 | 94.50 | 63.00 |
| Dsgn. L = 7.00 ft | | 2 | 0.027 | 0.022 | 0.78 | -2.44 | 2.44 | 152.50 | 91.32 | 1.00 | 1.00 | 1.40 | 94.50 | 63.00 |
| Dsgn. L = 6.00 ft | | 3 | 0.042 | 0.024 | 0.04 | -3.81 | 3.81 | 152.50 | 91.32 | 1.00 | 1.00 | 1.53 | 94.50 | 63.00 |
| Dsgn. L = 5.00 ft | | 4 | 0.042 | 0.024 | | -3.81 | 3.81 | 152.50 | 91.32 | 1.00 | 1.00 | 1.53 | 94.50 | 63.00 |
| +D+L+H | | | | | | | | | | | | | | |
| Dsgn. L = 4.00 ft | | 1 | 0.040 | 0.033 | | -3.64 | 3.64 | 152.50 | 91.32 | 1.00 | 1.00 | 2.09 | 94.50 | 63.00 |
| Dsgn. L = 7.00 ft | | 2 | 0.040 | 0.033 | 1.16 | -3.64 | 3.64 | 152.50 | 91.32 | 1.00 | 1.00 | 2.09 | 94.50 | 63.00 |
| Dsgn. L = 6.00 ft | | 3 | 0.062 | 0.036 | 0.06 | -5.69 | 5.69 | 152.50 | 91.32 | 1.00 | 1.00 | 2.29 | 94.50 | 63.00 |
| Dsgn. L = 5.00 ft | | 4 | 0.062 | 0.036 | | -5.69 | 5.69 | 152.50 | 91.32 | 1.00 | 1.00 | 2.28 | 94.50 | 63.00 |
| +D+Lr+H | | | | | | | | | | | | | | |
| Dsgn. L = 4.00 ft | | 1 | 0.027 | 0.022 | | -2.44 | 2.44 | 152.50 | 91.32 | 1.00 | 1.00 | 1.40 | 94.50 | 63.00 |
| Dsgn. L = 7.00 ft | | 2 | 0.027 | 0.022 | 0.78 | -2.44 | 2.44 | 152.50 | 91.32 | 1.00 | 1.00 | 1.40 | 94.50 | 63.00 |
| Dsgn. L = 6.00 ft | | 3 | 0.042 | 0.024 | 0.04 | -3.81 | 3.81 | 152.50 | 91.32 | 1.00 | 1.00 | 1.53 | 94.50 | 63.00 |
| Dsgn. L = 5.00 ft | | 4 | 0.042 | 0.024 | | -3.81 | 3.81 | 152.50 | 91.32 | 1.00 | 1.00 | 1.53 | 94.50 | 63.00 |
| +D+S+H | | | | | | | | | | | | | | |
| Dsgn. L = 4.00 ft | | 1 | 0.069 | 0.057 | | -6.28 | 6.28 | 152.50 | 91.32 | 1.00 | 1.00 | 3.61 | 94.50 | 63.00 |
| Dsgn. L = 7.00 ft | | 2 | 0.069 | 0.057 | 2.01 | -6.28 | 6.28 | 152.50 | 91.32 | 1.00 | 1.00 | 3.61 | 94.50 | 63.00 |
| Dsgn. L = 6.00 ft | | 3 | 0.107 | 0.063 | 0.11 | -9.81 | 9.81 | 152.50 | 91.32 | 1.00 | 1.00 | 3.95 | 94.50 | 63.00 |
| Dsgn. L = 5.00 ft | | 4 | 0.107 | 0.062 | | -9.81 | 9.81 | 152.50 | 91.32 | 1.00 | 1.00 | 3.93 | 94.50 | 63.00 |
| +D+0.750Lr+0.750L+H | | | | | | | | | | | | | | |
| Dsgn. L = 4.00 ft | | 1 | 0.037 | 0.030 | | -3.34 | 3.34 | 152.50 | 91.32 | 1.00 | 1.00 | 1.92 | 94.50 | 63.00 |
| Dsgn. L = 7.00 ft | | 2 | 0.037 | 0.030 | 1.07 | -3.34 | 3.34 | 152.50 | 91.32 | 1.00 | 1.00 | 1.92 | 94.50 | 63.00 |
| Dsgn. L = 6.00 ft | | 3 | 0.057 | 0.033 | 0.06 | -5.22 | 5.22 | 152.50 | 91.32 | 1.00 | 1.00 | 2.10 | 94.50 | 63.00 |

Steel Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTE-ZBB2XMC-F.Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9

Lic. #: KW-06009078

Licensee : Canyons Structural Inc

Description : FB5- B-Deck edge beam w/planter box abv

| Load Combination | Segment Length | Span # | Max Stress Ratios | | Summary of Moment Values | | | | | | Summary of Shear Values | | | |
|----------------------------|----------------|--------|-------------------|-------|--------------------------|--------|--------|--------|-----------|------|-------------------------|--------|-------|-----------|
| | | | M | V | Mmax + | Mmax - | Ma Max | Mnx | Mnx/Omega | Cb | Rm | Va Max | Vnx | Vnx/Omega |
| Dsgn. L = 5.00 ft | 4 | | 0.057 | 0.033 | | -5.22 | 5.22 | 152.50 | 91.32 | 1.00 | 1.00 | 2.09 | 94.50 | 63.00 |
| +D+0.750L+0.750S+H | | | | | | | | | | | | | | |
| Dsgn. L = 4.00 ft | 1 | | 0.068 | 0.057 | | -6.22 | 6.22 | 152.50 | 91.32 | 1.00 | 1.00 | 3.57 | 94.50 | 63.00 |
| Dsgn. L = 7.00 ft | 2 | | 0.068 | 0.057 | 1.99 | -6.22 | 6.22 | 152.50 | 91.32 | 1.00 | 1.00 | 3.57 | 94.50 | 63.00 |
| Dsgn. L = 6.00 ft | 3 | | 0.106 | 0.062 | 0.11 | -9.72 | 9.72 | 152.50 | 91.32 | 1.00 | 1.00 | 3.91 | 94.50 | 63.00 |
| Dsgn. L = 5.00 ft | 4 | | 0.106 | 0.062 | | -9.72 | 9.72 | 152.50 | 91.32 | 1.00 | 1.00 | 3.89 | 94.50 | 63.00 |
| +D+0.60W+H | | | | | | | | | | | | | | |
| Dsgn. L = 4.00 ft | 1 | | 0.035 | 0.029 | | -3.16 | 3.16 | 152.50 | 91.32 | 1.00 | 1.00 | 1.81 | 94.50 | 63.00 |
| Dsgn. L = 7.00 ft | 2 | | 0.035 | 0.029 | 1.01 | -3.16 | 3.16 | 152.50 | 91.32 | 1.00 | 1.00 | 1.81 | 94.50 | 63.00 |
| Dsgn. L = 6.00 ft | 3 | | 0.054 | 0.032 | 0.05 | -4.94 | 4.94 | 152.50 | 91.32 | 1.00 | 1.00 | 1.99 | 94.50 | 63.00 |
| Dsgn. L = 5.00 ft | 4 | | 0.054 | 0.031 | | -4.94 | 4.94 | 152.50 | 91.32 | 1.00 | 1.00 | 1.98 | 94.50 | 63.00 |
| +D+0.70E+H | | | | | | | | | | | | | | |
| Dsgn. L = 4.00 ft | 1 | | 0.027 | 0.022 | | -2.44 | 2.44 | 152.50 | 91.32 | 1.00 | 1.00 | 1.40 | 94.50 | 63.00 |
| Dsgn. L = 7.00 ft | 2 | | 0.027 | 0.022 | 0.78 | -2.44 | 2.44 | 152.50 | 91.32 | 1.00 | 1.00 | 1.40 | 94.50 | 63.00 |
| Dsgn. L = 6.00 ft | 3 | | 0.042 | 0.024 | 0.04 | -3.81 | 3.81 | 152.50 | 91.32 | 1.00 | 1.00 | 1.53 | 94.50 | 63.00 |
| Dsgn. L = 5.00 ft | 4 | | 0.042 | 0.024 | | -3.81 | 3.81 | 152.50 | 91.32 | 1.00 | 1.00 | 1.53 | 94.50 | 63.00 |
| +D+0.750L+0.750L+0.450W+H | | | | | | | | | | | | | | |
| Dsgn. L = 4.00 ft | 1 | | 0.042 | 0.035 | | -3.88 | 3.88 | 152.50 | 91.32 | 1.00 | 1.00 | 2.23 | 94.50 | 63.00 |
| Dsgn. L = 7.00 ft | 2 | | 0.042 | 0.035 | 1.24 | -3.88 | 3.88 | 152.50 | 91.32 | 1.00 | 1.00 | 2.23 | 94.50 | 63.00 |
| Dsgn. L = 6.00 ft | 3 | | 0.066 | 0.039 | 0.07 | -6.06 | 6.06 | 152.50 | 91.32 | 1.00 | 1.00 | 2.44 | 94.50 | 63.00 |
| Dsgn. L = 5.00 ft | 4 | | 0.066 | 0.038 | | -6.06 | 6.06 | 152.50 | 91.32 | 1.00 | 1.00 | 2.43 | 94.50 | 63.00 |
| +D+0.750L+0.750S+0.450W+H | | | | | | | | | | | | | | |
| Dsgn. L = 4.00 ft | 1 | | 0.074 | 0.062 | | -6.76 | 6.76 | 152.50 | 91.32 | 1.00 | 1.00 | 3.88 | 94.50 | 63.00 |
| Dsgn. L = 7.00 ft | 2 | | 0.074 | 0.062 | 2.16 | -6.76 | 6.76 | 152.50 | 91.32 | 1.00 | 1.00 | 3.88 | 94.50 | 63.00 |
| Dsgn. L = 6.00 ft | 3 | | 0.116 | 0.067 | 0.12 | -10.56 | 10.56 | 152.50 | 91.32 | 1.00 | 1.00 | 4.25 | 94.50 | 63.00 |
| Dsgn. L = 5.00 ft | 4 | | 0.116 | 0.067 | | -10.56 | 10.56 | 152.50 | 91.32 | 1.00 | 1.00 | 4.23 | 94.50 | 63.00 |
| +D+0.750L+0.750S+0.5250E+H | | | | | | | | | | | | | | |
| Dsgn. L = 4.00 ft | 1 | | 0.068 | 0.057 | | -6.22 | 6.22 | 152.50 | 91.32 | 1.00 | 1.00 | 3.57 | 94.50 | 63.00 |
| Dsgn. L = 7.00 ft | 2 | | 0.068 | 0.057 | 1.99 | -6.22 | 6.22 | 152.50 | 91.32 | 1.00 | 1.00 | 3.57 | 94.50 | 63.00 |
| Dsgn. L = 6.00 ft | 3 | | 0.106 | 0.062 | 0.11 | -9.72 | 9.72 | 152.50 | 91.32 | 1.00 | 1.00 | 3.91 | 94.50 | 63.00 |
| Dsgn. L = 5.00 ft | 4 | | 0.106 | 0.062 | | -9.72 | 9.72 | 152.50 | 91.32 | 1.00 | 1.00 | 3.89 | 94.50 | 63.00 |
| +0.60D+0.60W+0.60H | | | | | | | | | | | | | | |
| Dsgn. L = 4.00 ft | 1 | | 0.024 | 0.020 | | -2.18 | 2.18 | 152.50 | 91.32 | 1.00 | 1.00 | 1.25 | 94.50 | 63.00 |
| Dsgn. L = 7.00 ft | 2 | | 0.024 | 0.020 | 0.70 | -2.18 | 2.18 | 152.50 | 91.32 | 1.00 | 1.00 | 1.25 | 94.50 | 63.00 |
| Dsgn. L = 6.00 ft | 3 | | 0.037 | 0.022 | 0.04 | -3.41 | 3.41 | 152.50 | 91.32 | 1.00 | 1.00 | 1.37 | 94.50 | 63.00 |
| Dsgn. L = 5.00 ft | 4 | | 0.037 | 0.022 | | -3.41 | 3.41 | 152.50 | 91.32 | 1.00 | 1.00 | 1.37 | 94.50 | 63.00 |
| +0.60D+0.70E+0.60H | | | | | | | | | | | | | | |
| Dsgn. L = 4.00 ft | 1 | | 0.016 | 0.013 | | -1.46 | 1.46 | 152.50 | 91.32 | 1.00 | 1.00 | 0.84 | 94.50 | 63.00 |
| Dsgn. L = 7.00 ft | 2 | | 0.016 | 0.013 | 0.47 | -1.46 | 1.46 | 152.50 | 91.32 | 1.00 | 1.00 | 0.84 | 94.50 | 63.00 |
| Dsgn. L = 6.00 ft | 3 | | 0.025 | 0.015 | 0.02 | -2.29 | 2.29 | 152.50 | 91.32 | 1.00 | 1.00 | 0.92 | 94.50 | 63.00 |
| Dsgn. L = 5.00 ft | 4 | | 0.025 | 0.015 | | -2.29 | 2.29 | 152.50 | 91.32 | 1.00 | 1.00 | 0.92 | 94.50 | 63.00 |

Overall Maximum Deflections

| Load Combination | Span | Max. "-" Defl | Location in Span | Load Combination | Max. "+" Defl | Location in Span |
|---------------------------|------|---------------|------------------|---------------------------|---------------|------------------|
| +D+0.750L+0.750S+0.450W+H | 1 | 0.0152 | 0.000 | | 0.0000 | 0.000 |
| +D+0.750L+0.750S+0.450W+H | 2 | 0.0020 | 4.480 | +D+0.750L+0.750S+0.450W+H | -0.0005 | 0.793 |
| | 3 | 0.0000 | 4.480 | +D+0.750L+0.750S+0.450W+H | -0.0041 | 4.000 |
| +D+0.750L+0.750S+0.450W+H | 4 | 0.0472 | 5.000 | | 0.0000 | 4.000 |

Vertical Reactions

| Load Combination | Support notation : Far left is #1 | | | | | Values in KIPS |
|----------------------------|-----------------------------------|-----------|-----------|-----------|-----------|----------------|
| | Support 1 | Support 2 | Support 3 | Support 4 | Support 5 | |
| Overall MAXimum | | 7.263 | 2.854 | 8.473 | | |
| Overall MINimum | | 1.289 | 0.507 | 1.504 | | |
| +D+H | | 2.621 | 1.030 | 3.058 | | |
| +D+L+H | | 3.911 | 1.537 | 4.562 | | |
| +D+Lr+H | | 2.621 | 1.030 | 3.058 | | |
| +D+S+H | | 6.747 | 2.652 | 7.871 | | |
| +D+0.750Lr+0.750L+H | | 3.588 | 1.410 | 4.186 | | |
| +D+0.750L+0.750S+H | | 6.682 | 2.626 | 7.796 | | |
| +D+0.60W+H | | 3.395 | 1.334 | 3.961 | | |
| +D+0.70E+H | | 2.621 | 1.030 | 3.058 | | |
| +D+0.750Lr+0.750L+0.450W+H | | 4.168 | 1.638 | 4.863 | | |
| +D+0.750L+0.750S+0.450W+H | | 7.263 | 2.854 | 8.473 | | |
| +D+0.750L+0.750S+0.5250E+H | | 6.682 | 2.626 | 7.796 | | |
| +0.60D+0.60W+0.60H | | 2.346 | 0.922 | 2.737 | | |
| +0.60D+0.70E+0.60H | | 1.573 | 0.618 | 1.835 | | |
| D Only | | 2.621 | 1.030 | 3.058 | | |

Steel Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTE-ZBB2XMC-F.Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9

Lic. # : KW-06009078

Licensee : Canyons Structural Inc

Description : FB5- B-Deck edge beam w/planter box abv

| Load Combination | Support notation : Far left is #1 | | | | | Values in KIPS |
|------------------|-----------------------------------|-----------|-----------|-----------|-----------|----------------|
| | Support 1 | Support 2 | Support 3 | Support 4 | Support 5 | |
| Lr Only | | | | | | |
| L Only | | 1.289 | 0.507 | 1.504 | | |
| S Only | | 4.125 | 1.621 | 4.813 | | |
| W Only | | 1.289 | 0.507 | 1.504 | | |
| E Only | | | | | | |
| H Only | | | | | | |

Steel Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTE-ZBB2XMC-F.Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9

Lic. #: KW-06009078

Licensee: Canyons Structural Inc

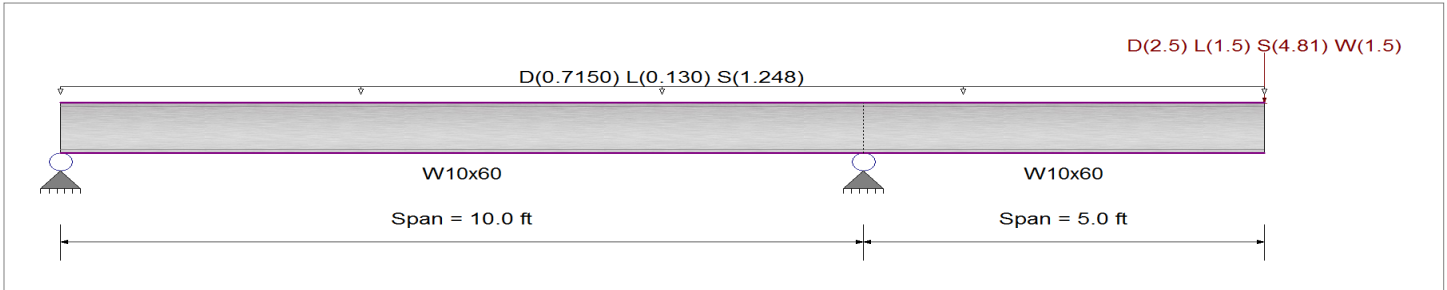
Description: FB6- B-Deck Beams w/cantilever

CODE REFERENCES

Calculations per AISC 360-10, IBC 2015, ASCE 7-10
 Load Combination Set : IBC 2015

Material Properties

Analysis Method : Allowable Strength Design
 Beam Bracing : Beam is Fully Braced against lateral-torsional buckling
 Bending Axis : Major Axis Bending
 Fy : Steel Yield : 50.0 ksi
 E : Modulus : 29,000.0 ksi



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loading
 Loads on all spans...
 Uniform Load on ALL spans : D = 0.110, L = 0.020, S = 0.1920 ksf, Tributary Width = 6.50 ft
 Load(s) for Span Number 2
 Point Load : D = 2.50, L = 1.50, S = 4.810, W = 1.50 k @ 5.0 ft

DESIGN SUMMARY

Design OK

| | | | |
|-----------------------------------|---------------------------|------------------------------|---------------------|
| Maximum Bending Stress Ratio = | 0.334 : 1 | Maximum Shear Stress Ratio = | 0.203 : 1 |
| Section used for this span | W10x60 | Section used for this span | W10x60 |
| Ma : Applied | 62.144 k-ft | Va : Applied | 17.425 k |
| Mn / Omega : Allowable | 186.128 k-ft | Vn/Omega : Allowable | 85.680 k |
| Load Combination | +D+0.750L+0.750S+0.450W+H | Load Combination | +D+S+H |
| Location of maximum on span | 10.000ft | Location of maximum on span | 10.000 ft |
| Span # where maximum occurs | Span # 1 | Span # where maximum occurs | Span # 1 |
| Maximum Deflection | | | |
| Max Downward Transient Deflection | 0.122 in | Ratio = | 984 >=600. |
| Max Upward Transient Deflection | -0.018 in | Ratio = | 6,594 >=600. |
| Max Downward Total Deflection | 0.197 in | Ratio = | 609 >=480. |
| Max Upward Total Deflection | -0.031 in | Ratio = | 3824 >=480. |

Maximum Forces & Stresses for Load Combinations

| Load Combination | Segment Length | Span # | Max Stress Ratios | | Summary of Moment Values | | | | | | Summary of Shear Values | | | |
|--------------------|----------------|--------|-------------------|-------|--------------------------|--------|--------|--------|-----------|------|-------------------------|--------|--------|-----------|
| | | | M | V | Mmax + | Mmax - | Ma Max | Mnx | Mnx/Omega | Cb | Rm | Va Max | Vnx | Vnx/Omega |
| +D+H | | | | | | | | | | | | | | |
| Dsgn. L = 10.00 ft | | 1 | 0.119 | 0.074 | 1.77 | -22.19 | 22.19 | 310.83 | 186.13 | 1.00 | 1.00 | 6.38 | 128.52 | 85.68 |
| Dsgn. L = 5.00 ft | | 2 | 0.119 | 0.074 | | -22.19 | 22.19 | 310.83 | 186.13 | 1.00 | 1.00 | 6.38 | 128.52 | 85.68 |
| +D+L+H | | | | | | | | | | | | | | |
| Dsgn. L = 10.00 ft | | 1 | 0.168 | 0.099 | 1.07 | -31.31 | 31.31 | 310.83 | 186.13 | 1.00 | 1.00 | 8.53 | 128.52 | 85.68 |
| Dsgn. L = 5.00 ft | | 2 | 0.168 | 0.099 | | -31.31 | 31.31 | 310.83 | 186.13 | 1.00 | 1.00 | 8.53 | 128.52 | 85.68 |
| +D+Lr+H | | | | | | | | | | | | | | |
| Dsgn. L = 10.00 ft | | 1 | 0.119 | 0.074 | 1.77 | -22.19 | 22.19 | 310.83 | 186.13 | 1.00 | 1.00 | 6.38 | 128.52 | 85.68 |
| Dsgn. L = 5.00 ft | | 2 | 0.119 | 0.074 | | -22.19 | 22.19 | 310.83 | 186.13 | 1.00 | 1.00 | 6.38 | 128.52 | 85.68 |
| +D+S+H | | | | | | | | | | | | | | |
| Dsgn. L = 10.00 ft | | 1 | 0.332 | 0.203 | 3.82 | -61.84 | 61.84 | 310.83 | 186.13 | 1.00 | 1.00 | 17.43 | 128.52 | 85.68 |
| Dsgn. L = 5.00 ft | | 2 | 0.332 | 0.203 | | -61.84 | 61.84 | 310.83 | 186.13 | 1.00 | 1.00 | 17.43 | 128.52 | 85.68 |
| +D+0.750L+0.750L+H | | | | | | | | | | | | | | |
| Dsgn. L = 10.00 ft | | 1 | 0.156 | 0.093 | 1.22 | -29.03 | 29.03 | 310.83 | 186.13 | 1.00 | 1.00 | 7.99 | 128.52 | 85.68 |
| Dsgn. L = 5.00 ft | | 2 | 0.156 | 0.093 | | -29.03 | 29.03 | 310.83 | 186.13 | 1.00 | 1.00 | 7.99 | 128.52 | 85.68 |
| +D+0.750L+0.750S+H | | | | | | | | | | | | | | |
| Dsgn. L = 10.00 ft | | 1 | 0.316 | 0.190 | 2.77 | -58.77 | 58.77 | 310.83 | 186.13 | 1.00 | 1.00 | 16.28 | 128.52 | 85.68 |
| Dsgn. L = 5.00 ft | | 2 | 0.316 | 0.190 | | -58.77 | 58.77 | 310.83 | 186.13 | 1.00 | 1.00 | 16.28 | 128.52 | 85.68 |
| +D+0.60W+H | | | | | | | | | | | | | | |
| Dsgn. L = 10.00 ft | | 1 | 0.143 | 0.085 | 0.94 | -26.69 | 26.69 | 310.83 | 186.13 | 1.00 | 1.00 | 7.28 | 128.52 | 85.68 |
| Dsgn. L = 5.00 ft | | 2 | 0.143 | 0.085 | | -26.69 | 26.69 | 310.83 | 186.13 | 1.00 | 1.00 | 7.28 | 128.52 | 85.68 |
| +D+0.70E+H | | | | | | | | | | | | | | |

Steel Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNT-E-ZBB2XMC-F.Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9

Lic. #: KW-06009078

Licensee : Canyons Structural Inc

Description : FB6- B-Deck Beams w/cantilever

| Load Combination | Segment Length | Span # | Max Stress Ratios | | Summary of Moment Values | | | | | | Summary of Shear Values | | | |
|----------------------------|----------------|--------|-------------------|-------|--------------------------|--------|--------|--------|-----------|------|-------------------------|--------|--------|-----------|
| | | | M | V | Mmax + | Mmax - | Ma Max | Mnx | Mnx/Omega | Cb | Rm | Va Max | Vnx | Vnx/Omega |
| Dsgn. L = 10.00 ft | | 1 | 0.119 | 0.074 | 1.77 | -22.19 | 22.19 | 310.83 | 186.13 | 1.00 | 1.00 | 6.38 | 128.52 | 85.68 |
| Dsgn. L = 5.00 ft | | 2 | 0.119 | 0.074 | | -22.19 | 22.19 | 310.83 | 186.13 | 1.00 | 1.00 | 6.38 | 128.52 | 85.68 |
| +D+0.750L+0.750L+0.450W+H | | | | | | | | | | | | | | |
| Dsgn. L = 10.00 ft | | 1 | 0.174 | 0.101 | 0.72 | -32.41 | 32.41 | 310.83 | 186.13 | 1.00 | 1.00 | 8.66 | 128.52 | 85.68 |
| Dsgn. L = 5.00 ft | | 2 | 0.174 | 0.101 | | -32.41 | 32.41 | 310.83 | 186.13 | 1.00 | 1.00 | 8.66 | 128.52 | 85.68 |
| +D+0.750L+0.750S+0.450W+H | | | | | | | | | | | | | | |
| Dsgn. L = 10.00 ft | | 1 | 0.334 | 0.198 | 2.21 | -62.14 | 62.14 | 310.83 | 186.13 | 1.00 | 1.00 | 16.95 | 128.52 | 85.68 |
| Dsgn. L = 5.00 ft | | 2 | 0.334 | 0.198 | | -62.14 | 62.14 | 310.83 | 186.13 | 1.00 | 1.00 | 16.95 | 128.52 | 85.68 |
| +D+0.750L+0.750S+0.5250E+H | | | | | | | | | | | | | | |
| Dsgn. L = 10.00 ft | | 1 | 0.316 | 0.190 | 2.77 | -58.77 | 58.77 | 310.83 | 186.13 | 1.00 | 1.00 | 16.28 | 128.52 | 85.68 |
| Dsgn. L = 5.00 ft | | 2 | 0.316 | 0.190 | | -58.77 | 58.77 | 310.83 | 186.13 | 1.00 | 1.00 | 16.28 | 128.52 | 85.68 |
| +0.60D+0.60W+0.60H | | | | | | | | | | | | | | |
| Dsgn. L = 10.00 ft | | 1 | 0.096 | 0.055 | 0.32 | -17.81 | 17.81 | 310.83 | 186.13 | 1.00 | 1.00 | 4.73 | 128.52 | 85.68 |
| Dsgn. L = 5.00 ft | | 2 | 0.096 | 0.055 | | -17.81 | 17.81 | 310.83 | 186.13 | 1.00 | 1.00 | 4.73 | 128.52 | 85.68 |
| +0.60D+0.70E+0.60H | | | | | | | | | | | | | | |
| Dsgn. L = 10.00 ft | | 1 | 0.072 | 0.045 | 1.06 | -13.31 | 13.31 | 310.83 | 186.13 | 1.00 | 1.00 | 3.83 | 128.52 | 85.68 |
| Dsgn. L = 5.00 ft | | 2 | 0.072 | 0.045 | | -13.31 | 13.31 | 310.83 | 186.13 | 1.00 | 1.00 | 3.83 | 128.52 | 85.68 |

Overall Maximum Deflections

| Load Combination | Span | Max. "-" Defl | Location in Span | Load Combination | Max. "+" Defl | Location in Span |
|---------------------------|------|---------------|------------------|---------------------------|---------------|------------------|
| | 1 | 0.0000 | 0.000 | +D+0.750L+0.750S+0.450W+H | -0.0314 | 6.760 |
| +D+0.750L+0.750S+0.450W+H | 2 | 0.1972 | 5.000 | | 0.0000 | 6.760 |

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

| Load Combination | Support 1 | Support 2 | Support 3 |
|----------------------------|-----------|-----------|-----------|
| Overall MAXimum | 3.931 | 33.724 | |
| Overall MINimum | -0.262 | 2.250 | |
| +D+H | 1.656 | 12.469 | |
| +D+L+H | 1.394 | 16.181 | |
| +D+Lr+H | 1.656 | 12.469 | |
| +D+S+H | 3.931 | 33.724 | |
| +D+0.750Lr+0.750L+H | 1.459 | 15.253 | |
| +D+0.750L+0.750S+H | 3.166 | 31.194 | |
| +D+0.60W+H | 1.206 | 13.819 | |
| +D+0.70E+H | 1.656 | 12.469 | |
| +D+0.750Lr+0.750L+0.450W+H | 1.122 | 16.266 | |
| +D+0.750L+0.750S+0.450W+H | 2.828 | 32.207 | |
| +D+0.750L+0.750S+0.5250E+H | 3.166 | 31.194 | |
| +0.60D+0.60W+0.60H | 0.544 | 8.831 | |
| +0.60D+0.70E+0.60H | 0.994 | 7.481 | |
| D Only | 1.656 | 12.469 | |
| Lr Only | | | |
| L Only | -0.262 | 3.713 | |
| S Only | 2.275 | 21.255 | |
| W Only | -0.750 | 2.250 | |
| E Only | | | |
| H Only | | | |

Steel Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTE-ZBB2XMC-F.Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9

Lic. #: KW-06009078

Licensee : Canyons Structural Inc

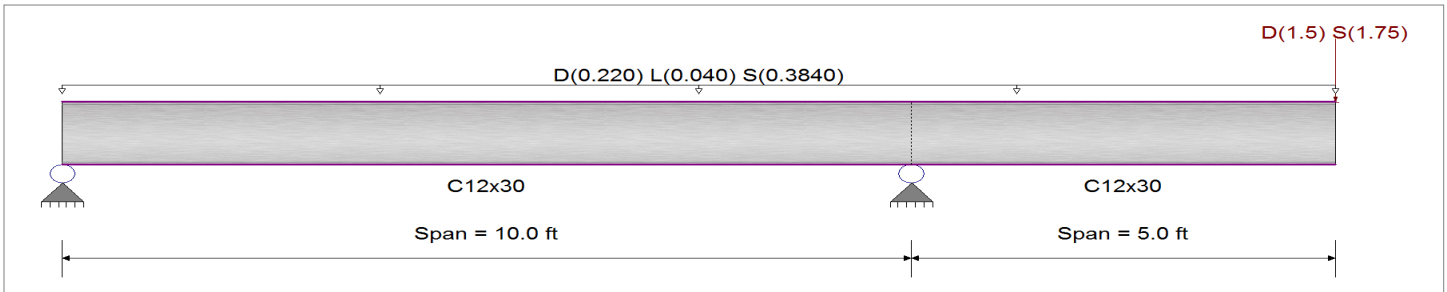
Description : FB8--Deck Beams w/cantilever (flush to conc. face)

CODE REFERENCES

Calculations per AISC 360-10, IBC 2015, ASCE 7-10
 Load Combination Set : IBC 2015

Material Properties

Analysis Method : Allowable Strength Design
 Beam Bracing : Beam is Fully Braced against lateral-torsional buckling
 Bending Axis : Major Axis Bending
 Fy : Steel Yield : 50.0 ksi
 E : Modulus : 29,000.0 ksi



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loading
 Loads on all spans...
 Uniform Load on ALL spans : D = 0.110, L = 0.020, S = 0.1920 ksf, Tributary Width = 2.0 ft
 Load(s) for Span Number 2
 Point Load : D = 1.50, S = 1.750 k @ 5.0 ft

DESIGN SUMMARY

Design OK

| | | | |
|-----------------------------------|------------------|------------------------------|---------------------|
| Maximum Bending Stress Ratio = | 0.287 : 1 | Maximum Shear Stress Ratio = | 0.058 : 1 |
| Section used for this span | C12x30 | Section used for this span | C12x30 |
| Ma : Applied | 24.175 k-ft | Va : Applied | 6.420 k |
| Mn / Omega : Allowable | 84.331 k-ft | Vn/Omega : Allowable | 109.940 k |
| Load Combination | +D+S+H | Load Combination | +D+S+H |
| Location of maximum on span | 10.000ft | Location of maximum on span | 10.000 ft |
| Span # where maximum occurs | Span # 1 | Span # where maximum occurs | Span # 1 |
| Maximum Deflection | | | |
| Max Downward Transient Deflection | 0.091 in | Ratio = | 1,313 >=600. |
| Max Upward Transient Deflection | -0.015 in | Ratio = | 8,091 >=600. |
| Max Downward Total Deflection | 0.167 in | Ratio = | 717 >=480. |
| Max Upward Total Deflection | -0.029 in | Ratio = | 4194 >=480. |

Maximum Forces & Stresses for Load Combinations

| Load Combination | Segment Length | Span # | Max Stress Ratios | | Summary of Moment Values | | | | | | Summary of Shear Values | | | |
|---------------------|----------------|--------|-------------------|-------|--------------------------|--------|--------|--------|-----------|------|-------------------------|--------|--------|-----------|
| | | | M | V | Mmax + | Mmax - | Ma Max | Mnx | Mnx/Omega | Cb | Rm | Va Max | Vnx | Vnx/Omega |
| +D+H | | | | | | | | | | | | | | |
| Dsgn. L = 10.00 ft | | 1 | 0.126 | 0.025 | 0.07 | -10.63 | 10.63 | 140.83 | 84.33 | 1.00 | 1.00 | 2.75 | 183.60 | 109.94 |
| Dsgn. L = 5.00 ft | | 2 | 0.126 | 0.025 | | -10.63 | 10.63 | 140.83 | 84.33 | 1.00 | 1.00 | 2.75 | 183.60 | 109.94 |
| +D+L+H | | | | | | | | | | | | | | |
| Dsgn. L = 10.00 ft | | 1 | 0.132 | 0.027 | 0.20 | -11.13 | 11.13 | 140.83 | 84.33 | 1.00 | 1.00 | 2.95 | 183.60 | 109.94 |
| Dsgn. L = 5.00 ft | | 2 | 0.132 | 0.027 | | -11.13 | 11.13 | 140.83 | 84.33 | 1.00 | 1.00 | 2.95 | 183.60 | 109.94 |
| +D+Lr+H | | | | | | | | | | | | | | |
| Dsgn. L = 10.00 ft | | 1 | 0.126 | 0.025 | 0.07 | -10.63 | 10.63 | 140.83 | 84.33 | 1.00 | 1.00 | 2.75 | 183.60 | 109.94 |
| Dsgn. L = 5.00 ft | | 2 | 0.126 | 0.025 | | -10.63 | 10.63 | 140.83 | 84.33 | 1.00 | 1.00 | 2.75 | 183.60 | 109.94 |
| +D+S+H | | | | | | | | | | | | | | |
| Dsgn. L = 10.00 ft | | 1 | 0.287 | 0.058 | 0.45 | -24.18 | 24.18 | 140.83 | 84.33 | 1.00 | 1.00 | 6.42 | 183.60 | 109.94 |
| Dsgn. L = 5.00 ft | | 2 | 0.287 | 0.058 | | -24.18 | 24.18 | 140.83 | 84.33 | 1.00 | 1.00 | 6.42 | 183.60 | 109.94 |
| +D+0.750Lr+0.750L+H | | | | | | | | | | | | | | |
| Dsgn. L = 10.00 ft | | 1 | 0.130 | 0.026 | 0.16 | -11.00 | 11.00 | 140.83 | 84.33 | 1.00 | 1.00 | 2.90 | 183.60 | 109.94 |
| Dsgn. L = 5.00 ft | | 2 | 0.130 | 0.026 | | -11.00 | 11.00 | 140.83 | 84.33 | 1.00 | 1.00 | 2.90 | 183.60 | 109.94 |
| +D+0.750L+0.750S+H | | | | | | | | | | | | | | |
| Dsgn. L = 10.00 ft | | 1 | 0.251 | 0.051 | 0.46 | -21.16 | 21.16 | 140.83 | 84.33 | 1.00 | 1.00 | 5.65 | 183.60 | 109.94 |
| Dsgn. L = 5.00 ft | | 2 | 0.251 | 0.051 | | -21.16 | 21.16 | 140.83 | 84.33 | 1.00 | 1.00 | 5.65 | 183.60 | 109.94 |
| +D+0.60W+H | | | | | | | | | | | | | | |
| Dsgn. L = 10.00 ft | | 1 | 0.126 | 0.025 | 0.07 | -10.63 | 10.63 | 140.83 | 84.33 | 1.00 | 1.00 | 2.75 | 183.60 | 109.94 |
| Dsgn. L = 5.00 ft | | 2 | 0.126 | 0.025 | | -10.63 | 10.63 | 140.83 | 84.33 | 1.00 | 1.00 | 2.75 | 183.60 | 109.94 |
| +D+0.70E+H | | | | | | | | | | | | | | |

Steel Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNT-E-ZBB2XMC-F.Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9

Lic. #: KW-06009078

Licensee: Canyons Structural Inc

Description: FB8--Deck Beams w/cantilever (flush to conc. face)

| Load Combination | Segment Length | Span # | Max Stress Ratios | | Summary of Moment Values | | | | | | Summary of Shear Values | | | |
|----------------------------|----------------|--------|-------------------|-------|--------------------------|--------|--------|--------|-----------|------|-------------------------|--------|--------|-----------|
| | | | M | V | Mmax + | Mmax - | Ma Max | Mnx | Mnx/Omega | Cb | Rm | Va Max | Vnx | Vnx/Omega |
| Dsgn. L = 10.00 ft | | 1 | 0.126 | 0.025 | 0.07 | -10.63 | 10.63 | 140.83 | 84.33 | 1.00 | 1.00 | 2.75 | 183.60 | 109.94 |
| Dsgn. L = 5.00 ft | | 2 | 0.126 | 0.025 | | -10.63 | 10.63 | 140.83 | 84.33 | 1.00 | 1.00 | 2.75 | 183.60 | 109.94 |
| +D+0.750Lr+0.750L+0.450W+H | | | | | | | | | | | | | | |
| Dsgn. L = 10.00 ft | | 1 | 0.130 | 0.026 | 0.16 | -11.00 | 11.00 | 140.83 | 84.33 | 1.00 | 1.00 | 2.90 | 183.60 | 109.94 |
| Dsgn. L = 5.00 ft | | 2 | 0.130 | 0.026 | | -11.00 | 11.00 | 140.83 | 84.33 | 1.00 | 1.00 | 2.90 | 183.60 | 109.94 |
| +D+0.750L+0.750S+0.450W+H | | | | | | | | | | | | | | |
| Dsgn. L = 10.00 ft | | 1 | 0.251 | 0.051 | 0.46 | -21.16 | 21.16 | 140.83 | 84.33 | 1.00 | 1.00 | 5.65 | 183.60 | 109.94 |
| Dsgn. L = 5.00 ft | | 2 | 0.251 | 0.051 | | -21.16 | 21.16 | 140.83 | 84.33 | 1.00 | 1.00 | 5.65 | 183.60 | 109.94 |
| +D+0.750L+0.750S+0.5250E+H | | | | | | | | | | | | | | |
| Dsgn. L = 10.00 ft | | 1 | 0.251 | 0.051 | 0.46 | -21.16 | 21.16 | 140.83 | 84.33 | 1.00 | 1.00 | 5.65 | 183.60 | 109.94 |
| Dsgn. L = 5.00 ft | | 2 | 0.251 | 0.051 | | -21.16 | 21.16 | 140.83 | 84.33 | 1.00 | 1.00 | 5.65 | 183.60 | 109.94 |
| +0.60D+0.60W+0.60H | | | | | | | | | | | | | | |
| Dsgn. L = 10.00 ft | | 1 | 0.076 | 0.015 | 0.04 | -6.38 | 6.38 | 140.83 | 84.33 | 1.00 | 1.00 | 1.65 | 183.60 | 109.94 |
| Dsgn. L = 5.00 ft | | 2 | 0.076 | 0.015 | | -6.38 | 6.38 | 140.83 | 84.33 | 1.00 | 1.00 | 1.65 | 183.60 | 109.94 |
| +0.60D+0.70E+0.60H | | | | | | | | | | | | | | |
| Dsgn. L = 10.00 ft | | 1 | 0.076 | 0.015 | 0.04 | -6.38 | 6.38 | 140.83 | 84.33 | 1.00 | 1.00 | 1.65 | 183.60 | 109.94 |
| Dsgn. L = 5.00 ft | | 2 | 0.076 | 0.015 | | -6.38 | 6.38 | 140.83 | 84.33 | 1.00 | 1.00 | 1.65 | 183.60 | 109.94 |

Overall Maximum Deflections

| Load Combination | Span | Max. "-" Defl | Location in Span | Load Combination | Max. "+" Defl | Location in Span |
|------------------|------|---------------|------------------|------------------|---------------|------------------|
| +D+S+H | 1 | 0.0000 | 0.000 | +D+S+H | -0.0286 | 6.600 |
| | 2 | 0.1674 | 5.000 | | 0.0000 | 6.600 |

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

| Load Combination | Support 1 | Support 2 | Support 3 |
|----------------------------|-----------|-----------|-----------|
| Overall MAXimum | 0.752 | 12.008 | |
| Overall MINimum | 0.113 | 0.450 | |
| +D+H | 0.187 | 5.063 | |
| +D+L+H | 0.337 | 5.513 | |
| +D+Lr+H | 0.187 | 5.063 | |
| +D+S+H | 0.752 | 12.008 | |
| +D+0.750Lr+0.750L+H | 0.300 | 5.400 | |
| +D+0.750L+0.750S+H | 0.724 | 10.609 | |
| +D+0.60W+H | 0.187 | 5.063 | |
| +D+0.70E+H | 0.187 | 5.063 | |
| +D+0.750Lr+0.750L+0.450W+H | 0.300 | 5.400 | |
| +D+0.750L+0.750S+0.450W+H | 0.724 | 10.609 | |
| +D+0.750L+0.750S+0.5250E+H | 0.724 | 10.609 | |
| +0.60D+0.60W+0.60H | 0.113 | 3.038 | |
| +0.60D+0.70E+0.60H | 0.113 | 3.038 | |
| D Only | 0.187 | 5.063 | |
| Lr Only | | | |
| L Only | 0.150 | 0.450 | |
| S Only | 0.565 | 6.945 | |
| W Only | | | |
| E Only | | | |
| H Only | | | |

Steel Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTE-ZBB2XMC-F.Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9

Lic. #: KW-06009078

Licensee : Canyons Structural Inc

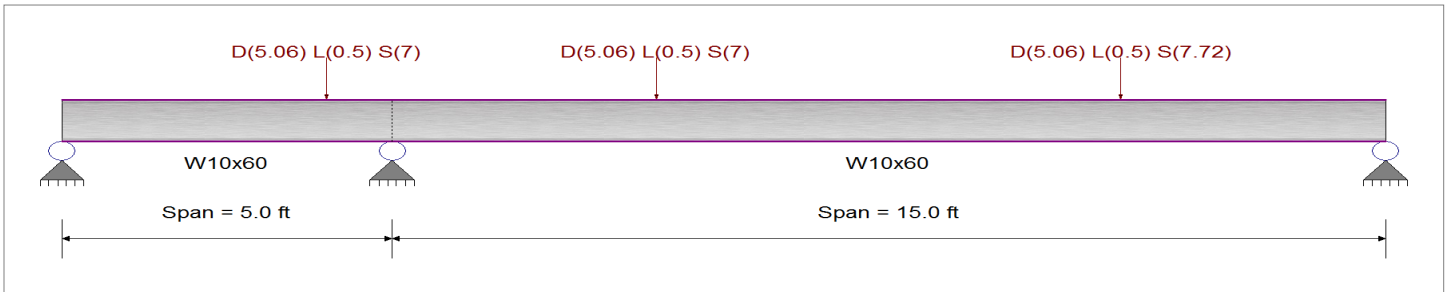
Description : FB6- b-deck beam abv glass supporting beams over eave

CODE REFERENCES

Calculations per AISC 360-10, IBC 2015, ASCE 7-10
 Load Combination Set : IBC 2015

Material Properties

Analysis Method : Allowable Strength Design
 Beam Bracing : Beam is Fully Braced against lateral-torsional buckling
 Bending Axis : Major Axis Bending
 Fy : Steel Yield : 50.0 ksi
 E : Modulus : 29,000.0 ksi



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loading
 Load(s) for Span Number 1
 Point Load : D = 5.060, L = 0.50, S = 7.0 k @ 4.0 ft
 Load(s) for Span Number 2
 Point Load : D = 5.060, L = 0.50, S = 7.0 k @ 4.0 ft
 Point Load : D = 5.060, L = 0.50, S = 7.720 k @ 11.0 ft

DESIGN SUMMARY

Design OK

| | | | |
|-----------------------------------|------------------|------------------------------|------------------|
| Maximum Bending Stress Ratio = | 0.238 : 1 | Maximum Shear Stress Ratio = | 0.218 : 1 |
| Section used for this span | W10x60 | Section used for this span | W10x60 |
| Ma : Applied | 44.284 k-ft | Va : Applied | 18.655 k |
| Mn / Omega : Allowable | 186.128 k-ft | Vn/Omega : Allowable | 85.680 k |
| Load Combination | +D+S+H | Load Combination | +D+S+H |
| Location of maximum on span | 5.000ft | Location of maximum on span | 5.000 ft |
| Span # where maximum occurs | Span # 1 | Span # where maximum occurs | Span # 1 |
| Maximum Deflection | | | |
| Max Downward Transient Deflection | 0.070 in | Ratio = | 2,560 >=600. |
| Max Upward Transient Deflection | -0.005 in | Ratio = | 11,339 >=600. |
| Max Downward Total Deflection | 0.122 in | Ratio = | 1477 >=480. |
| Max Upward Total Deflection | -0.009 in | Ratio = | 6523 >=480. |

Maximum Forces & Stresses for Load Combinations

| Load Combination | Segment Length | Span # | Max Stress Ratios | | Summary of Moment Values | | | | | | Summary of Shear Values | | | |
|---------------------|----------------|--------|-------------------|-------|--------------------------|--------|--------|--------|-----------|------|-------------------------|--------|--------|-----------|
| | | | M | V | Mmax + | Mmax - | Ma Max | Mnx | Mnx/Omega | Cb | Rm | Va Max | Vnx | Vnx/Omega |
| +D+H | | | | | | | | | | | | | | |
| Dsgn. L = 5.00 ft | | 1 | 0.102 | 0.093 | | -18.92 | 18.92 | 310.83 | 186.13 | 1.00 | 1.00 | 7.98 | 128.52 | 85.68 |
| Dsgn. L = 15.00 ft | | 2 | 0.102 | 0.079 | 16.49 | -18.92 | 18.92 | 310.83 | 186.13 | 1.00 | 1.00 | 6.77 | 128.52 | 85.68 |
| +D+L+H | | | | | | | | | | | | | | |
| Dsgn. L = 5.00 ft | | 1 | 0.111 | 0.102 | | -20.66 | 20.66 | 310.83 | 186.13 | 1.00 | 1.00 | 8.73 | 128.52 | 85.68 |
| Dsgn. L = 15.00 ft | | 2 | 0.111 | 0.086 | 18.03 | -20.66 | 20.66 | 310.83 | 186.13 | 1.00 | 1.00 | 7.39 | 128.52 | 85.68 |
| +D+Lr+H | | | | | | | | | | | | | | |
| Dsgn. L = 5.00 ft | | 1 | 0.102 | 0.093 | | -18.92 | 18.92 | 310.83 | 186.13 | 1.00 | 1.00 | 7.98 | 128.52 | 85.68 |
| Dsgn. L = 15.00 ft | | 2 | 0.102 | 0.079 | 16.49 | -18.92 | 18.92 | 310.83 | 186.13 | 1.00 | 1.00 | 6.77 | 128.52 | 85.68 |
| +D+S+H | | | | | | | | | | | | | | |
| Dsgn. L = 5.00 ft | | 1 | 0.238 | 0.218 | | -44.28 | 44.28 | 310.83 | 186.13 | 1.00 | 1.00 | 18.65 | 128.52 | 85.68 |
| Dsgn. L = 15.00 ft | | 2 | 0.238 | 0.183 | 39.80 | -44.28 | 44.28 | 310.83 | 186.13 | 1.00 | 1.00 | 15.65 | 128.52 | 85.68 |
| +D+0.750Lr+0.750L+H | | | | | | | | | | | | | | |
| Dsgn. L = 5.00 ft | | 1 | 0.109 | 0.100 | | -20.23 | 20.23 | 310.83 | 186.13 | 1.00 | 1.00 | 8.54 | 128.52 | 85.68 |
| Dsgn. L = 15.00 ft | | 2 | 0.109 | 0.084 | 17.64 | -20.23 | 20.23 | 310.83 | 186.13 | 1.00 | 1.00 | 7.23 | 128.52 | 85.68 |
| +D+0.750L+0.750S+H | | | | | | | | | | | | | | |
| Dsgn. L = 5.00 ft | | 1 | 0.211 | 0.193 | | -39.25 | 39.25 | 310.83 | 186.13 | 1.00 | 1.00 | 16.55 | 128.52 | 85.68 |
| Dsgn. L = 15.00 ft | | 2 | 0.211 | 0.162 | 35.13 | -39.25 | 39.25 | 310.83 | 186.13 | 1.00 | 1.00 | 13.90 | 128.52 | 85.68 |
| +D+0.60W+H | | | | | | | | | | | | | | |
| Dsgn. L = 5.00 ft | | 1 | 0.102 | 0.093 | | -18.92 | 18.92 | 310.83 | 186.13 | 1.00 | 1.00 | 7.98 | 128.52 | 85.68 |
| Dsgn. L = 15.00 ft | | 2 | 0.102 | 0.079 | 16.49 | -18.92 | 18.92 | 310.83 | 186.13 | 1.00 | 1.00 | 6.77 | 128.52 | 85.68 |

Steel Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNT-2\BB2XMC-F\Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9

Lic. #: KW-06009078

Licensee: Canyons Structural Inc

Description: FB6- b-deck beam abv glass supporting beams over eave

| Load Combination Segment Length | Span # | Max Stress Ratios | | Summary of Moment Values | | | | | | Summary of Shear Values | | | |
|------------------------------------|--------|-------------------|-------|--------------------------|--------|--------|--------|-----------|------|-------------------------|--------|--------|-----------|
| | | M | V | Mmax + | Mmax - | Ma Max | Mnx | Mnx/Omega | Cb | Rm | Va Max | Vnx | Vnx/Omega |
| +D+0.70E+H | | | | | | | | | | | | | |
| Dsgn. L = 5.00 ft | 1 | 0.102 | 0.093 | | -18.92 | 18.92 | 310.83 | 186.13 | 1.00 | 1.00 | 7.98 | 128.52 | 85.68 |
| Dsgn. L = 15.00 ft | 2 | 0.102 | 0.079 | 16.49 | -18.92 | 18.92 | 310.83 | 186.13 | 1.00 | 1.00 | 6.77 | 128.52 | 85.68 |
| +D+0.750Lr+0.750L+0.450W+H | | | | | | | | | | | | | |
| Dsgn. L = 5.00 ft | 1 | 0.109 | 0.100 | | -20.23 | 20.23 | 310.83 | 186.13 | 1.00 | 1.00 | 8.54 | 128.52 | 85.68 |
| Dsgn. L = 15.00 ft | 2 | 0.109 | 0.084 | 17.64 | -20.23 | 20.23 | 310.83 | 186.13 | 1.00 | 1.00 | 7.23 | 128.52 | 85.68 |
| +D+0.750L+0.750S+0.450W+H | | | | | | | | | | | | | |
| Dsgn. L = 5.00 ft | 1 | 0.211 | 0.193 | | -39.25 | 39.25 | 310.83 | 186.13 | 1.00 | 1.00 | 16.55 | 128.52 | 85.68 |
| Dsgn. L = 15.00 ft | 2 | 0.211 | 0.162 | 35.13 | -39.25 | 39.25 | 310.83 | 186.13 | 1.00 | 1.00 | 13.90 | 128.52 | 85.68 |
| +D+0.750L+0.750S+0.5250E+H | | | | | | | | | | | | | |
| Dsgn. L = 5.00 ft | 1 | 0.211 | 0.193 | | -39.25 | 39.25 | 310.83 | 186.13 | 1.00 | 1.00 | 16.55 | 128.52 | 85.68 |
| Dsgn. L = 15.00 ft | 2 | 0.211 | 0.162 | 35.13 | -39.25 | 39.25 | 310.83 | 186.13 | 1.00 | 1.00 | 13.90 | 128.52 | 85.68 |
| +0.60D+0.60W+0.60H | | | | | | | | | | | | | |
| Dsgn. L = 5.00 ft | 1 | 0.061 | 0.056 | | -11.35 | 11.35 | 310.83 | 186.13 | 1.00 | 1.00 | 4.79 | 128.52 | 85.68 |
| Dsgn. L = 15.00 ft | 2 | 0.061 | 0.047 | 9.90 | -11.35 | 11.35 | 310.83 | 186.13 | 1.00 | 1.00 | 4.06 | 128.52 | 85.68 |
| +0.60D+0.70E+0.60H | | | | | | | | | | | | | |
| Dsgn. L = 5.00 ft | 1 | 0.061 | 0.056 | | -11.35 | 11.35 | 310.83 | 186.13 | 1.00 | 1.00 | 4.79 | 128.52 | 85.68 |
| Dsgn. L = 15.00 ft | 2 | 0.061 | 0.047 | 9.90 | -11.35 | 11.35 | 310.83 | 186.13 | 1.00 | 1.00 | 4.06 | 128.52 | 85.68 |

Overall Maximum Deflections

| Load Combination | Span | Max. "-" Defl | Location in Span | Load Combination | Max. "+" Defl | Location in Span |
|------------------|------|---------------|------------------|------------------|---------------|------------------|
| | 1 | 0.0000 | 0.000 | | | |
| +D+S+H | 2 | 0.1218 | 8.460 | +D+S+H | -0.0092 | 2.920 |
| | | | | | 0.0000 | 2.920 |

Vertical Reactions

| Load Combination | Support notation : Far left is #1 | | | Values in KIPS |
|----------------------------|-----------------------------------|-----------|-----------|----------------|
| | Support 1 | Support 2 | Support 3 | |
| Overall MAXimum | -6.295 | 34.309 | 10.086 | |
| Overall MINimum | -0.248 | 1.364 | 0.384 | |
| +D+H | -2.622 | 14.754 | 4.249 | |
| +D+L+H | -2.870 | 16.118 | 4.633 | |
| +D+Lr+H | -2.622 | 14.754 | 4.249 | |
| +D+S+H | -6.295 | 34.309 | 10.086 | |
| +D+0.750Lr+0.750L+H | -2.808 | 15.777 | 4.537 | |
| +D+0.750L+0.750S+H | -5.563 | 30.443 | 8.914 | |
| +D+0.60W+H | -2.622 | 14.754 | 4.249 | |
| +D+0.70E+H | -2.622 | 14.754 | 4.249 | |
| +D+0.750Lr+0.750L+0.450W+H | -2.808 | 15.777 | 4.537 | |
| +D+0.750L+0.750S+0.450W+H | -5.563 | 30.443 | 8.914 | |
| +D+0.750L+0.750S+0.5250E+H | -5.563 | 30.443 | 8.914 | |
| +0.60D+0.60W+0.60H | -1.573 | 8.852 | 2.549 | |
| +0.60D+0.70E+0.60H | -1.573 | 8.852 | 2.549 | |
| D Only | -2.622 | 14.754 | 4.249 | |
| Lr Only | | | | |
| L Only | -0.248 | 1.364 | 0.384 | |
| S Only | -3.673 | 19.556 | 5.837 | |
| W Only | | | | |
| E Only | | | | |
| H Only | | | | |

Steel Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTE-ZBB2XMC-F.Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9

Lic. #: KW-0609078

Licensee : Canyons Structural Inc

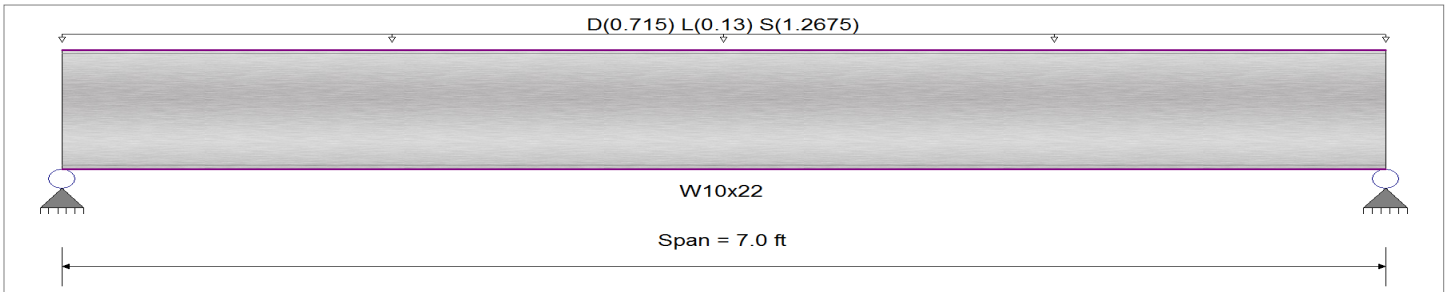
Description : FB5- B-deck, simple supported beam

CODE REFERENCES

Calculations per AISC 360-10, IBC 2015, ASCE 7-10
 Load Combination Set : IBC 2015

Material Properties

Analysis Method : Allowable Strength Design
 Beam Bracing : Beam is Fully Braced against lateral-torsional buckling
 Bending Axis : Major Axis Bending
 Fy : Steel Yield : 50.0 ksi
 E: Modulus : 29,000.0 ksi



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loading
 Uniform Load : D = 0.110, L = 0.020, S = 0.1950 ksf, Tributary Width = 6.50 ft

DESIGN SUMMARY

Design OK

| | | | |
|-----------------------------------|------------------|------------------------------|------------------|
| Maximum Bending Stress Ratio = | 0.189 : 1 | Maximum Shear Stress Ratio = | 0.143 : 1 |
| Section used for this span | W10x22 | Section used for this span | W10x22 |
| Ma : Applied | 12.278 k-ft | Va : Applied | 7.016 k |
| Mn / Omega : Allowable | 64.870 k-ft | Vn/Omega : Allowable | 48.960 k |
| Load Combination | +D+S+H | Load Combination | +D+S+H |
| Location of maximum on span | 3.500ft | Location of maximum on span | 0.000 ft |
| Span # where maximum occurs | Span # 1 | Span # where maximum occurs | Span # 1 |
| Maximum Deflection | | | |
| Max Downward Transient Deflection | 0.020 in | Ratio = | 4,178 >=600. |
| Max Upward Transient Deflection | 0.000 in | Ratio = | 0 <600.0 |
| Max Downward Total Deflection | 0.032 in | Ratio = | 2642 >=480. |
| Max Upward Total Deflection | 0.000 in | Ratio = | 0 <480.0 |

Maximum Forces & Stresses for Load Combinations

| Load Combination | Segment Length | Span # | Max Stress Ratios | | Summary of Moment Values | | | | | | Summary of Shear Values | | | |
|----------------------------|-------------------|--------|-------------------|-------|--------------------------|--------|--------|--------|-----------|------|-------------------------|--------|-------|-----------|
| | | | M | V | Mmax + | Mmax - | Ma Max | Mnx | Mnx/Omega | Cb | Rm | Va Max | Vnx | Vnx/Omega |
| +D+H | Dsgn. L = 7.00 ft | 1 | 0.070 | 0.053 | 4.51 | | 4.51 | 108.33 | 64.87 | 1.00 | 1.00 | 2.58 | 73.44 | 48.96 |
| +D+L+H | Dsgn. L = 7.00 ft | 1 | 0.082 | 0.062 | 5.31 | | 5.31 | 108.33 | 64.87 | 1.00 | 1.00 | 3.03 | 73.44 | 48.96 |
| +D+Lr+H | Dsgn. L = 7.00 ft | 1 | 0.070 | 0.053 | 4.51 | | 4.51 | 108.33 | 64.87 | 1.00 | 1.00 | 2.58 | 73.44 | 48.96 |
| +D+S+H | Dsgn. L = 7.00 ft | 1 | 0.189 | 0.143 | 12.28 | | 12.28 | 108.33 | 64.87 | 1.00 | 1.00 | 7.02 | 73.44 | 48.96 |
| +D+0.750Lr+0.750L+H | Dsgn. L = 7.00 ft | 1 | 0.079 | 0.060 | 5.11 | | 5.11 | 108.33 | 64.87 | 1.00 | 1.00 | 2.92 | 73.44 | 48.96 |
| +D+0.750L+0.750S+H | Dsgn. L = 7.00 ft | 1 | 0.169 | 0.128 | 10.93 | | 10.93 | 108.33 | 64.87 | 1.00 | 1.00 | 6.25 | 73.44 | 48.96 |
| +D+0.60W+H | Dsgn. L = 7.00 ft | 1 | 0.070 | 0.053 | 4.51 | | 4.51 | 108.33 | 64.87 | 1.00 | 1.00 | 2.58 | 73.44 | 48.96 |
| +D+0.70E+H | Dsgn. L = 7.00 ft | 1 | 0.070 | 0.053 | 4.51 | | 4.51 | 108.33 | 64.87 | 1.00 | 1.00 | 2.58 | 73.44 | 48.96 |
| +D+0.750Lr+0.750L+0.450W+H | Dsgn. L = 7.00 ft | 1 | 0.079 | 0.060 | 5.11 | | 5.11 | 108.33 | 64.87 | 1.00 | 1.00 | 2.92 | 73.44 | 48.96 |
| +D+0.750L+0.750S+0.450W+H | Dsgn. L = 7.00 ft | 1 | 0.169 | 0.128 | 10.93 | | 10.93 | 108.33 | 64.87 | 1.00 | 1.00 | 6.25 | 73.44 | 48.96 |
| +D+0.750L+0.750S+0.5250E+H | Dsgn. L = 7.00 ft | 1 | 0.169 | 0.128 | 10.93 | | 10.93 | 108.33 | 64.87 | 1.00 | 1.00 | 6.25 | 73.44 | 48.96 |
| +0.60D+0.60W+0.60H | Dsgn. L = 7.00 ft | 1 | 0.042 | 0.032 | 2.71 | | 2.71 | 108.33 | 64.87 | 1.00 | 1.00 | 1.55 | 73.44 | 48.96 |
| +0.60D+0.70E+0.60H | | | | | | | | | | | | | | |

Steel Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTE-ZBB2XMC-F.Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9

Lic. #: KW-06009078

Licensee: Canyons Structural Inc

Description: FB5- B-deck, simple supported beam

| Load Combination | Segment Length | Span # | Max Stress Ratios | | Summary of Moment Values | | | | | | Summary of Shear Values | | | |
|------------------|----------------|--------|-------------------|-------|--------------------------|--------|--------|--------|-----------|------|-------------------------|--------|-------|-----------|
| | | | M | V | Mmax + | Mmax - | Ma Max | Mnx | Mnx/Omega | Cb | Rm | Va Max | Vnx | Vnx/Omega |
| Dsgn. L = | 7.00 ft | 1 | 0.042 | 0.032 | 2.71 | | 2.71 | 108.33 | 64.87 | 1.00 | 1.00 | 1.55 | 73.44 | 48.96 |

Overall Maximum Deflections

| Load Combination | Span | Max. "-" Defl | Location in Span | Load Combination | Max. "+" Defl | Location in Span |
|------------------|------|---------------|------------------|------------------|---------------|------------------|
| +D+S+H | 1 | 0.0318 | 3.520 | | 0.0000 | 0.000 |

Vertical Reactions

| Load Combination | Support 1 | Support 2 |
|----------------------------|-----------|-----------|
| Overall MAXimum | 7.016 | 7.016 |
| Overall MINimum | 0.455 | 0.455 |
| +D+H | 2.580 | 2.580 |
| +D+L+H | 3.035 | 3.035 |
| +D+Lr+H | 2.580 | 2.580 |
| +D+S+H | 7.016 | 7.016 |
| +D+0.750Lr+0.750L+H | 2.921 | 2.921 |
| +D+0.750L+0.750S+H | 6.248 | 6.248 |
| +D+0.60W+H | 2.580 | 2.580 |
| +D+0.70E+H | 2.580 | 2.580 |
| +D+0.750Lr+0.750L+0.450W+H | 2.921 | 2.921 |
| +D+0.750L+0.750S+0.450W+H | 6.248 | 6.248 |
| +D+0.750L+0.750S+0.5250E+H | 6.248 | 6.248 |
| +0.60D+0.60W+0.60H | 1.548 | 1.548 |
| +0.60D+0.70E+0.60H | 1.548 | 1.548 |
| D Only | 2.580 | 2.580 |
| Lr Only | | |
| L Only | 0.455 | 0.455 |
| S Only | 4.436 | 4.436 |
| W Only | | |
| E Only | | |
| H Only | | |

Steel Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTE-ZBB2XMC-F.Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9

Lic. #: KW-06009078

Licensee : Canyons Structural Inc

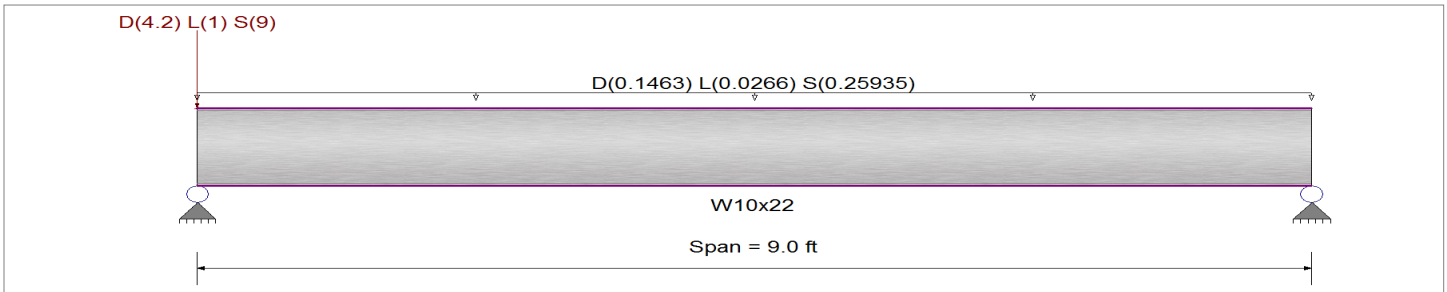
Description : FB5- B-deck, simple supported beam w/point load

CODE REFERENCES

Calculations per AISC 360-10, IBC 2015, ASCE 7-10
 Load Combination Set : IBC 2015

Material Properties

Analysis Method : Allowable Strength Design
 Beam Bracing : Beam is Fully Braced against lateral-torsional buckling
 Bending Axis : Major Axis Bending
 Fy : Steel Yield : 50.0 ksi
 E: Modulus : 29,000.0 ksi



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loading
 Uniform Load : D = 0.110, L = 0.020, S = 0.1950 ksf, Tributary Width = 1.330 ft
 Point Load : D = 4.20, L = 1.0, S = 9.0 k @ 0.0 ft

DESIGN SUMMARY

Design OK

| | | | |
|-----------------------------------|------------------|------------------------------|------------------|
| Maximum Bending Stress Ratio = | 0.067 : 1 | Maximum Shear Stress Ratio = | 0.039 : 1 |
| Section used for this span | W10x22 | Section used for this span | W10x22 |
| Ma : Applied | 4.330 k-ft | Va : Applied | 1.924 k |
| Mn / Omega : Allowable | 64.870 k-ft | Vn/Omega : Allowable | 48.960 k |
| Load Combination | +D+S+H | Load Combination | +D+S+H |
| Location of maximum on span | 4.500ft | Location of maximum on span | 0.000 ft |
| Span # where maximum occurs | Span # 1 | Span # where maximum occurs | Span # 1 |
| Maximum Deflection | | | |
| Max Downward Transient Deflection | 0.011 in | Ratio = | 9,609 >=600. |
| Max Upward Transient Deflection | 0.000 in | Ratio = | 0 <600.0 |
| Max Downward Total Deflection | 0.019 in | Ratio = | 5827 >=480. |
| Max Upward Total Deflection | 0.000 in | Ratio = | 0 <480.0 |

Maximum Forces & Stresses for Load Combinations

| Load Combination | Segment Length | Span # | Max Stress Ratios | | Summary of Moment Values | | | | | | Summary of Shear Values | | | |
|----------------------------|-------------------|--------|-------------------|-------|--------------------------|--------|--------|--------|-----------|------|-------------------------|--------|-------|-----------|
| | | | M | V | Mmax + | Mmax - | Ma Max | Mnx | Mnx/Omega | Cb | Rm | Va Max | Vnx | Vnx/Omega |
| +D+H | Dsgn. L = 9.00 ft | 1 | 0.026 | 0.015 | 1.70 | | 1.70 | 108.33 | 64.87 | 1.00 | 1.00 | 0.76 | 73.44 | 48.96 |
| +D+L+H | Dsgn. L = 9.00 ft | 1 | 0.030 | 0.018 | 1.97 | | 1.97 | 108.33 | 64.87 | 1.00 | 1.00 | 0.88 | 73.44 | 48.96 |
| +D+Lr+H | Dsgn. L = 9.00 ft | 1 | 0.026 | 0.015 | 1.70 | | 1.70 | 108.33 | 64.87 | 1.00 | 1.00 | 0.76 | 73.44 | 48.96 |
| +D+S+H | Dsgn. L = 9.00 ft | 1 | 0.067 | 0.039 | 4.33 | | 4.33 | 108.33 | 64.87 | 1.00 | 1.00 | 1.92 | 73.44 | 48.96 |
| +D+0.750Lr+0.750L+H | Dsgn. L = 9.00 ft | 1 | 0.029 | 0.017 | 1.91 | | 1.91 | 108.33 | 64.87 | 1.00 | 1.00 | 0.85 | 73.44 | 48.96 |
| +D+0.750L+0.750S+H | Dsgn. L = 9.00 ft | 1 | 0.060 | 0.035 | 3.88 | | 3.88 | 108.33 | 64.87 | 1.00 | 1.00 | 1.72 | 73.44 | 48.96 |
| +D+0.60W+H | Dsgn. L = 9.00 ft | 1 | 0.026 | 0.015 | 1.70 | | 1.70 | 108.33 | 64.87 | 1.00 | 1.00 | 0.76 | 73.44 | 48.96 |
| +D+0.70E+H | Dsgn. L = 9.00 ft | 1 | 0.026 | 0.015 | 1.70 | | 1.70 | 108.33 | 64.87 | 1.00 | 1.00 | 0.76 | 73.44 | 48.96 |
| +D+0.750Lr+0.750L+0.450W+H | Dsgn. L = 9.00 ft | 1 | 0.029 | 0.017 | 1.91 | | 1.91 | 108.33 | 64.87 | 1.00 | 1.00 | 0.85 | 73.44 | 48.96 |
| +D+0.750L+0.750S+0.450W+H | Dsgn. L = 9.00 ft | 1 | 0.060 | 0.035 | 3.88 | | 3.88 | 108.33 | 64.87 | 1.00 | 1.00 | 1.72 | 73.44 | 48.96 |
| +D+0.750L+0.750S+0.5250E+H | Dsgn. L = 9.00 ft | 1 | 0.060 | 0.035 | 3.88 | | 3.88 | 108.33 | 64.87 | 1.00 | 1.00 | 1.72 | 73.44 | 48.96 |
| +0.60D+0.60W+0.60H | Dsgn. L = 9.00 ft | 1 | 0.016 | 0.009 | 1.02 | | 1.02 | 108.33 | 64.87 | 1.00 | 1.00 | 0.45 | 73.44 | 48.96 |

Steel Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTE-ZBB2XMC-F.Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9

Lic. #: KW-06009078

Licensee: Canyons Structural Inc

Description: FB5- B-deck, simple supported beam w/point load

| Load Combination | Segment Length | Span # | Max Stress Ratios | | Summary of Moment Values | | | | | | Summary of Shear Values | | | |
|--------------------|-------------------|--------|-------------------|-------|--------------------------|--------|--------|--------|-----------|------|-------------------------|--------|-------|-----------|
| | | | M | V | Mmax + | Mmax - | Ma Max | Mnx | Mnx/Omega | Cb | Rm | Va Max | Vnx | Vnx/Omega |
| +0.60D+0.70E+0.60H | Dsgn. L = 9.00 ft | 1 | 0.016 | 0.009 | 1.02 | | 1.02 | 108.33 | 64.87 | 1.00 | 1.00 | 0.45 | 73.44 | 48.96 |

Overall Maximum Deflections

| Load Combination | Span | Max. "-" Defl | Location in Span | Load Combination | Max. "+" Defl | Location in Span |
|------------------|------|---------------|------------------|------------------|---------------|------------------|
| +D+S+H | 1 | 0.0185 | 4.526 | | 0.0000 | 0.000 |

Vertical Reactions

| Load Combination | Support 1 | Support 2 |
|----------------------------|-----------|-----------|
| Overall MAXimum | 15.124 | 1.924 |
| Overall MINimum | 1.120 | 0.120 |
| +D+H | 4.957 | 0.757 |
| +D+L+H | 6.077 | 0.877 |
| +D+Lr+H | 4.957 | 0.757 |
| +D+S+H | 15.124 | 1.924 |
| +D+0.750Lr+0.750L+H | 5.797 | 0.847 |
| +D+0.750L+0.750S+H | 13.422 | 1.722 |
| +D+0.60W+H | 4.957 | 0.757 |
| +D+0.70E+H | 4.957 | 0.757 |
| +D+0.750Lr+0.750L+0.450W+H | 5.797 | 0.847 |
| +D+0.750L+0.750S+0.450W+H | 13.422 | 1.722 |
| +D+0.750L+0.750S+0.5250E+H | 13.422 | 1.722 |
| +0.60D+0.60W+0.60H | 2.974 | 0.454 |
| +0.60D+0.70E+0.60H | 2.974 | 0.454 |
| D Only | 4.957 | 0.757 |
| Lr Only | | |
| L Only | 1.120 | 0.120 |
| S Only | 10.167 | 1.167 |
| W Only | | |
| E Only | | |
| H Only | | |

Steel Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTE-ZBB2XMC-F.Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9

Lic. #: KW-06009078

Licensee : Canyons Structural Inc

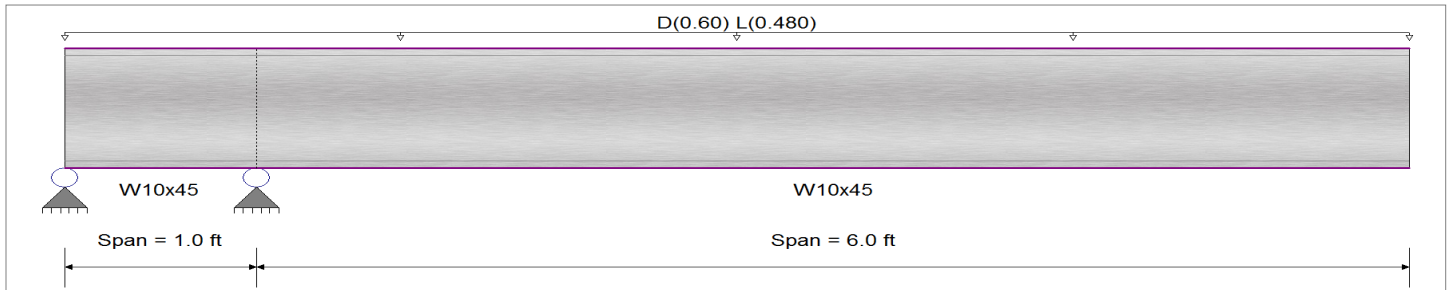
Description : FB9- Deck beam cantilevered

CODE REFERENCES

Calculations per AISC 360-10, IBC 2015, ASCE 7-10
 Load Combination Set : IBC 2015

Material Properties

Analysis Method : Allowable Strength Design
 Beam Bracing : Beam is Fully Braced against lateral-torsional buckling
 Bending Axis : Major Axis Bending
 Fy : Steel Yield : 50.0 ksi
 E : Modulus : 29,000.0 ksi



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loading
 Loads on all spans...
 Uniform Load on ALL spans : D = 0.0750, L = 0.060 ksf, Tributary Width = 8.0 ft

DESIGN SUMMARY

Design OK

| | | | |
|-----------------------------------|------------------|------------------------------|------------------|
| Maximum Bending Stress Ratio = | 0.148 : 1 | Maximum Shear Stress Ratio = | 0.294 : 1 |
| Section used for this span | W10x45 | Section used for this span | W10x45 |
| Ma : Applied | 20.250 k-ft | Va : Applied | 20.813 k |
| Mn / Omega : Allowable | 136.976 k-ft | Vn/Omega : Allowable | 70.70 k |
| Load Combination | +D+L+H | Load Combination | +D+L+H |
| Location of maximum on span | 1.000 ft | Location of maximum on span | 1.000 ft |
| Span # where maximum occurs | Span # 1 | Span # where maximum occurs | Span # 1 |
| Maximum Deflection | | | |
| Max Downward Transient Deflection | 0.023 in | Ratio = | 6,327 >=600. |
| Max Upward Transient Deflection | 0.000 in | Ratio = | 0 <600.0 |
| Max Downward Total Deflection | 0.053 in | Ratio = | 2700 >=480. |
| Max Upward Total Deflection | -0.000 in | Ratio = | 38672 >=480. |

Maximum Forces & Stresses for Load Combinations

| Load Combination | Segment Length | Span # | Max Stress Ratios | | Summary of Moment Values | | | | | | Summary of Shear Values | | | |
|---------------------|----------------|--------|-------------------|-------|--------------------------|--------|--------|--------|-----------|------|-------------------------|--------|--------|-----------|
| | | | M | V | Mmax + | Mmax - | Ma Max | Mnx | Mnx/Omega | Cb | Rm | Va Max | Vnx | Vnx/Omega |
| +D+H | | | | | | | | | | | | | | |
| Dsgn. L = 1.00 ft | | 1 | 0.085 | 0.169 | | -11.61 | 11.61 | 228.75 | 136.98 | 1.00 | 1.00 | 11.93 | 106.05 | 70.70 |
| Dsgn. L = 6.00 ft | | 2 | 0.085 | 0.055 | | -11.61 | 11.61 | 228.75 | 136.98 | 1.00 | 1.00 | 3.87 | 106.05 | 70.70 |
| +D+L+H | | | | | | | | | | | | | | |
| Dsgn. L = 1.00 ft | | 1 | 0.148 | 0.294 | | -20.25 | 20.25 | 228.75 | 136.98 | 1.00 | 1.00 | 20.81 | 106.05 | 70.70 |
| Dsgn. L = 6.00 ft | | 2 | 0.148 | 0.095 | | -20.25 | 20.25 | 228.75 | 136.98 | 1.00 | 1.00 | 6.75 | 106.05 | 70.70 |
| +D+Lr+H | | | | | | | | | | | | | | |
| Dsgn. L = 1.00 ft | | 1 | 0.085 | 0.169 | | -11.61 | 11.61 | 228.75 | 136.98 | 1.00 | 1.00 | 11.93 | 106.05 | 70.70 |
| Dsgn. L = 6.00 ft | | 2 | 0.085 | 0.055 | | -11.61 | 11.61 | 228.75 | 136.98 | 1.00 | 1.00 | 3.87 | 106.05 | 70.70 |
| +D+S+H | | | | | | | | | | | | | | |
| Dsgn. L = 1.00 ft | | 1 | 0.085 | 0.169 | | -11.61 | 11.61 | 228.75 | 136.98 | 1.00 | 1.00 | 11.93 | 106.05 | 70.70 |
| Dsgn. L = 6.00 ft | | 2 | 0.085 | 0.055 | | -11.61 | 11.61 | 228.75 | 136.98 | 1.00 | 1.00 | 3.87 | 106.05 | 70.70 |
| +D+0.750Lr+0.750L+H | | | | | | | | | | | | | | |
| Dsgn. L = 1.00 ft | | 1 | 0.132 | 0.263 | | -18.09 | 18.09 | 228.75 | 136.98 | 1.00 | 1.00 | 18.59 | 106.05 | 70.70 |
| Dsgn. L = 6.00 ft | | 2 | 0.132 | 0.085 | | -18.09 | 18.09 | 228.75 | 136.98 | 1.00 | 1.00 | 6.03 | 106.05 | 70.70 |
| +D+0.750Lr+0.750S+H | | | | | | | | | | | | | | |
| Dsgn. L = 1.00 ft | | 1 | 0.132 | 0.263 | | -18.09 | 18.09 | 228.75 | 136.98 | 1.00 | 1.00 | 18.59 | 106.05 | 70.70 |
| Dsgn. L = 6.00 ft | | 2 | 0.132 | 0.085 | | -18.09 | 18.09 | 228.75 | 136.98 | 1.00 | 1.00 | 6.03 | 106.05 | 70.70 |
| +D+0.60W+H | | | | | | | | | | | | | | |
| Dsgn. L = 1.00 ft | | 1 | 0.085 | 0.169 | | -11.61 | 11.61 | 228.75 | 136.98 | 1.00 | 1.00 | 11.93 | 106.05 | 70.70 |
| Dsgn. L = 6.00 ft | | 2 | 0.085 | 0.055 | | -11.61 | 11.61 | 228.75 | 136.98 | 1.00 | 1.00 | 3.87 | 106.05 | 70.70 |
| +D+0.70E+H | | | | | | | | | | | | | | |
| Dsgn. L = 1.00 ft | | 1 | 0.085 | 0.169 | | -11.61 | 11.61 | 228.75 | 136.98 | 1.00 | 1.00 | 11.93 | 106.05 | 70.70 |
| Dsgn. L = 6.00 ft | | 2 | 0.085 | 0.055 | | -11.61 | 11.61 | 228.75 | 136.98 | 1.00 | 1.00 | 3.87 | 106.05 | 70.70 |

Steel Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTE-ZBB2XMC-F.Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9

Lic. #: KW-06009078

Licensee : Canyons Structural Inc

Description : FB9- Deck beam cantilevered

| Load Combination | Segment Length | Span # | Max Stress Ratios | | Summary of Moment Values | | | | | | Summary of Shear Values | | | |
|----------------------------|----------------|--------|-------------------|-------|--------------------------|--------|--------|--------|-----------|------|-------------------------|--------|--------|-----------|
| | | | M | V | Mmax + | Mmax - | Ma Max | Mnx | Mnx/Omega | Cb | Rm | Va Max | Vnx | Vnx/Omega |
| +D+0.750Lr+0.750L+0.450W+H | | | | | | | | | | | | | | |
| Dsgn. L = 1.00 ft | | 1 | 0.132 | 0.263 | | -18.09 | 18.09 | 228.75 | 136.98 | 1.00 | 1.00 | 18.59 | 106.05 | 70.70 |
| Dsgn. L = 6.00 ft | | 2 | 0.132 | 0.085 | | -18.09 | 18.09 | 228.75 | 136.98 | 1.00 | 1.00 | 6.03 | 106.05 | 70.70 |
| +D+0.750L+0.750S+0.450W+H | | | | | | | | | | | | | | |
| Dsgn. L = 1.00 ft | | 1 | 0.132 | 0.263 | | -18.09 | 18.09 | 228.75 | 136.98 | 1.00 | 1.00 | 18.59 | 106.05 | 70.70 |
| Dsgn. L = 6.00 ft | | 2 | 0.132 | 0.085 | | -18.09 | 18.09 | 228.75 | 136.98 | 1.00 | 1.00 | 6.03 | 106.05 | 70.70 |
| +D+0.750L+0.750S+0.5250E+H | | | | | | | | | | | | | | |
| Dsgn. L = 1.00 ft | | 1 | 0.132 | 0.263 | | -18.09 | 18.09 | 228.75 | 136.98 | 1.00 | 1.00 | 18.59 | 106.05 | 70.70 |
| Dsgn. L = 6.00 ft | | 2 | 0.132 | 0.085 | | -18.09 | 18.09 | 228.75 | 136.98 | 1.00 | 1.00 | 6.03 | 106.05 | 70.70 |
| +0.60D+0.60W+0.60H | | | | | | | | | | | | | | |
| Dsgn. L = 1.00 ft | | 1 | 0.051 | 0.101 | | -6.97 | 6.97 | 228.75 | 136.98 | 1.00 | 1.00 | 7.16 | 106.05 | 70.70 |
| Dsgn. L = 6.00 ft | | 2 | 0.051 | 0.033 | | -6.97 | 6.97 | 228.75 | 136.98 | 1.00 | 1.00 | 2.32 | 106.05 | 70.70 |
| +0.60D+0.70E+0.60H | | | | | | | | | | | | | | |
| Dsgn. L = 1.00 ft | | 1 | 0.051 | 0.101 | | -6.97 | 6.97 | 228.75 | 136.98 | 1.00 | 1.00 | 7.16 | 106.05 | 70.70 |
| Dsgn. L = 6.00 ft | | 2 | 0.051 | 0.033 | | -6.97 | 6.97 | 228.75 | 136.98 | 1.00 | 1.00 | 2.32 | 106.05 | 70.70 |

Overall Maximum Deflections

| Load Combination | Span | Max. "-" Defl | Location in Span | Load Combination | Max. "+" Defl | Location in Span |
|------------------|------|---------------|------------------|------------------|---------------|------------------|
| | 1 | 0.0000 | 0.000 | | | |
| +D+L+H | 2 | 0.0533 | 6.000 | +D+L+H | -0.0003 | 0.580 |
| | | | | | 0.0000 | 0.580 |

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

| Load Combination | Support 1 | Support 2 | Support 3 |
|----------------------------|-----------|-----------|-----------|
| Overall MAXimum | -19.688 | 27.563 | |
| Overall MINimum | -6.773 | 9.482 | |
| +D+H | -11.288 | 15.803 | |
| +D+L+H | -19.688 | 27.563 | |
| +D+Lr+H | -11.288 | 15.803 | |
| +D+S+H | -11.288 | 15.803 | |
| +D+0.750Lr+0.750L+H | -17.588 | 24.623 | |
| +D+0.750L+0.750S+H | -17.588 | 24.623 | |
| +D+0.60W+H | -11.288 | 15.803 | |
| +D+0.70E+H | -11.288 | 15.803 | |
| +D+0.750Lr+0.750L+0.450W+H | -17.588 | 24.623 | |
| +D+0.750L+0.750S+0.450W+H | -17.588 | 24.623 | |
| +D+0.750L+0.750S+0.5250E+H | -17.588 | 24.623 | |
| +0.60D+0.60W+0.60H | -6.773 | 9.482 | |
| +0.60D+0.70E+0.60H | -6.773 | 9.482 | |
| D Only | -11.288 | 15.803 | |
| Lr Only | | | |
| L Only | -8.400 | 11.760 | |
| S Only | | | |
| W Only | | | |
| E Only | | | |
| H Only | | | |

Steel Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTE-ZBB2XMC-F.Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9

Lic. #: KW-0609078

Licensee : Canyons Structural Inc

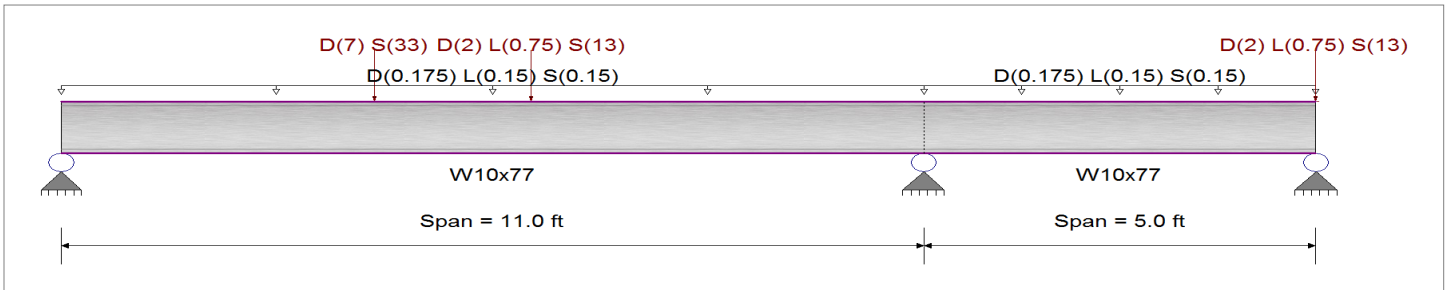
Description : FB7- FLOOR bEAM WITH ROOF HIP POINT LOAD

CODE REFERENCES

Calculations per AISC 360-10, IBC 2015, ASCE 7-10
 Load Combination Set : IBC 2015

Material Properties

Analysis Method : Allowable Strength Design
 Beam Bracing : Beam is Fully Braced against lateral-torsional buckling
 Bending Axis : Major Axis Bending
 Fy : Steel Yield : 50.0 ksi
 E : Modulus : 29,000.0 ksi



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loading
 Load for Span Number 1
 Uniform Load : D = 0.070, L = 0.060, S = 0.060 ksf, Tributary Width = 2.50 ft
 Point Load : D = 2.0, L = 0.750, S = 13.0 k @ 6.0 ft
 Point Load : D = 7.0, S = 33.0 k @ 4.0 ft
 Load for Span Number 2
 Uniform Load : D = 0.070, L = 0.060, S = 0.060 ksf, Tributary Width = 2.50 ft
 Point Load : D = 2.0, L = 0.750, S = 13.0 k @ 5.0 ft

DESIGN SUMMARY

Design OK

| | | | |
|-----------------------------------|------------------|------------------------------|------------------|
| Maximum Bending Stress Ratio = | 0.442 : 1 | Maximum Shear Stress Ratio = | 0.282 : 1 |
| Section used for this span | W10x77 | Section used for this span | W10x77 |
| Ma : Applied | 107.742 k-ft | Va : Applied | 31.669 k |
| Mn / Omega : Allowable | 243.513 k-ft | Vn/Omega : Allowable | 112.360 k |
| Load Combination | +D+S+H | Load Combination | +D+S+H |
| Location of maximum on span | 4.004ft | Location of maximum on span | 11.000 ft |
| Span # where maximum occurs | Span # 1 | Span # where maximum occurs | Span # 1 |
| Maximum Deflection | | | |
| Max Downward Transient Deflection | 0.102 in | Ratio = | 1,297 >=480. |
| Max Upward Transient Deflection | -0.013 in | Ratio = | 4,777 >=480. |
| Max Downward Total Deflection | 0.125 in | Ratio = | 1058 >=360. |
| Max Upward Total Deflection | -0.015 in | Ratio = | 3924 >=360. |

Maximum Forces & Stresses for Load Combinations

| Load Combination | Segment Length | Span # | Max Stress Ratios | | Summary of Moment Values | | | | | | Summary of Shear Values | | | |
|---------------------|----------------|--------|-------------------|-------|--------------------------|--------|--------|--------|-----------|------|-------------------------|--------|--------|-----------|
| | | | M | V | Mmax + | Mmax - | Ma Max | Mnx | Mnx/Omega | Cb | Rm | Va Max | Vnx | Vnx/Omega |
| +D+H | | | | | | | | | | | | | | |
| Dsgn. L = 11.00 ft | | 1 | 0.081 | 0.056 | 19.84 | -14.12 | 19.84 | 406.67 | 243.51 | 1.00 | 1.00 | 6.31 | 168.54 | 112.36 |
| Dsgn. L = 5.00 ft | | 2 | 0.058 | 0.031 | | -14.12 | 14.12 | 406.67 | 243.51 | 1.00 | 1.00 | 3.45 | 168.54 | 112.36 |
| +D+L+H | | | | | | | | | | | | | | |
| Dsgn. L = 11.00 ft | | 1 | 0.092 | 0.069 | 22.29 | -16.91 | 22.29 | 406.67 | 243.51 | 1.00 | 1.00 | 7.79 | 168.54 | 112.36 |
| Dsgn. L = 5.00 ft | | 2 | 0.069 | 0.039 | | -16.91 | 16.91 | 406.67 | 243.51 | 1.00 | 1.00 | 4.39 | 168.54 | 112.36 |
| +D+Lr+H | | | | | | | | | | | | | | |
| Dsgn. L = 11.00 ft | | 1 | 0.081 | 0.056 | 19.84 | -14.12 | 19.84 | 406.67 | 243.51 | 1.00 | 1.00 | 6.31 | 168.54 | 112.36 |
| Dsgn. L = 5.00 ft | | 2 | 0.058 | 0.031 | | -14.12 | 14.12 | 406.67 | 243.51 | 1.00 | 1.00 | 3.45 | 168.54 | 112.36 |
| +D+S+H | | | | | | | | | | | | | | |
| Dsgn. L = 11.00 ft | | 1 | 0.442 | 0.282 | 107.74 | -74.03 | 107.74 | 406.67 | 243.51 | 1.00 | 1.00 | 31.67 | 168.54 | 112.36 |
| Dsgn. L = 5.00 ft | | 2 | 0.304 | 0.141 | | -74.03 | 74.03 | 406.67 | 243.51 | 1.00 | 1.00 | 15.81 | 168.54 | 112.36 |
| +D+0.750Lr+0.750L+H | | | | | | | | | | | | | | |
| Dsgn. L = 11.00 ft | | 1 | 0.089 | 0.066 | 21.68 | -16.21 | 21.68 | 406.67 | 243.51 | 1.00 | 1.00 | 7.42 | 168.54 | 112.36 |
| Dsgn. L = 5.00 ft | | 2 | 0.067 | 0.037 | | -16.21 | 16.21 | 406.67 | 243.51 | 1.00 | 1.00 | 4.15 | 168.54 | 112.36 |
| +D+0.750L+0.750S+H | | | | | | | | | | | | | | |
| Dsgn. L = 11.00 ft | | 1 | 0.360 | 0.235 | 87.60 | -61.15 | 87.60 | 406.67 | 243.51 | 1.00 | 1.00 | 26.44 | 168.54 | 112.36 |
| Dsgn. L = 5.00 ft | | 2 | 0.251 | 0.119 | | -61.15 | 61.15 | 406.67 | 243.51 | 1.00 | 1.00 | 13.42 | 168.54 | 112.36 |
| +D+0.60W+H | | | | | | | | | | | | | | |

Steel Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTE-ZBB2XMC-F.Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9

Lic. #: KW-06009078

Licensee : Canyons Structural Inc

Description : FB7- fLOOR bEAM WITH ROOF HIP POINT LOAD

| Load Combination | Segment Length | Span # | Max Stress Ratios | | Summary of Moment Values | | | | | | Summary of Shear Values | | | |
|----------------------------|----------------|--------|-------------------|-------|--------------------------|--------|--------|--------|-----------|------|-------------------------|--------|--------|-----------|
| | | | M | V | Mmax + | Mmax - | Ma Max | Mnx | Mnx/Omega | Cb | Rm | Va Max | Vnx | Vnx/Omega |
| Dsgn. L = 11.00 ft | | 1 | 0.081 | 0.056 | 19.84 | -14.12 | 19.84 | 406.67 | 243.51 | 1.00 | 1.00 | 6.31 | 168.54 | 112.36 |
| Dsgn. L = 5.00 ft | | 2 | 0.058 | 0.031 | | -14.12 | 14.12 | 406.67 | 243.51 | 1.00 | 1.00 | 3.45 | 168.54 | 112.36 |
| +D+0.70E+H | | | | | | | | | | | | | | |
| Dsgn. L = 11.00 ft | | 1 | 0.081 | 0.056 | 19.84 | -14.12 | 19.84 | 406.67 | 243.51 | 1.00 | 1.00 | 6.31 | 168.54 | 112.36 |
| Dsgn. L = 5.00 ft | | 2 | 0.058 | 0.031 | | -14.12 | 14.12 | 406.67 | 243.51 | 1.00 | 1.00 | 3.45 | 168.54 | 112.36 |
| +D+0.750Lr+0.750L+0.450W+H | | | | | | | | | | | | | | |
| Dsgn. L = 11.00 ft | | 1 | 0.089 | 0.066 | 21.68 | -16.21 | 21.68 | 406.67 | 243.51 | 1.00 | 1.00 | 7.42 | 168.54 | 112.36 |
| Dsgn. L = 5.00 ft | | 2 | 0.067 | 0.037 | | -16.21 | 16.21 | 406.67 | 243.51 | 1.00 | 1.00 | 4.15 | 168.54 | 112.36 |
| +D+0.750L+0.750S+0.450W+H | | | | | | | | | | | | | | |
| Dsgn. L = 11.00 ft | | 1 | 0.360 | 0.235 | 87.60 | -61.15 | 87.60 | 406.67 | 243.51 | 1.00 | 1.00 | 26.44 | 168.54 | 112.36 |
| Dsgn. L = 5.00 ft | | 2 | 0.251 | 0.119 | | -61.15 | 61.15 | 406.67 | 243.51 | 1.00 | 1.00 | 13.42 | 168.54 | 112.36 |
| +D+0.750L+0.750S+0.5250E+H | | | | | | | | | | | | | | |
| Dsgn. L = 11.00 ft | | 1 | 0.360 | 0.235 | 87.60 | -61.15 | 87.60 | 406.67 | 243.51 | 1.00 | 1.00 | 26.44 | 168.54 | 112.36 |
| Dsgn. L = 5.00 ft | | 2 | 0.251 | 0.119 | | -61.15 | 61.15 | 406.67 | 243.51 | 1.00 | 1.00 | 13.42 | 168.54 | 112.36 |
| +0.60D+0.60W+0.60H | | | | | | | | | | | | | | |
| Dsgn. L = 11.00 ft | | 1 | 0.049 | 0.034 | 11.90 | -8.47 | 11.90 | 406.67 | 243.51 | 1.00 | 1.00 | 3.78 | 168.54 | 112.36 |
| Dsgn. L = 5.00 ft | | 2 | 0.035 | 0.018 | | -8.47 | 8.47 | 406.67 | 243.51 | 1.00 | 1.00 | 2.07 | 168.54 | 112.36 |
| +0.60D+0.70E+0.60H | | | | | | | | | | | | | | |
| Dsgn. L = 11.00 ft | | 1 | 0.049 | 0.034 | 11.90 | -8.47 | 11.90 | 406.67 | 243.51 | 1.00 | 1.00 | 3.78 | 168.54 | 112.36 |
| Dsgn. L = 5.00 ft | | 2 | 0.035 | 0.018 | | -8.47 | 8.47 | 406.67 | 243.51 | 1.00 | 1.00 | 2.07 | 168.54 | 112.36 |

Overall Maximum Deflections

| Load Combination | Span | Max. "-" Defl | Location in Span | Load Combination | Max. "+" Defl | Location in Span |
|------------------|------|---------------|------------------|------------------|---------------|------------------|
| +D+S+H | 1 | 0.1248 | 4.840 | +D+S+H | 0.0000 | 0.000 |
| | 2 | 0.0000 | 4.840 | | -0.0153 | 2.120 |

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

| Load Combination | Support 1 | Support 2 | Support 3 |
|----------------------------|-----------|-----------|-----------|
| Overall MAXimum | 27.753 | 47.480 | 1.392 |
| Overall MINimum | 0.912 | 2.422 | -0.116 |
| +D+H | 5.466 | 9.759 | -0.193 |
| +D+L+H | 6.378 | 12.181 | 0.373 |
| +D+Lr+H | 5.466 | 9.759 | -0.193 |
| +D+S+H | 27.753 | 47.480 | 1.198 |
| +D+0.750Lr+0.750L+H | 6.150 | 11.575 | 0.232 |
| +D+0.750L+0.750S+H | 22.866 | 39.866 | 1.275 |
| +D+0.60W+H | 5.466 | 9.759 | -0.193 |
| +D+0.70E+H | 5.466 | 9.759 | -0.193 |
| +D+0.750Lr+0.750L+0.450W+H | 6.150 | 11.575 | 0.232 |
| +D+0.750L+0.750S+0.450W+H | 22.866 | 39.866 | 1.275 |
| +D+0.750L+0.750S+0.5250E+H | 22.866 | 39.866 | 1.275 |
| +0.60D+0.60W+0.60H | 3.280 | 5.855 | -0.116 |
| +0.60D+0.70E+0.60H | 3.280 | 5.855 | -0.116 |
| D Only | 5.466 | 9.759 | -0.193 |
| Lr Only | | | |
| L Only | 0.912 | 2.422 | 0.566 |
| S Only | 22.287 | 37.721 | 1.392 |
| W Only | | | |
| E Only | | | |
| H Only | | | |

Concrete Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTE-ZBB2XMC-F.Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9
 Licensee : Canyons Structural Inc

Lic. # : KW-06009078

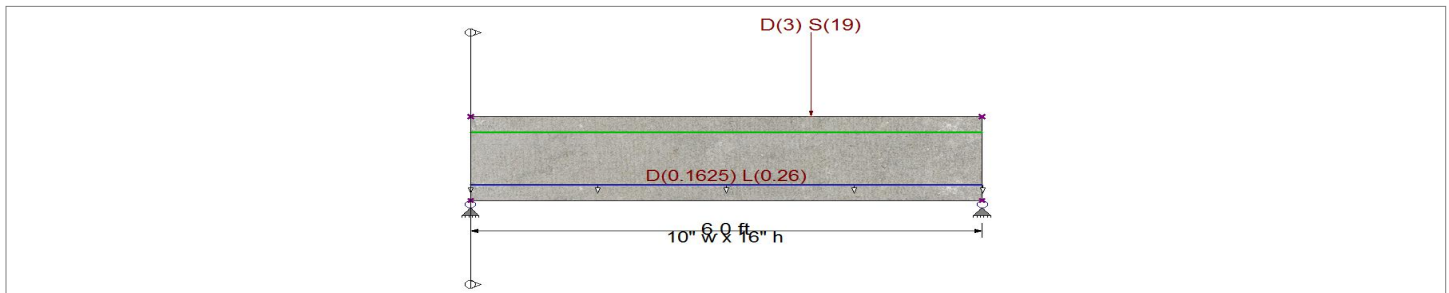
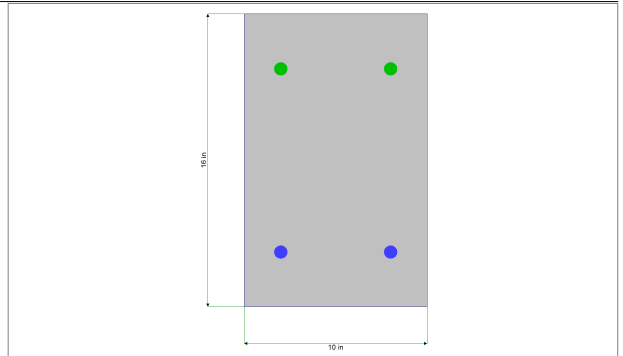
Description : Concrete Lintels around perimeter floor at skylights

CODE REFERENCES

Calculations per ACI 318-14, IBC 2015, ASCE 7-10
 Load Combination Set : IBC 2015

Material Properties

| | | | | | |
|---------------------------|---|--------------|--|-----------|--------------|
| f'_c | = | 3.0 ksi | ϕ Phi Values | Flexure : | 0.90 |
| $f_r = f'_c^{1/2} * 7.50$ | = | 410.792 psi | | Shear : | 0.750 |
| ψ Density | = | 145.0 pcf | β_1 | = | 0.850 |
| λ LtWt Factor | = | 1.0 | | | |
| Elastic Modulus | = | 3,122.0 ksi | F_y - Stirrups | = | 40.0 ksi |
| f_y - Main Rebar | = | 60.0 ksi | E - Stirrups | = | 29,000.0 ksi |
| E - Main Rebar | = | 29,000.0 ksi | Stirrup Bar Size # | = | 3 |
| | | | Number of Resisting Legs Per Stirrup = | = | 6.0 |



Cross Section & Reinforcing Details

Rectangular Section, Width = 10.0 in, Height = 16.0 in

Span #1 Reinforcing....

2-#6 at 3.0 in from Bottom, from 0.0 to 6.0 ft in this span

2-#6 at 3.0 in from Top, from 0.0 to 6.0 ft in this span

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loads

Load for Span Number 1

Uniform Load : D = 0.0250, L = 0.040 ksf, Tributary Width = 6.50 ft

Point Load : D = 3.0, S = 19.0 k @ 4.0 ft

DESIGN SUMMARY

Design OK

| | | | | |
|--------------------------------|------------------------|-----------------------------------|----------|-------------------|
| Maximum Bending Stress Ratio = | 0.992 : 1 | Maximum Deflection | | |
| Section used for this span | Typical Section | Max Downward Transient Deflection | 0.023 in | Ratio = 3089 >=36 |
| Mu : Applied | 47.407 k-ft | Max Upward Transient Deflection | 0.000 in | Ratio = 0 <360 |
| Mn * Phi : Allowable | 47.790 k-ft | Max Downward Total Deflection | 0.037 in | Ratio = 1959 >=18 |
| Location of maximum on span | 4.000 ft | Max Upward Total Deflection | 0.000 in | Ratio = 999 <180 |
| Span # where maximum occurs | Span # 1 | | | |

Vertical Reactions

Support notation : Far left is #1

| Load Combination | Support 1 | Support 2 |
|---------------------------|-----------|-----------|
| Overall MAXimum | 8.304 | 15.638 |
| Overall MINimum | 0.780 | 0.780 |
| +D+H | 1.971 | 2.971 |
| +D+L+H | 2.751 | 3.751 |
| +D+L+H | 1.971 | 2.971 |
| +D+S+H | 8.304 | 15.638 |
| +D+0.750L+0.750L+H | 2.556 | 3.556 |
| +D+0.750L+0.750S+H | 7.306 | 13.056 |
| +D+0.60W+H | 1.971 | 2.971 |
| +D+0.70E+H | 1.971 | 2.971 |
| +D+0.750L+0.750L+0.450W+H | 2.556 | 3.556 |
| +D+0.750L+0.750S+0.450W+H | 7.306 | 13.056 |

Concrete Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTE-ZBB2XMC-F.Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9

Lic. #: KW-06009078

Licensee : Canyons Structural Inc

Description : Concrete Lintels around perimeter floor at skylights

| Vertical Reactions | Support notation : Far left is #1 | |
|----------------------------|-----------------------------------|-----------|
| Load Combination | Support 1 | Support 2 |
| +D+0.750L+0.750S+0.5250E+H | 7.306 | 13.056 |
| +0.60D+0.60W+0.60H | 1.183 | 1.782 |
| +0.60D+0.70E+0.60H | 1.183 | 1.782 |
| D Only | 1.971 | 2.971 |
| Lr Only | | |
| L Only | 0.780 | 0.780 |
| S Only | 6.333 | 12.667 |
| W Only | | |
| E Only | | |
| H Only | | |

| Detailed Shear Information | | | | | | | | | | | | | |
|----------------------------|-------------|---------------|----------|---------------|---------------|-----------|---------|------------|------------|------------|------------|--------------------|----------------------|
| Load Combination | Span Number | Distance (ft) | 'd' (in) | Vu (k) Actual | Vu (k) Design | Mu (k-ft) | d*Vu/Mu | Phi*Vc (k) | Comment | Phi*Vs (k) | Phi*Vn (k) | Spacing (in) Req'd | Spacing (in) Suggest |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.00 | 13.00 | 12.89 | 12.89 | 0.00 | 1.00 | 11.80 | PhiVc < Vu | 1.092 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.01 | 13.00 | 12.88 | 12.88 | 0.14 | 1.00 | 11.80 | PhiVc < Vu | 1.086 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.02 | 13.00 | 12.88 | 12.88 | 0.28 | 1.00 | 11.80 | PhiVc < Vu | 1.080 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.03 | 13.00 | 12.87 | 12.87 | 0.42 | 1.00 | 11.80 | PhiVc < Vu | 1.075 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.04 | 13.00 | 12.87 | 12.87 | 0.56 | 1.00 | 11.80 | PhiVc < Vu | 1.069 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.05 | 13.00 | 12.86 | 12.86 | 0.70 | 1.00 | 11.80 | PhiVc < Vu | 1.063 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.07 | 13.00 | 12.85 | 12.85 | 0.84 | 1.00 | 11.80 | PhiVc < Vu | 1.058 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.08 | 13.00 | 12.85 | 12.85 | 0.98 | 1.00 | 11.80 | PhiVc < Vu | 1.052 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.09 | 13.00 | 12.84 | 12.84 | 1.12 | 1.00 | 11.80 | PhiVc < Vu | 1.046 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.10 | 13.00 | 12.84 | 12.84 | 1.27 | 1.00 | 11.80 | PhiVc < Vu | 1.041 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.11 | 13.00 | 12.83 | 12.83 | 1.41 | 1.00 | 11.80 | PhiVc < Vu | 1.035 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.12 | 13.00 | 12.83 | 12.83 | 1.55 | 1.00 | 11.80 | PhiVc < Vu | 1.029 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.13 | 13.00 | 12.82 | 12.82 | 1.69 | 1.00 | 11.80 | PhiVc < Vu | 1.024 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.14 | 13.00 | 12.81 | 12.81 | 1.83 | 1.00 | 11.80 | PhiVc < Vu | 1.018 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.15 | 13.00 | 12.81 | 12.81 | 1.97 | 1.00 | 11.80 | PhiVc < Vu | 1.012 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.16 | 13.00 | 12.80 | 12.80 | 2.11 | 1.00 | 11.80 | PhiVc < Vu | 1.007 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.17 | 13.00 | 12.80 | 12.80 | 2.25 | 1.00 | 11.80 | PhiVc < Vu | 1.001 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.19 | 13.00 | 12.79 | 12.79 | 2.39 | 1.00 | 11.80 | PhiVc < Vu | 0.9955 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.20 | 13.00 | 12.79 | 12.79 | 2.53 | 1.00 | 11.80 | PhiVc < Vu | 0.9898 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.21 | 13.00 | 12.78 | 12.78 | 2.67 | 1.00 | 11.80 | PhiVc < Vu | 0.9841 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.22 | 13.00 | 12.78 | 12.78 | 2.80 | 1.00 | 11.80 | PhiVc < Vu | 0.9785 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.23 | 13.00 | 12.77 | 12.77 | 2.94 | 1.00 | 11.80 | PhiVc < Vu | 0.9728 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.24 | 13.00 | 12.76 | 12.76 | 3.08 | 1.00 | 11.80 | PhiVc < Vu | 0.9671 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.25 | 13.00 | 12.76 | 12.76 | 3.22 | 1.00 | 11.80 | PhiVc < Vu | 0.9615 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.26 | 13.00 | 12.75 | 12.75 | 3.36 | 1.00 | 11.80 | PhiVc < Vu | 0.9558 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.27 | 13.00 | 12.75 | 12.75 | 3.50 | 1.00 | 11.80 | PhiVc < Vu | 0.9502 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.28 | 13.00 | 12.74 | 12.74 | 3.64 | 1.00 | 11.80 | PhiVc < Vu | 0.9445 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.30 | 13.00 | 12.74 | 12.74 | 3.78 | 1.00 | 11.80 | PhiVc < Vu | 0.9388 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.31 | 13.00 | 12.73 | 12.73 | 3.92 | 1.00 | 11.80 | PhiVc < Vu | 0.9332 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.32 | 13.00 | 12.72 | 12.72 | 4.06 | 1.00 | 11.80 | PhiVc < Vu | 0.9275 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.33 | 13.00 | 12.72 | 12.72 | 4.20 | 1.00 | 11.80 | PhiVc < Vu | 0.9218 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.34 | 13.00 | 12.71 | 12.71 | 4.34 | 1.00 | 11.80 | PhiVc < Vu | 0.9162 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.35 | 13.00 | 12.71 | 12.71 | 4.48 | 1.00 | 11.80 | PhiVc < Vu | 0.9105 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.36 | 13.00 | 12.70 | 12.70 | 4.61 | 1.00 | 11.80 | PhiVc < Vu | 0.9048 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.37 | 13.00 | 12.70 | 12.70 | 4.75 | 1.00 | 11.80 | PhiVc < Vu | 0.8992 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.38 | 13.00 | 12.69 | 12.69 | 4.89 | 1.00 | 11.80 | PhiVc < Vu | 0.8935 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.39 | 13.00 | 12.68 | 12.68 | 5.03 | 1.00 | 11.80 | PhiVc < Vu | 0.8878 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.40 | 13.00 | 12.68 | 12.68 | 5.17 | 1.00 | 11.80 | PhiVc < Vu | 0.8822 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.42 | 13.00 | 12.67 | 12.67 | 5.31 | 1.00 | 11.80 | PhiVc < Vu | 0.8765 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.43 | 13.00 | 12.67 | 12.67 | 5.45 | 1.00 | 11.80 | PhiVc < Vu | 0.8708 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.44 | 13.00 | 12.66 | 12.66 | 5.58 | 1.00 | 11.80 | PhiVc < Vu | 0.8652 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.45 | 13.00 | 12.66 | 12.66 | 5.72 | 1.00 | 11.80 | PhiVc < Vu | 0.8595 | 54.738 | 6.5 | 6.0 |

Concrete Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTE-ZBB2XMC-F.Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9

Lic. #: KW-06009078

Licensee: Canyons Structural Inc

Description: Concrete Lintels around perimeter floor at skylights

Detailed Shear Information

| Load Combination | Span Number | Distance (ft) | 'd' (in) | Vu (k) | | Mu (k-ft) | d*Vu/Mu | Phi*Vc (k) | Comment | Phi*Vs (k) | Phi*Vn (k) | Spacing (in) | |
|--------------------------|-------------|---------------|----------|--------|--------|-----------|---------|------------|------------|------------|------------|--------------|---------|
| | | | | Actual | Design | | | | | | | Req'd | Suggest |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.46 | 13.00 | 12.65 | 12.65 | 5.86 | 1.00 | 11.80 | PhiVc < Vu | 0.8538 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.47 | 13.00 | 12.64 | 12.64 | 6.00 | 1.00 | 11.80 | PhiVc < Vu | 0.8482 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.48 | 13.00 | 12.64 | 12.64 | 6.14 | 1.00 | 11.80 | PhiVc < Vu | 0.8425 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.49 | 13.00 | 12.63 | 12.63 | 6.28 | 1.00 | 11.80 | PhiVc < Vu | 0.8369 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.50 | 13.00 | 12.63 | 12.63 | 6.41 | 1.00 | 11.80 | PhiVc < Vu | 0.8312 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.51 | 13.00 | 12.62 | 12.62 | 6.55 | 1.00 | 11.80 | PhiVc < Vu | 0.8255 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.52 | 13.00 | 12.62 | 12.62 | 6.69 | 1.00 | 11.80 | PhiVc < Vu | 0.8199 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.54 | 13.00 | 12.61 | 12.61 | 6.83 | 1.00 | 11.80 | PhiVc < Vu | 0.8142 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.55 | 13.00 | 12.61 | 12.61 | 6.97 | 1.00 | 11.80 | PhiVc < Vu | 0.8085 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.56 | 13.00 | 12.60 | 12.60 | 7.10 | 1.00 | 11.80 | PhiVc < Vu | 0.8029 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.57 | 13.00 | 12.59 | 12.59 | 7.24 | 1.00 | 11.80 | PhiVc < Vu | 0.7972 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.58 | 13.00 | 12.59 | 12.59 | 7.38 | 1.00 | 11.80 | PhiVc < Vu | 0.7915 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.59 | 13.00 | 12.58 | 12.58 | 7.52 | 1.00 | 11.80 | PhiVc < Vu | 0.7859 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.60 | 13.00 | 12.58 | 12.58 | 7.65 | 1.00 | 11.80 | PhiVc < Vu | 0.7802 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.61 | 13.00 | 12.57 | 12.57 | 7.79 | 1.00 | 11.80 | PhiVc < Vu | 0.7745 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.62 | 13.00 | 12.57 | 12.57 | 7.93 | 1.00 | 11.80 | PhiVc < Vu | 0.7689 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.63 | 13.00 | 12.56 | 12.56 | 8.07 | 1.00 | 11.80 | PhiVc < Vu | 0.7632 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.64 | 13.00 | 12.55 | 12.55 | 8.20 | 1.00 | 11.80 | PhiVc < Vu | 0.7575 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.66 | 13.00 | 12.55 | 12.55 | 8.34 | 1.00 | 11.80 | PhiVc < Vu | 0.7519 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.67 | 13.00 | 12.54 | 12.54 | 8.48 | 1.00 | 11.80 | PhiVc < Vu | 0.7462 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.68 | 13.00 | 12.54 | 12.54 | 8.61 | 1.00 | 11.80 | PhiVc < Vu | 0.7406 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.69 | 13.00 | 12.53 | 12.53 | 8.75 | 1.00 | 11.80 | PhiVc < Vu | 0.7349 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.70 | 13.00 | 12.53 | 12.53 | 8.89 | 1.00 | 11.80 | PhiVc < Vu | 0.7292 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.71 | 13.00 | 12.52 | 12.52 | 9.02 | 1.00 | 11.80 | PhiVc < Vu | 0.7236 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.72 | 13.00 | 12.51 | 12.51 | 9.16 | 1.00 | 11.80 | PhiVc < Vu | 0.7179 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.73 | 13.00 | 12.51 | 12.51 | 9.30 | 1.00 | 11.80 | PhiVc < Vu | 0.7122 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.74 | 13.00 | 12.50 | 12.50 | 9.44 | 1.00 | 11.80 | PhiVc < Vu | 0.7066 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.75 | 13.00 | 12.50 | 12.50 | 9.57 | 1.00 | 11.80 | PhiVc < Vu | 0.7009 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.77 | 13.00 | 12.49 | 12.49 | 9.71 | 1.00 | 11.80 | PhiVc < Vu | 0.6952 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.78 | 13.00 | 12.49 | 12.49 | 9.84 | 1.00 | 11.80 | PhiVc < Vu | 0.6896 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.79 | 13.00 | 12.48 | 12.48 | 9.98 | 1.00 | 11.80 | PhiVc < Vu | 0.6839 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.80 | 13.00 | 12.47 | 12.47 | 10.12 | 1.00 | 11.80 | PhiVc < Vu | 0.6782 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.81 | 13.00 | 12.47 | 12.47 | 10.25 | 1.00 | 11.80 | PhiVc < Vu | 0.6726 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.82 | 13.00 | 12.46 | 12.46 | 10.39 | 1.00 | 11.80 | PhiVc < Vu | 0.6669 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.83 | 13.00 | 12.46 | 12.46 | 10.53 | 1.00 | 11.80 | PhiVc < Vu | 0.6612 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.84 | 13.00 | 12.45 | 12.45 | 10.66 | 1.00 | 11.80 | PhiVc < Vu | 0.6556 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.85 | 13.00 | 12.45 | 12.45 | 10.80 | 1.00 | 11.80 | PhiVc < Vu | 0.6499 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.86 | 13.00 | 12.44 | 12.44 | 10.93 | 1.00 | 11.80 | PhiVc < Vu | 0.6443 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.87 | 13.00 | 12.44 | 12.44 | 11.07 | 1.00 | 11.80 | PhiVc < Vu | 0.6386 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.89 | 13.00 | 12.43 | 12.43 | 11.21 | 1.00 | 11.80 | PhiVc < Vu | 0.6329 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.90 | 13.00 | 12.42 | 12.42 | 11.34 | 1.00 | 11.80 | PhiVc < Vu | 0.6273 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.91 | 13.00 | 12.42 | 12.42 | 11.48 | 1.00 | 11.80 | PhiVc < Vu | 0.6216 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.92 | 13.00 | 12.41 | 12.41 | 11.61 | 1.00 | 11.80 | PhiVc < Vu | 0.6159 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.93 | 13.00 | 12.41 | 12.41 | 11.75 | 1.00 | 11.80 | PhiVc < Vu | 0.6103 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.94 | 13.00 | 12.40 | 12.40 | 11.88 | 1.00 | 11.80 | PhiVc < Vu | 0.6046 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.95 | 13.00 | 12.40 | 12.40 | 12.02 | 1.00 | 11.80 | PhiVc < Vu | 0.5989 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.96 | 13.00 | 12.39 | 12.39 | 12.16 | 1.00 | 11.80 | PhiVc < Vu | 0.5933 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.97 | 13.00 | 12.38 | 12.38 | 12.29 | 1.00 | 11.80 | PhiVc < Vu | 0.5876 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.98 | 13.00 | 12.38 | 12.38 | 12.43 | 1.00 | 11.80 | PhiVc < Vu | 0.5819 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.99 | 13.00 | 12.37 | 12.37 | 12.56 | 1.00 | 11.80 | PhiVc < Vu | 0.5763 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.01 | 13.00 | 12.37 | 12.37 | 12.70 | 1.00 | 11.80 | PhiVc < Vu | 0.5706 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.02 | 13.00 | 12.36 | 12.36 | 12.83 | 1.00 | 11.80 | PhiVc < Vu | 0.5649 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.03 | 13.00 | 12.36 | 12.36 | 12.97 | 1.00 | 11.80 | PhiVc < Vu | 0.5593 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.04 | 13.00 | 12.35 | 12.35 | 13.10 | 1.00 | 11.80 | PhiVc < Vu | 0.5536 | 54.7 | 6.5 | 6.0 |

Concrete Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTE-ZBB2XMC-F.Calcs\beams.ec6
ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9

Lic. #: KW-06009078

Licensee: Canyons Structural Inc

Description: Concrete Lintels around perimeter floor at skylights

Detailed Shear Information

Table with columns: Load Combination, Span Number, Distance (ft), 'd' (in), Vu (k) Actual/Design, Mu (k-ft), d*Vu/Mu, Phi*Vc (k), Comment, Phi*Vs (k), Phi*Vn (k), Spacing (in) Req'd/Suggest. Contains 50 rows of structural data.

Concrete Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTS-ZBB2XMC-F\Calcs\beams.ecb

ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9

Lic. #: KW-06009078

Licensee : Canyons Structural Inc

Description : Concrete Lintels around perimeter floor at skylights

Detailed Shear Information

| Load Combination | Span Number | Distance (ft) | 'd' (in) | Vu (k) | | Mu (k-ft) | d*Vu/Mu | Phi*Vc (k) | Comment | Phi*Vs (k) | Phi*Vn (k) | Spacing (in) | |
|--------------------------|-------------|---------------|----------|--------|--------|-----------|---------|------------|------------|------------|------------|--------------|---------|
| | | | | Actual | Design | | | | | | | Req'd | Suggest |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.23 | 13.00 | 11.73 | 11.73 | 27.45 | 0.46 | 10.91 | PhiVc < Vu | 0.8220 | 53.8 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.24 | 13.00 | 11.73 | 11.73 | 27.57 | 0.46 | 10.91 | PhiVc < Vu | 0.8203 | 53.8 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.25 | 13.00 | 11.72 | 11.72 | 27.70 | 0.46 | 10.90 | PhiVc < Vu | 0.8185 | 53.8 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.26 | 13.00 | 11.72 | 11.72 | 27.83 | 0.46 | 10.90 | PhiVc < Vu | 0.8167 | 53.8 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.27 | 13.00 | 11.71 | 11.71 | 27.96 | 0.45 | 10.90 | PhiVc < Vu | 0.8148 | 53.8 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.28 | 13.00 | 11.70 | 11.70 | 28.09 | 0.45 | 10.89 | PhiVc < Vu | 0.8129 | 53.8 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.30 | 13.00 | 11.70 | 11.70 | 28.21 | 0.45 | 10.89 | PhiVc < Vu | 0.8110 | 53.8 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.31 | 13.00 | 11.69 | 11.69 | 28.34 | 0.45 | 10.88 | PhiVc < Vu | 0.8090 | 53.8 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.32 | 13.00 | 11.69 | 11.69 | 28.47 | 0.44 | 10.88 | PhiVc < Vu | 0.8070 | 53.8 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.33 | 13.00 | 11.68 | 11.68 | 28.60 | 0.44 | 10.88 | PhiVc < Vu | 0.8050 | 53.8 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.34 | 13.00 | 11.68 | 11.68 | 28.73 | 0.44 | 10.87 | PhiVc < Vu | 0.8029 | 53.8 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.35 | 13.00 | 11.67 | 11.67 | 28.85 | 0.44 | 10.87 | PhiVc < Vu | 0.8008 | 53.8 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.36 | 13.00 | 11.66 | 11.66 | 28.98 | 0.44 | 10.87 | PhiVc < Vu | 0.7987 | 53.8 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.37 | 13.00 | 11.66 | 11.66 | 29.11 | 0.43 | 10.86 | PhiVc < Vu | 0.7965 | 53.8 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.38 | 13.00 | 11.65 | 11.65 | 29.24 | 0.43 | 10.86 | PhiVc < Vu | 0.7943 | 53.8 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.39 | 13.00 | 11.65 | 11.65 | 29.36 | 0.43 | 10.86 | PhiVc < Vu | 0.7921 | 53.8 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.40 | 13.00 | 11.64 | 11.64 | 29.49 | 0.43 | 10.85 | PhiVc < Vu | 0.7898 | 53.8 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.42 | 13.00 | 11.64 | 11.64 | 29.62 | 0.43 | 10.85 | PhiVc < Vu | 0.7875 | 53.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.43 | 13.00 | 11.63 | 11.63 | 29.74 | 0.42 | 10.85 | PhiVc < Vu | 0.7852 | 53.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.44 | 13.00 | 11.63 | 11.63 | 29.87 | 0.42 | 10.84 | PhiVc < Vu | 0.7829 | 53.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.45 | 13.00 | 11.62 | 11.62 | 30.00 | 0.42 | 10.84 | PhiVc < Vu | 0.7805 | 53.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.46 | 13.00 | 11.61 | 11.61 | 30.13 | 0.42 | 10.84 | PhiVc < Vu | 0.7781 | 53.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.47 | 13.00 | 11.61 | 11.61 | 30.25 | 0.42 | 10.83 | PhiVc < Vu | 0.7756 | 53.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.48 | 13.00 | 11.60 | 11.60 | 30.38 | 0.41 | 10.83 | PhiVc < Vu | 0.7732 | 53.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.49 | 13.00 | 11.60 | 11.60 | 30.51 | 0.41 | 10.83 | PhiVc < Vu | 0.7707 | 53.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.50 | 13.00 | 11.59 | 11.59 | 30.63 | 0.41 | 10.82 | PhiVc < Vu | 0.7682 | 53.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.51 | 13.00 | 11.59 | 11.59 | 30.76 | 0.41 | 10.82 | PhiVc < Vu | 0.7656 | 53.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.52 | 13.00 | 11.58 | 11.58 | 30.89 | 0.41 | 10.82 | PhiVc < Vu | 0.7630 | 53.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.54 | 13.00 | 11.57 | 11.57 | 31.01 | 0.40 | 10.81 | PhiVc < Vu | 0.7604 | 53.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.55 | 13.00 | 11.57 | 11.57 | 31.14 | 0.40 | 10.81 | PhiVc < Vu | 0.7578 | 53.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.56 | 13.00 | 11.56 | 11.56 | 31.27 | 0.40 | 10.81 | PhiVc < Vu | 0.7551 | 53.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.57 | 13.00 | 11.56 | 11.56 | 31.39 | 0.40 | 10.80 | PhiVc < Vu | 0.7525 | 53.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.58 | 13.00 | 11.55 | 11.55 | 31.52 | 0.40 | 10.80 | PhiVc < Vu | 0.7497 | 53.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.59 | 13.00 | 11.55 | 11.55 | 31.64 | 0.40 | 10.80 | PhiVc < Vu | 0.7470 | 53.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.60 | 13.00 | 11.54 | 11.54 | 31.77 | 0.39 | 10.80 | PhiVc < Vu | 0.7443 | 53.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.61 | 13.00 | 11.53 | 11.53 | 31.90 | 0.39 | 10.79 | PhiVc < Vu | 0.7415 | 53.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.62 | 13.00 | 11.53 | 11.53 | 32.02 | 0.39 | 10.79 | PhiVc < Vu | 0.7387 | 53.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.63 | 13.00 | 11.52 | 11.52 | 32.15 | 0.39 | 10.79 | PhiVc < Vu | 0.7358 | 53.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.64 | 13.00 | 11.52 | 11.52 | 32.27 | 0.39 | 10.78 | PhiVc < Vu | 0.7330 | 53.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.66 | 13.00 | 11.51 | 11.51 | 32.40 | 0.38 | 10.78 | PhiVc < Vu | 0.7301 | 53.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.67 | 13.00 | 11.51 | 11.51 | 32.53 | 0.38 | 10.78 | PhiVc < Vu | 0.7272 | 53.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.68 | 13.00 | 11.50 | 11.50 | 32.65 | 0.38 | 10.78 | PhiVc < Vu | 0.7243 | 53.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.69 | 13.00 | 11.49 | 11.49 | 32.78 | 0.38 | 10.77 | PhiVc < Vu | 0.7214 | 53.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.70 | 13.00 | 11.49 | 11.49 | 32.90 | 0.38 | 10.77 | PhiVc < Vu | 0.7184 | 53.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.71 | 13.00 | 11.48 | 11.48 | 33.03 | 0.38 | 10.77 | PhiVc < Vu | 0.7154 | 53.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.72 | 13.00 | 11.48 | 11.48 | 33.15 | 0.38 | 10.77 | PhiVc < Vu | 0.7124 | 53.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.73 | 13.00 | 11.47 | 11.47 | 33.28 | 0.37 | 10.76 | PhiVc < Vu | 0.7094 | 53.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.74 | 13.00 | 11.47 | 11.47 | 33.40 | 0.37 | 10.76 | PhiVc < Vu | 0.7063 | 53.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.75 | 13.00 | 11.46 | 11.46 | 33.53 | 0.37 | 10.76 | PhiVc < Vu | 0.7033 | 53.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.77 | 13.00 | 11.46 | 11.46 | 33.66 | 0.37 | 10.75 | PhiVc < Vu | 0.7002 | 53.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.78 | 13.00 | 11.45 | 11.45 | 33.78 | 0.37 | 10.75 | PhiVc < Vu | 0.6970 | 53.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.79 | 13.00 | 11.44 | 11.44 | 33.91 | 0.37 | 10.75 | PhiVc < Vu | 0.6939 | 53.6 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.80 | 13.00 | 11.44 | 11.44 | 34.03 | 0.36 | 10.75 | PhiVc < Vu | 0.6908 | 53.6 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 2.81 | 13.00 | 11.43 | 11.43 | 34.16 | 0.36 | 10.74 | PhiVc < Vu | 0.6876 | 53.6 | 6.5 | 6.0 |

Concrete Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTE-ZBB2XMC-F.Calcs\beams.ec6
ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9

Lic. #: KW-06009078

Licensee: Canyons Structural Inc

Description: Concrete Lintels around perimeter floor at skylights

Detailed Shear Information

| Load Combination | Span Number | Distance (ft) | 'd' (in) | Vu (k) | | Mu (k-ft) | d*Vu/Mu | Phi*Vc (k) | Comment | Phi*Vs (k) | Phi*Vn (k) | Spacing (in) | |
|--------------------------|-------------|---------------|----------|--------|--------|-----------|---------|------------|------------|------------|------------|--------------|---------|
| | | | | Actual | Design | | | | | | | Req'd | Suggest |
| +1.20D+0.50L+1.60S+1.60H | 1 | 5.77 | 13.00 | -24.10 | 24.10 | 5.55 | 1.00 | 11.80 | PhiVc < Vu | 12.306 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 5.78 | 13.00 | -24.11 | 24.11 | 5.28 | 1.00 | 11.80 | PhiVc < Vu | 12.312 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 5.79 | 13.00 | -24.11 | 24.11 | 5.02 | 1.00 | 11.80 | PhiVc < Vu | 12.317 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 5.80 | 13.00 | -24.12 | 24.12 | 4.75 | 1.00 | 11.80 | PhiVc < Vu | 12.323 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 5.81 | 13.00 | -24.13 | 24.13 | 4.49 | 1.00 | 11.80 | PhiVc < Vu | 12.329 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 5.83 | 13.00 | -24.13 | 24.13 | 4.23 | 1.00 | 11.80 | PhiVc < Vu | 12.334 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 5.84 | 13.00 | -24.14 | 24.14 | 3.96 | 1.00 | 11.80 | PhiVc < Vu | 12.340 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 5.85 | 13.00 | -24.14 | 24.14 | 3.70 | 1.00 | 11.80 | PhiVc < Vu | 12.346 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 5.86 | 13.00 | -24.15 | 24.15 | 3.44 | 1.00 | 11.80 | PhiVc < Vu | 12.351 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 5.87 | 13.00 | -24.15 | 24.15 | 3.17 | 1.00 | 11.80 | PhiVc < Vu | 12.357 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 5.88 | 13.00 | -24.16 | 24.16 | 2.91 | 1.00 | 11.80 | PhiVc < Vu | 12.363 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 5.89 | 13.00 | -24.17 | 24.17 | 2.64 | 1.00 | 11.80 | PhiVc < Vu | 12.368 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 5.90 | 13.00 | -24.17 | 24.17 | 2.38 | 1.00 | 11.80 | PhiVc < Vu | 12.374 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 5.91 | 13.00 | -24.18 | 24.18 | 2.12 | 1.00 | 11.80 | PhiVc < Vu | 12.380 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 5.92 | 13.00 | -24.18 | 24.18 | 1.85 | 1.00 | 11.80 | PhiVc < Vu | 12.385 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 5.93 | 13.00 | -24.19 | 24.19 | 1.59 | 1.00 | 11.80 | PhiVc < Vu | 12.391 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 5.95 | 13.00 | -24.19 | 24.19 | 1.32 | 1.00 | 11.80 | PhiVc < Vu | 12.397 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 5.96 | 13.00 | -24.20 | 24.20 | 1.06 | 1.00 | 11.80 | PhiVc < Vu | 12.402 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 5.97 | 13.00 | -24.20 | 24.20 | 0.79 | 1.00 | 11.80 | PhiVc < Vu | 12.408 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 5.98 | 13.00 | -24.21 | 24.21 | 0.53 | 1.00 | 11.80 | PhiVc < Vu | 12.414 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 5.99 | 13.00 | -24.22 | 24.22 | 0.26 | 1.00 | 11.80 | PhiVc < Vu | 12.419 | 54.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 6.00 | 13.00 | -24.22 | 24.22 | 0.00 | 1.00 | 11.80 | PhiVc < Vu | 12.425 | 54.7 | 6.5 | 6.0 |

Maximum Forces & Stresses for Load Combinations

| Load Combination | Segment Length | Span # | Location (ft) in Span | Bending Stress Results (k-ft) | | |
|----------------------------|----------------|--------|-----------------------|-------------------------------|---------|--------------|
| | | | | Mu : Max | Phi*Mnx | Stress Ratio |
| MAXimum BENDING Envelope | | | | | | |
| Span # 1 | | 1 | 6.000 | 47.41 | 47.79 | 0.99 |
| +1.40D+1.60H | | | | | | |
| Span # 1 | | 1 | 6.000 | 7.41 | 47.79 | 0.16 |
| +1.20D+0.50L+1.60L+1.60H | | | | | | |
| Span # 1 | | 1 | 6.000 | 8.02 | 47.79 | 0.17 |
| +1.20D+1.60L+0.50S+1.60H | | | | | | |
| Span # 1 | | 1 | 6.000 | 20.68 | 47.79 | 0.43 |
| +1.20D+1.60L+0.50L+1.60H | | | | | | |
| Span # 1 | | 1 | 6.000 | 6.87 | 47.79 | 0.14 |
| +1.20D+1.60L+0.50W+1.60H | | | | | | |
| Span # 1 | | 1 | 6.000 | 6.35 | 47.79 | 0.13 |
| +1.20D+0.50L+1.60S+1.60H | | | | | | |
| Span # 1 | | 1 | 6.000 | 47.41 | 47.79 | 0.99 |
| +1.20D+1.60S+0.50W+1.60H | | | | | | |
| Span # 1 | | 1 | 6.000 | 46.89 | 47.79 | 0.98 |
| +1.20D+0.50L+0.50L+W+1.60H | | | | | | |
| Span # 1 | | 1 | 6.000 | 6.87 | 47.79 | 0.14 |
| +1.20D+0.50L+0.50S+W+1.60H | | | | | | |
| Span # 1 | | 1 | 6.000 | 19.54 | 47.79 | 0.41 |
| +1.20D+0.50L+0.70S+E+1.60H | | | | | | |
| Span # 1 | | 1 | 6.000 | 24.61 | 47.79 | 0.51 |
| +0.90D+W+0.90H | | | | | | |
| Span # 1 | | 1 | 6.000 | 4.77 | 47.79 | 0.10 |
| +0.90D+E+0.90H | | | | | | |
| Span # 1 | | 1 | 6.000 | 4.77 | 47.79 | 0.10 |

Overall Maximum Deflections

| Load Combination | Span | Max. "-" Defl | Location in Span | Load Combination | Max. "+" Defl | Location in Span |
|------------------|------|---------------|------------------|------------------|---------------|------------------|
| +D+S+H | 1 | 0.0367 | 3.393 | | 0.0000 | 0.000 |

Concrete Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTE-ZBB2XMC-F.Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9
 Licensee : Canyons Structural Inc

Lic. # : KW-06009078

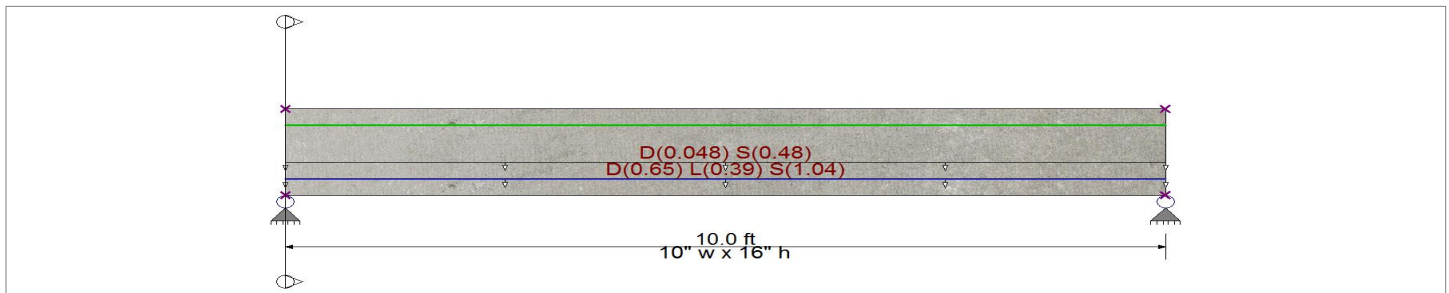
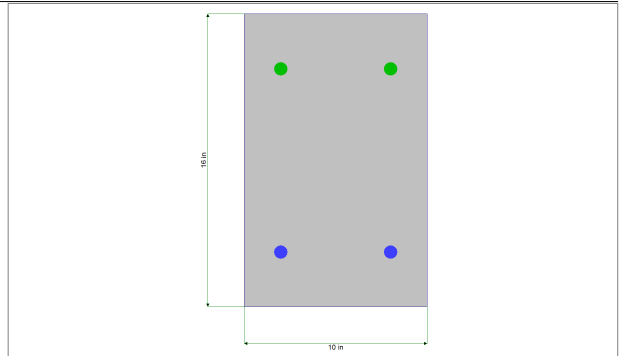
Description : Concrete Lintels at greenroof

CODE REFERENCES

Calculations per ACI 318-14, IBC 2015, ASCE 7-10
 Load Combination Set : IBC 2015

Material Properties

| | | | | | |
|---------------------------|---|--------------|--|-----------|--------------|
| f'_c | = | 3.0 ksi | ϕ Phi Values | Flexure : | 0.90 |
| $f_r = f'_c^{1/2} * 7.50$ | = | 410.792 psi | | Shear : | 0.750 |
| ψ Density | = | 145.0 pcf | β_1 | = | 0.850 |
| λ LtWt Factor | = | 1.0 | | | |
| Elastic Modulus | = | 3,122.0 ksi | Fy - Stirrups | = | 40.0 ksi |
| f_y - Main Rebar | = | 60.0 ksi | E - Stirrups | = | 29,000.0 ksi |
| E - Main Rebar | = | 29,000.0 ksi | Stirrup Bar Size # | = | 3 |
| | | | Number of Resisting Legs Per Stirrup = | = | 8.0 |



Cross Section & Reinforcing Details

Rectangular Section, Width = 10.0 in, Height = 16.0 in

Span #1 Reinforcing....

2-#6 at 3.0 in from Bottom, from 0.0 to 10.0 ft in this span

2-#6 at 3.0 in from Top, from 0.0 to 10.0 ft in this span

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loads

Load for Span Number 1

Uniform Load : D = 0.10, L = 0.060, S = 0.160 ksf, Tributary Width = 6.50 ft

Uniform Load : D = 0.0120, S = 0.120 ksf, Tributary Width = 4.0 ft, (Metal Deck)

DESIGN SUMMARY

Design OK

| | | | |
|--------------------------------|------------------------|-----------------------------------|----------------------------|
| Maximum Bending Stress Ratio = | 0.957 : 1 | Maximum Deflection | |
| Section used for this span | Typical Section | Max Downward Transient Deflection | 0.050 in Ratio = 2388 >=36 |
| Mu : Applied | 45.724 k-ft | Max Upward Transient Deflection | 0.000 in Ratio = 0 <360 |
| Mn * Phi : Allowable | 47.790 k-ft | Max Downward Total Deflection | 0.147 in Ratio = 814 >=18 |
| Location of maximum on span | 5.009 ft | Max Upward Total Deflection | 0.000 in Ratio = 999 <180 |
| Span # where maximum occurs | Span # 1 | | |

Vertical Reactions

Support notation : Far left is #1

| Load Combination | Support 1 | Support 2 |
|----------------------------|-----------|-----------|
| Overall MAXimum | 11.896 | 11.896 |
| Overall MINimum | 1.950 | 1.950 |
| +D+H | 4.296 | 4.296 |
| +D+L+H | 6.246 | 6.246 |
| +D+Lr+H | 4.296 | 4.296 |
| +D+S+H | 11.896 | 11.896 |
| +D+0.750Lr+0.750L+H | 5.758 | 5.758 |
| +D+0.750L+0.750S+H | 11.458 | 11.458 |
| +D+0.60W+H | 4.296 | 4.296 |
| +D+0.70E+H | 4.296 | 4.296 |
| +D+0.750Lr+0.750L+0.450W+H | 5.758 | 5.758 |
| +D+0.750L+0.750S+0.450W+H | 11.458 | 11.458 |

Concrete Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTE-ZBB2XMC-F.Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9

Lic. #: KW-06009078

Licensee: Canyons Structural Inc

Description: Concrete Lintels at greenroof

| Vertical Reactions | Support notation : Far left is #1 | |
|----------------------------|-----------------------------------|-----------|
| Load Combination | Support 1 | Support 2 |
| +D+0.750L+0.750S+0.5250E+H | 11.458 | 11.458 |
| +0.60D+0.60W+0.60H | 2.577 | 2.577 |
| +0.60D+0.70E+0.60H | 2.577 | 2.577 |
| D Only | 4.296 | 4.296 |
| Lr Only | | |
| L Only | 1.950 | 1.950 |
| S Only | 7.600 | 7.600 |
| W Only | | |
| E Only | | |
| H Only | | |

| Detailed Shear Information | | | | | | | | | | | | | |
|----------------------------|-------------|---------------|----------|---------------|---------------|-----------|---------|------------|------------|------------|------------|--------------------|----------------------|
| Load Combination | Span Number | Distance (ft) | 'd' (in) | Vu (k) Actual | Vu (k) Design | Mu (k-ft) | d*Vu/Mu | Phi*Vc (k) | Comment | Phi*Vs (k) | Phi*Vn (k) | Spacing (in) Req'd | Spacing (in) Suggest |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.00 | 13.00 | 18.29 | 18.29 | 0.00 | 1.00 | 11.80 | PhiVc < Vu | 6.493 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.02 | 13.00 | 18.22 | 18.22 | 0.33 | 1.00 | 11.80 | PhiVc < Vu | 6.426 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.04 | 13.00 | 18.16 | 18.16 | 0.66 | 1.00 | 11.80 | PhiVc < Vu | 6.360 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.05 | 13.00 | 18.09 | 18.09 | 0.99 | 1.00 | 11.80 | PhiVc < Vu | 6.293 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.07 | 13.00 | 18.02 | 18.02 | 1.32 | 1.00 | 11.80 | PhiVc < Vu | 6.227 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.09 | 13.00 | 17.96 | 17.96 | 1.65 | 1.00 | 11.80 | PhiVc < Vu | 6.160 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.11 | 13.00 | 17.89 | 17.89 | 1.98 | 1.00 | 11.80 | PhiVc < Vu | 6.093 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.13 | 13.00 | 17.82 | 17.82 | 2.30 | 1.00 | 11.80 | PhiVc < Vu | 6.027 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.15 | 13.00 | 17.76 | 17.76 | 2.63 | 1.00 | 11.80 | PhiVc < Vu | 5.960 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.16 | 13.00 | 17.69 | 17.69 | 2.95 | 1.00 | 11.80 | PhiVc < Vu | 5.893 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.18 | 13.00 | 17.62 | 17.62 | 3.27 | 1.00 | 11.80 | PhiVc < Vu | 5.827 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.20 | 13.00 | 17.56 | 17.56 | 3.59 | 1.00 | 11.80 | PhiVc < Vu | 5.760 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.22 | 13.00 | 17.49 | 17.49 | 3.91 | 1.00 | 11.80 | PhiVc < Vu | 5.694 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.24 | 13.00 | 17.42 | 17.42 | 4.23 | 1.00 | 11.80 | PhiVc < Vu | 5.627 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.26 | 13.00 | 17.36 | 17.36 | 4.55 | 1.00 | 11.80 | PhiVc < Vu | 5.560 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.27 | 13.00 | 17.29 | 17.29 | 4.86 | 1.00 | 11.80 | PhiVc < Vu | 5.494 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.29 | 13.00 | 17.22 | 17.22 | 5.17 | 1.00 | 11.80 | PhiVc < Vu | 5.427 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.31 | 13.00 | 17.16 | 17.16 | 5.49 | 1.00 | 11.80 | PhiVc < Vu | 5.360 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.33 | 13.00 | 17.09 | 17.09 | 5.80 | 1.00 | 11.80 | PhiVc < Vu | 5.294 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.35 | 13.00 | 17.02 | 17.02 | 6.11 | 1.00 | 11.80 | PhiVc < Vu | 5.227 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.36 | 13.00 | 16.96 | 16.96 | 6.42 | 1.00 | 11.80 | PhiVc < Vu | 5.161 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.38 | 13.00 | 16.89 | 16.89 | 6.73 | 1.00 | 11.80 | PhiVc < Vu | 5.094 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.40 | 13.00 | 16.82 | 16.82 | 7.04 | 1.00 | 11.80 | PhiVc < Vu | 5.027 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.42 | 13.00 | 16.76 | 16.76 | 7.34 | 1.00 | 11.80 | PhiVc < Vu | 4.961 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.44 | 13.00 | 16.69 | 16.69 | 7.65 | 1.00 | 11.80 | PhiVc < Vu | 4.894 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.46 | 13.00 | 16.62 | 16.62 | 7.95 | 1.00 | 11.80 | PhiVc < Vu | 4.827 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.47 | 13.00 | 16.56 | 16.56 | 8.25 | 1.00 | 11.80 | PhiVc < Vu | 4.761 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.49 | 13.00 | 16.49 | 16.49 | 8.55 | 1.00 | 11.80 | PhiVc < Vu | 4.694 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.51 | 13.00 | 16.42 | 16.42 | 8.85 | 1.00 | 11.80 | PhiVc < Vu | 4.627 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.53 | 13.00 | 16.36 | 16.36 | 9.15 | 1.00 | 11.80 | PhiVc < Vu | 4.561 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.55 | 13.00 | 16.29 | 16.29 | 9.45 | 1.00 | 11.80 | PhiVc < Vu | 4.494 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.56 | 13.00 | 16.22 | 16.22 | 9.74 | 1.00 | 11.80 | PhiVc < Vu | 4.428 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.58 | 13.00 | 16.16 | 16.16 | 10.04 | 1.00 | 11.80 | PhiVc < Vu | 4.361 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.60 | 13.00 | 16.09 | 16.09 | 10.33 | 1.00 | 11.80 | PhiVc < Vu | 4.294 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.62 | 13.00 | 16.02 | 16.02 | 10.63 | 1.00 | 11.80 | PhiVc < Vu | 4.228 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.64 | 13.00 | 15.96 | 15.96 | 10.92 | 1.00 | 11.80 | PhiVc < Vu | 4.161 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.66 | 13.00 | 15.89 | 15.89 | 11.21 | 1.00 | 11.80 | PhiVc < Vu | 4.094 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.67 | 13.00 | 15.82 | 15.82 | 11.50 | 1.00 | 11.80 | PhiVc < Vu | 4.028 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.69 | 13.00 | 15.76 | 15.76 | 11.78 | 1.00 | 11.80 | PhiVc < Vu | 3.961 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.71 | 13.00 | 15.69 | 15.69 | 12.07 | 1.00 | 11.80 | PhiVc < Vu | 3.895 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.73 | 13.00 | 15.62 | 15.62 | 12.35 | 1.00 | 11.80 | PhiVc < Vu | 3.828 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.75 | 13.00 | 15.56 | 15.56 | 12.64 | 1.00 | 11.80 | PhiVc < Vu | 3.761 | 69.0 | 6.5 | 6.0 |

Concrete Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTE-ZBB2XMC-F.Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9

Lic. #: KW-06009078

Licensee: Canyons Structural Inc

Description: Concrete Lintels at greenroof

Detailed Shear Information

| Load Combination | Span Number | Distance (ft) | 'd' (in) | Vu (k) | | Mu (k-ft) | d*Vu/Mu | Phi*Vc (k) | Comment | Phi*Vs (k) | Phi*Vn (k) | Spacing (in) | |
|--------------------------|-------------|---------------|----------|--------|--------|-----------|---------|------------|------------|------------|------------|--------------|---------|
| | | | | Actual | Design | | | | | | | Req'd | Suggest |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.77 | 13.00 | 15.49 | 15.49 | 12.92 | 1.00 | 11.80 | PhiVc < Vu | 3.695 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.78 | 13.00 | 15.42 | 15.42 | 13.20 | 1.00 | 11.80 | PhiVc < Vu | 3.628 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.80 | 13.00 | 15.36 | 15.36 | 13.48 | 1.00 | 11.80 | PhiVc < Vu | 3.561 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.82 | 13.00 | 15.29 | 15.29 | 13.76 | 1.00 | 11.80 | PhiVc < Vu | 3.495 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.84 | 13.00 | 15.22 | 15.22 | 14.04 | 1.00 | 11.80 | PhiVc < Vu | 3.428 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.86 | 13.00 | 15.16 | 15.16 | 14.32 | 1.00 | 11.80 | PhiVc < Vu | 3.362 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.87 | 13.00 | 15.09 | 15.09 | 14.59 | 1.00 | 11.80 | PhiVc < Vu | 3.295 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.89 | 13.00 | 15.02 | 15.02 | 14.87 | 1.00 | 11.80 | PhiVc < Vu | 3.228 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.91 | 13.00 | 14.96 | 14.96 | 15.14 | 1.00 | 11.80 | PhiVc < Vu | 3.162 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.93 | 13.00 | 14.89 | 14.89 | 15.41 | 1.00 | 11.80 | PhiVc < Vu | 3.095 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.95 | 13.00 | 14.82 | 14.82 | 15.68 | 1.00 | 11.80 | PhiVc < Vu | 3.028 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.97 | 13.00 | 14.76 | 14.76 | 15.95 | 1.00 | 11.80 | PhiVc < Vu | 2.962 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 0.98 | 13.00 | 14.69 | 14.69 | 16.22 | 0.98 | 11.77 | PhiVc < Vu | 2.926 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.00 | 13.00 | 14.63 | 14.63 | 16.49 | 0.96 | 11.73 | PhiVc < Vu | 2.893 | 68.9 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.02 | 13.00 | 14.56 | 14.56 | 16.75 | 0.94 | 11.70 | PhiVc < Vu | 2.859 | 68.9 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.04 | 13.00 | 14.49 | 14.49 | 17.02 | 0.92 | 11.67 | PhiVc < Vu | 2.823 | 68.9 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.06 | 13.00 | 14.43 | 14.43 | 17.28 | 0.90 | 11.64 | PhiVc < Vu | 2.787 | 68.8 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.07 | 13.00 | 14.36 | 14.36 | 17.54 | 0.89 | 11.61 | PhiVc < Vu | 2.749 | 68.8 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.09 | 13.00 | 14.29 | 14.29 | 17.80 | 0.87 | 11.58 | PhiVc < Vu | 2.710 | 68.8 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.11 | 13.00 | 14.23 | 14.23 | 18.06 | 0.85 | 11.55 | PhiVc < Vu | 2.671 | 68.8 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.13 | 13.00 | 14.16 | 14.16 | 18.32 | 0.84 | 11.53 | PhiVc < Vu | 2.631 | 68.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.15 | 13.00 | 14.09 | 14.09 | 18.58 | 0.82 | 11.50 | PhiVc < Vu | 2.590 | 68.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.17 | 13.00 | 14.03 | 14.03 | 18.84 | 0.81 | 11.48 | PhiVc < Vu | 2.548 | 68.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.18 | 13.00 | 13.96 | 13.96 | 19.09 | 0.79 | 11.45 | PhiVc < Vu | 2.505 | 68.7 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.20 | 13.00 | 13.89 | 13.89 | 19.34 | 0.78 | 11.43 | PhiVc < Vu | 2.462 | 68.6 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.22 | 13.00 | 13.83 | 13.83 | 19.60 | 0.76 | 11.41 | PhiVc < Vu | 2.418 | 68.6 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.24 | 13.00 | 13.76 | 13.76 | 19.85 | 0.75 | 11.39 | PhiVc < Vu | 2.373 | 68.6 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.26 | 13.00 | 13.69 | 13.69 | 20.10 | 0.74 | 11.36 | PhiVc < Vu | 2.328 | 68.6 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.28 | 13.00 | 13.63 | 13.63 | 20.35 | 0.73 | 11.34 | PhiVc < Vu | 2.282 | 68.5 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.29 | 13.00 | 13.56 | 13.56 | 20.59 | 0.71 | 11.32 | PhiVc < Vu | 2.236 | 68.5 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.31 | 13.00 | 13.49 | 13.49 | 20.84 | 0.70 | 11.30 | PhiVc < Vu | 2.189 | 68.5 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.33 | 13.00 | 13.43 | 13.43 | 21.09 | 0.69 | 11.28 | PhiVc < Vu | 2.141 | 68.5 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.35 | 13.00 | 13.36 | 13.36 | 21.33 | 0.68 | 11.27 | PhiVc < Vu | 2.093 | 68.5 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.37 | 13.00 | 13.29 | 13.29 | 21.57 | 0.67 | 11.25 | PhiVc < Vu | 2.045 | 68.4 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.38 | 13.00 | 13.23 | 13.23 | 21.81 | 0.66 | 11.23 | PhiVc < Vu | 1.996 | 68.4 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.40 | 13.00 | 13.16 | 13.16 | 22.05 | 0.65 | 11.21 | PhiVc < Vu | 1.946 | 68.4 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.42 | 13.00 | 13.09 | 13.09 | 22.29 | 0.64 | 11.20 | PhiVc < Vu | 1.896 | 68.4 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.44 | 13.00 | 13.03 | 13.03 | 22.53 | 0.63 | 11.18 | PhiVc < Vu | 1.846 | 68.4 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.46 | 13.00 | 12.96 | 12.96 | 22.77 | 0.62 | 11.16 | PhiVc < Vu | 1.795 | 68.4 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.48 | 13.00 | 12.89 | 12.89 | 23.00 | 0.61 | 11.15 | PhiVc < Vu | 1.744 | 68.3 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.49 | 13.00 | 12.83 | 12.83 | 23.24 | 0.60 | 11.13 | PhiVc < Vu | 1.693 | 68.3 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.51 | 13.00 | 12.76 | 12.76 | 23.47 | 0.59 | 11.12 | PhiVc < Vu | 1.641 | 68.3 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.53 | 13.00 | 12.69 | 12.69 | 23.70 | 0.58 | 11.10 | PhiVc < Vu | 1.589 | 68.3 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.55 | 13.00 | 12.63 | 12.63 | 23.93 | 0.57 | 11.09 | PhiVc < Vu | 1.537 | 68.3 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.57 | 13.00 | 12.56 | 12.56 | 24.16 | 0.56 | 11.08 | PhiVc < Vu | 1.484 | 68.3 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.58 | 13.00 | 12.49 | 12.49 | 24.39 | 0.55 | 11.06 | PhiVc < Vu | 1.431 | 68.3 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.60 | 13.00 | 12.43 | 12.43 | 24.62 | 0.55 | 11.05 | PhiVc < Vu | 1.377 | 68.2 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.62 | 13.00 | 12.36 | 12.36 | 24.84 | 0.54 | 11.04 | PhiVc < Vu | 1.324 | 68.2 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.64 | 13.00 | 12.29 | 12.29 | 25.07 | 0.53 | 11.02 | PhiVc < Vu | 1.270 | 68.2 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.66 | 13.00 | 12.23 | 12.23 | 25.29 | 0.52 | 11.01 | PhiVc < Vu | 1.216 | 68.2 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.68 | 13.00 | 12.16 | 12.16 | 25.51 | 0.52 | 11.00 | PhiVc < Vu | 1.161 | 68.2 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.69 | 13.00 | 12.09 | 12.09 | 25.73 | 0.51 | 10.99 | PhiVc < Vu | 1.107 | 68.2 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.71 | 13.00 | 12.03 | 12.03 | 25.95 | 0.50 | 10.97 | PhiVc < Vu | 1.052 | 68.2 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 1.73 | 13.00 | 11.96 | 11.96 | 26.17 | 0.50 | 10.96 | PhiVc < Vu | 0.9965 | 68.251 | 6.5 | 6.0 |

Concrete Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTE-ZBB2XMC-F.Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9

Lic. #: KW-06009078

Licensee: Canyons Structural Inc

Description: Concrete Lintels at greenroof

Detailed Shear Information

| Load Combination | Span Number | Distance (ft) | 'd' (in) | Vu (k) | | Mu (k-ft) | d*Vu/Mu | Phi*Vc (k) | Comment | Phi*Vs (k) | Phi*Vn (k) | Spacing (in) | | |
|--------------------------|-------------|---------------|----------|--------|--------|-----------|---------|------------|--------------|------------|------------|--------------------|---------|-----|
| | | | | Actual | Design | | | | | | | Req'd | Suggest | |
| +1.20D+0.50L+1.60S+1.60H | 1 | 3.72 | 13.00 | 4.70 | 4.70 | 42.71 | 0.12 | 10.34 | Vu < PhiVc/2 | Not Req'd | 9 | 10.3 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 3.73 | 13.00 | 4.63 | 4.63 | 42.79 | 0.12 | 10.34 | Vu < PhiVc/2 | Not Req'd | 9 | 10.3 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 3.75 | 13.00 | 4.56 | 4.56 | 42.88 | 0.12 | 10.34 | Vu < PhiVc/2 | Not Req'd | 9 | 10.3 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 3.77 | 13.00 | 4.50 | 4.50 | 42.96 | 0.11 | 10.33 | Vu < PhiVc/2 | Not Req'd | 9 | 10.3 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 3.79 | 13.00 | 4.43 | 4.43 | 43.04 | 0.11 | 10.33 | Vu < PhiVc/2 | Not Req'd | 9 | 10.3 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 3.81 | 13.00 | 4.36 | 4.36 | 43.12 | 0.11 | 10.33 | Vu < PhiVc/2 | Not Req'd | 9 | 10.3 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 3.83 | 13.00 | 4.30 | 4.30 | 43.20 | 0.11 | 10.32 | Vu < PhiVc/2 | Not Req'd | 9 | 10.3 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 3.84 | 13.00 | 4.23 | 4.23 | 43.28 | 0.11 | 10.32 | Vu < PhiVc/2 | Not Req'd | 9 | 10.3 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 3.86 | 13.00 | 4.16 | 4.16 | 43.35 | 0.10 | 10.32 | Vu < PhiVc/2 | Not Req'd | 9 | 10.3 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 3.88 | 13.00 | 4.10 | 4.10 | 43.43 | 0.10 | 10.32 | Vu < PhiVc/2 | Not Req'd | 9 | 10.3 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 3.90 | 13.00 | 4.03 | 4.03 | 43.50 | 0.10 | 10.31 | Vu < PhiVc/2 | Not Req'd | 9 | 10.3 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 3.92 | 13.00 | 3.96 | 3.96 | 43.58 | 0.10 | 10.31 | Vu < PhiVc/2 | Not Req'd | 9 | 10.3 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 3.93 | 13.00 | 3.90 | 3.90 | 43.65 | 0.10 | 10.31 | Vu < PhiVc/2 | Not Req'd | 9 | 10.3 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 3.95 | 13.00 | 3.83 | 3.83 | 43.72 | 0.09 | 10.30 | Vu < PhiVc/2 | Not Req'd | 9 | 10.3 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 3.97 | 13.00 | 3.76 | 3.76 | 43.79 | 0.09 | 10.30 | Vu < PhiVc/2 | Not Req'd | 9 | 10.3 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 3.99 | 13.00 | 3.70 | 3.70 | 43.86 | 0.09 | 10.30 | Vu < PhiVc/2 | Not Req'd | 9 | 10.3 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 4.01 | 13.00 | 3.63 | 3.63 | 43.92 | 0.09 | 10.29 | Vu < PhiVc/2 | Not Req'd | 9 | 10.3 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 4.03 | 13.00 | 3.56 | 3.56 | 43.99 | 0.09 | 10.29 | Vu < PhiVc/2 | Not Req'd | 9 | 10.3 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 4.04 | 13.00 | 3.50 | 3.50 | 44.05 | 0.09 | 10.29 | Vu < PhiVc/2 | Not Req'd | 9 | 10.3 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 4.06 | 13.00 | 3.43 | 3.43 | 44.11 | 0.08 | 10.29 | Vu < PhiVc/2 | Not Req'd | 9 | 10.3 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 4.08 | 13.00 | 3.36 | 3.36 | 44.18 | 0.08 | 10.28 | Vu < PhiVc/2 | Not Req'd | 9 | 10.3 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 4.10 | 13.00 | 3.30 | 3.30 | 44.24 | 0.08 | 10.28 | Vu < PhiVc/2 | Not Req'd | 9 | 10.3 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 4.12 | 13.00 | 3.23 | 3.23 | 44.30 | 0.08 | 10.28 | Vu < PhiVc/2 | Not Req'd | 9 | 10.3 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 4.13 | 13.00 | 3.16 | 3.16 | 44.36 | 0.08 | 10.27 | Vu < PhiVc/2 | Not Req'd | 9 | 10.3 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 4.15 | 13.00 | 3.10 | 3.10 | 44.41 | 0.08 | 10.27 | Vu < PhiVc/2 | Not Req'd | 9 | 10.3 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 4.17 | 13.00 | 3.03 | 3.03 | 44.47 | 0.07 | 10.27 | Vu < PhiVc/2 | Not Req'd | 9 | 10.3 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 4.19 | 13.00 | 2.96 | 2.96 | 44.52 | 0.07 | 10.27 | Vu < PhiVc/2 | Not Req'd | 9 | 10.3 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 4.21 | 13.00 | 2.90 | 2.90 | 44.58 | 0.07 | 10.26 | Vu < PhiVc/2 | Not Req'd | 9 | 10.3 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 4.23 | 13.00 | 2.83 | 2.83 | 44.63 | 0.07 | 10.26 | Vu < PhiVc/2 | Not Req'd | 9 | 10.3 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 4.24 | 13.00 | 2.77 | 2.77 | 44.68 | 0.07 | 10.26 | Vu < PhiVc/2 | Not Req'd | 9 | 10.3 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 4.26 | 13.00 | 2.70 | 2.70 | 44.73 | 0.07 | 10.25 | Vu < PhiVc/2 | Not Req'd | 9 | 10.3 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 4.28 | 13.00 | 2.63 | 2.63 | 44.78 | 0.06 | 10.25 | Vu < PhiVc/2 | Not Req'd | 9 | 10.3 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 4.30 | 13.00 | 2.57 | 2.57 | 44.82 | 0.06 | 10.25 | Vu < PhiVc/2 | Not Req'd | 9 | 10.2 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 4.32 | 13.00 | 2.50 | 2.50 | 44.87 | 0.06 | 10.25 | Vu < PhiVc/2 | Not Req'd | 9 | 10.2 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 4.34 | 13.00 | 2.43 | 2.43 | 44.92 | 0.06 | 10.24 | Vu < PhiVc/2 | Not Req'd | 9 | 10.2 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 4.35 | 13.00 | 2.37 | 2.37 | 44.96 | 0.06 | 10.24 | Vu < PhiVc/2 | Not Req'd | 9 | 10.2 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 4.37 | 13.00 | 2.30 | 2.30 | 45.00 | 0.06 | 10.24 | Vu < PhiVc/2 | Not Req'd | 9 | 10.2 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 4.39 | 13.00 | 2.23 | 2.23 | 45.04 | 0.05 | 10.24 | Vu < PhiVc/2 | Not Req'd | 9 | 10.2 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 4.41 | 13.00 | 2.17 | 2.17 | 45.08 | 0.05 | 10.23 | Vu < PhiVc/2 | Not Req'd | 9 | 10.2 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 4.43 | 13.00 | 2.10 | 2.10 | 45.12 | 0.05 | 10.23 | Vu < PhiVc/2 | Not Req'd | 9 | 10.2 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 4.44 | 13.00 | 2.03 | 2.03 | 45.16 | 0.05 | 10.23 | Vu < PhiVc/2 | Not Req'd | 9 | 10.2 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 4.46 | 13.00 | 1.97 | 1.97 | 45.20 | 0.05 | 10.22 | Vu < PhiVc/2 | Not Req'd | 9 | 10.2 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 4.48 | 13.00 | 1.90 | 1.90 | 45.23 | 0.05 | 10.22 | Vu < PhiVc/2 | Not Req'd | 9 | 10.2 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 4.50 | 13.00 | 1.83 | 1.83 | 45.27 | 0.04 | 10.22 | Vu < PhiVc/2 | Not Req'd | 9 | 10.2 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 4.52 | 13.00 | 1.77 | 1.77 | 45.30 | 0.04 | 10.22 | Vu < PhiVc/2 | Not Req'd | 9 | 10.2 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 4.54 | 13.00 | 1.70 | 1.70 | 45.33 | 0.04 | 10.21 | Vu < PhiVc/2 | Not Req'd | 9 | 10.2 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 4.55 | 13.00 | 1.63 | 1.63 | 45.36 | 0.04 | 10.21 | Vu < PhiVc/2 | Not Req'd | 9 | 10.2 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 4.57 | 13.00 | 1.57 | 1.57 | 45.39 | 0.04 | 10.21 | Vu < PhiVc/2 | Not Req'd | 9 | 10.2 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 4.59 | 13.00 | 1.50 | 1.50 | 45.42 | 0.04 | 10.21 | Vu < PhiVc/2 | Not Req'd | 9 | 10.2 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 4.61 | 13.00 | 1.43 | 1.43 | 45.44 | 0.03 | 10.20 | Vu < PhiVc/2 | Not Req'd | 9 | 10.2 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 4.63 | 13.00 | 1.37 | 1.37 | 45.47 | 0.03 | 10.20 | Vu < PhiVc/2 | Not Req'd | 9 | 10.2 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 4.64 | 13.00 | 1.30 | 1.30 | 45.49 | 0.03 | 10.20 | Vu < PhiVc/2 | Not Req'd | 9 | 10.2 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 4.66 | 13.00 | 1.23 | 1.23 | 45.52 | 0.03 | 10.19 | Vu < PhiVc/2 | Not Req'd | 9 | 10.2 | 0.0 | 0.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 4.68 | 13.00 | 1.17 | 1.17 | 45.54 | 0.03 | 10.19 | Vu < PhiVc/2 | Not Req'd | 9 | 10.2 ⁵⁴ | 0.0 | 0.0 |

Concrete Beam

File = \\CSI-LAN-SERVER\CSI Projects\P5WNTE-ZBB2XMC-F.Calcs\beams.ec6
 ENERCALC, INC. 1983-2017, Build:10.17.8.9, Ver:10.17.8.9

Lic. #: KW-06009078

Licensee: Canyons Structural Inc

Description: Concrete Lintels at greenroof

Detailed Shear Information

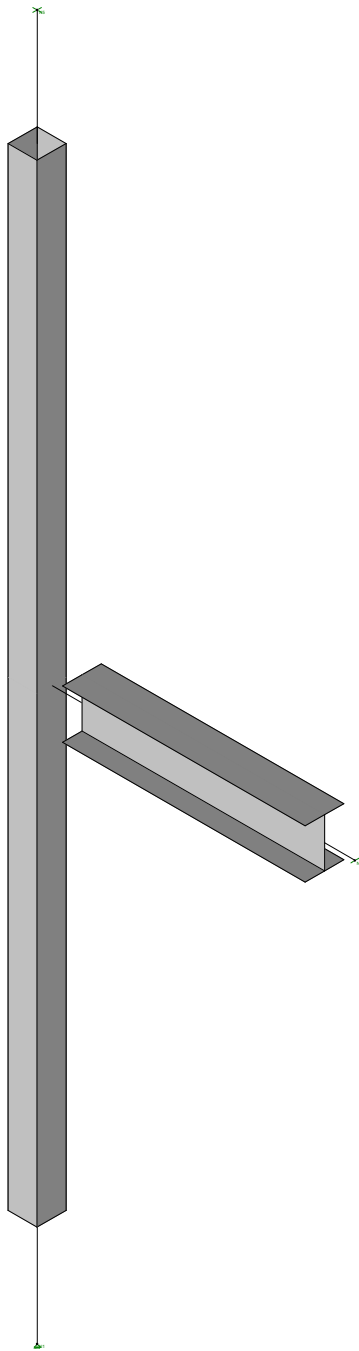
| Load Combination | Span Number | Distance (ft) | 'd' (in) | Vu (k) | | Mu (k-ft) | d*Vu/Mu | Phi*Vc (k) | Comment | Phi*Vs (k) | Phi*Vn (k) | Spacing (in) | |
|--------------------------|-------------|---------------|----------|--------|--------|-----------|---------|------------|------------|------------|------------|--------------|---------|
| | | | | Actual | Design | | | | | | | Req'd | Suggest |
| +1.20D+0.50L+1.60S+1.60H | 1 | 9.62 | 13.00 | -16.89 | 16.89 | 6.73 | 1.00 | 11.80 | PhiVc < Vu | 5.094 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 9.64 | 13.00 | -16.96 | 16.96 | 6.42 | 1.00 | 11.80 | PhiVc < Vu | 5.161 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 9.65 | 13.00 | -17.02 | 17.02 | 6.11 | 1.00 | 11.80 | PhiVc < Vu | 5.227 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 9.67 | 13.00 | -17.09 | 17.09 | 5.80 | 1.00 | 11.80 | PhiVc < Vu | 5.294 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 9.69 | 13.00 | -17.16 | 17.16 | 5.49 | 1.00 | 11.80 | PhiVc < Vu | 5.360 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 9.71 | 13.00 | -17.22 | 17.22 | 5.17 | 1.00 | 11.80 | PhiVc < Vu | 5.427 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 9.73 | 13.00 | -17.29 | 17.29 | 4.86 | 1.00 | 11.80 | PhiVc < Vu | 5.494 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 9.74 | 13.00 | -17.36 | 17.36 | 4.55 | 1.00 | 11.80 | PhiVc < Vu | 5.560 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 9.76 | 13.00 | -17.42 | 17.42 | 4.23 | 1.00 | 11.80 | PhiVc < Vu | 5.627 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 9.78 | 13.00 | -17.49 | 17.49 | 3.91 | 1.00 | 11.80 | PhiVc < Vu | 5.694 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 9.80 | 13.00 | -17.56 | 17.56 | 3.59 | 1.00 | 11.80 | PhiVc < Vu | 5.760 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 9.82 | 13.00 | -17.62 | 17.62 | 3.27 | 1.00 | 11.80 | PhiVc < Vu | 5.827 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 9.84 | 13.00 | -17.69 | 17.69 | 2.95 | 1.00 | 11.80 | PhiVc < Vu | 5.893 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 9.85 | 13.00 | -17.76 | 17.76 | 2.63 | 1.00 | 11.80 | PhiVc < Vu | 5.960 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 9.87 | 13.00 | -17.82 | 17.82 | 2.30 | 1.00 | 11.80 | PhiVc < Vu | 6.027 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 9.89 | 13.00 | -17.89 | 17.89 | 1.98 | 1.00 | 11.80 | PhiVc < Vu | 6.093 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 9.91 | 13.00 | -17.96 | 17.96 | 1.65 | 1.00 | 11.80 | PhiVc < Vu | 6.160 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 9.93 | 13.00 | -18.02 | 18.02 | 1.32 | 1.00 | 11.80 | PhiVc < Vu | 6.227 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 9.95 | 13.00 | -18.09 | 18.09 | 0.99 | 1.00 | 11.80 | PhiVc < Vu | 6.293 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 9.96 | 13.00 | -18.16 | 18.16 | 0.66 | 1.00 | 11.80 | PhiVc < Vu | 6.360 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 9.98 | 13.00 | -18.22 | 18.22 | 0.33 | 1.00 | 11.80 | PhiVc < Vu | 6.426 | 69.0 | 6.5 | 6.0 |
| +1.20D+0.50L+1.60S+1.60H | 1 | 10.00 | 13.00 | -18.29 | 18.29 | 0.00 | 1.00 | 11.80 | PhiVc < Vu | 6.493 | 69.0 | 6.5 | 6.0 |

Maximum Forces & Stresses for Load Combinations

| Load Combination | Segment Length | Span # | Location (ft) in Span | Bending Stress Results (k-ft) | | |
|----------------------------|----------------|--------|-----------------------|-------------------------------|---------|--------------|
| | | | | Mu : Max | Phi*Mnx | Stress Ratio |
| MAXIMUM BENDING Envelope | | | | | | |
| Span # 1 | | 1 | 10.000 | 45.72 | 47.79 | 0.96 |
| +1.40D+1.60H | | | | | | |
| Span # 1 | | 1 | 10.000 | 15.03 | 47.79 | 0.31 |
| +1.20D+0.50L+1.60L+1.60H | | | | | | |
| Span # 1 | | 1 | 10.000 | 20.69 | 47.79 | 0.43 |
| +1.20D+1.60L+0.50S+1.60H | | | | | | |
| Span # 1 | | 1 | 10.000 | 30.19 | 47.79 | 0.63 |
| +1.20D+1.60L+0.50L+1.60H | | | | | | |
| Span # 1 | | 1 | 10.000 | 15.32 | 47.79 | 0.32 |
| +1.20D+1.60L+0.50W+1.60H | | | | | | |
| Span # 1 | | 1 | 10.000 | 12.89 | 47.79 | 0.27 |
| +1.20D+0.50L+1.60S+1.60H | | | | | | |
| Span # 1 | | 1 | 10.000 | 45.72 | 47.79 | 0.96 |
| +1.20D+1.60S+0.50W+1.60H | | | | | | |
| Span # 1 | | 1 | 10.000 | 43.29 | 47.79 | 0.91 |
| +1.20D+0.50L+0.50L+W+1.60H | | | | | | |
| Span # 1 | | 1 | 10.000 | 15.32 | 47.79 | 0.32 |
| +1.20D+0.50L+0.50S+W+1.60H | | | | | | |
| Span # 1 | | 1 | 10.000 | 24.82 | 47.79 | 0.52 |
| +1.20D+0.50L+0.70S+E+1.60H | | | | | | |
| Span # 1 | | 1 | 10.000 | 28.62 | 47.79 | 0.60 |
| +0.90D+W+0.90H | | | | | | |
| Span # 1 | | 1 | 10.000 | 9.66 | 47.79 | 0.20 |
| +0.90D+E+0.90H | | | | | | |
| Span # 1 | | 1 | 10.000 | 9.66 | 47.79 | 0.20 |

Overall Maximum Deflections

| Load Combination | Span | Max. "-" Defl | Location in Span | Load Combination | Max. "+" Defl | Location in Span |
|------------------|------|---------------|------------------|------------------|---------------|------------------|
| +D+S+H | 1 | 0.1474 | 5.000 | | 0.0000 | 0.000 |



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| |
| Courtney Fleming |
| Browning Ski Lodge |

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| Column w/ fixed beam |
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| |
|----------------------------------|
| SK - 2 |
| Aug 15, 2017 at 8:54 AM |
| Cantilevered Beam off Column.r3d |



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|---|-------|----------|------|-------------|-------------|--------------|------|-------|-------|------|
| N | ` l i | eppSñSñU | É~ä | t äÉ-çã-áÖÉ | e o l p q i | o i äÉpÉíO | VKTQ | QUP | QUP | UNKN |
| O | É~ä | t NMICR | É~ä | t äÉ-çã-áÖÉ | e o l p q i | qóéá~ä | NPKP | RPIQ | OQJ | NKRN |

ççäí= ççÇä ~ÍÉé= áÇ-çÉä éÉé-üÉé

| | i~ÄÉä | u=ñiz | v=ñiz | w=ñiz | qÉä é=cz | a Éí~ÄÜçéçä çã-éKK |
|---|-------|-------|-------|-------|----------|--------------------|
| N | kN | M | M | M | M | |
| O | kP | M | NM | M | M | |
| P | kQ | RR | NM | M | M | |
| Q | kR | M | CM | M | M | |

j Éä ÄÉéméã ~éó-a ~í-

| | i~ÄÉä | fççäí | gççäí | hççäí | oççí~ÍÉÉÇÓF | pÉÄíçálpÜ-éÉ | qóéÉ | a Éããá= äí | j ~ÍÉãä | a Éããä-óí äé |
|---|-------|-------|-------|-------|-------------|--------------|------|-------------|-------------|--------------|
| N | j N | kR | kN | | | ` l i | É~ä | t äÉ-çã-áÖÉ | e o l p q i | o i äÉpÉíO |
| O | j P | kP | kQ | | | É~ä | É~ä | t äÉ-çã-áÖÉ | e o l p q i | qóéá~ä |

ççäí= çãäÇ-éó= çãÇäíçäé

| | ççäí=ÄÉä | u=äláç | v=äláç | w=äláç | u=çíkáñilê-Ç | v=çíkáñilê-Ç | w=çíkáñilê-Ç |
|---|----------|----------|----------|----------|--------------|--------------|--------------|
| N | kN | o É~Äíçä | o É~Äíçä | o É~Äíçä | | | |
| O | kR | o É~Äíçä | | o É~Äíçä | | | |
| P | kP | o É~Äíçä | | o É~Äíçä | | | |
| Q | kQ | | | o É~Äíçä | | | |

iç~Ç= çã Ää~íçäé

| | a Éããáçã pçãñk | oççí~ÍÉÉÇÓF | c~Äíçä | c~Äíçä | c~Äíçä | c~Äíçä | c~Äíçä | c~Äíçä | c~Äíçä | c~Äíçä | c~Äíçä | c~Äíçä | c~Äíçä | c~Äíçä | c~Äíçä | c~Äíçä | c~Äíçä | c~Äíçä |
|---|----------------|-------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| N | f` ÑSNJvÉé v | | ai | NQ | | | | | | | | | | | | | | |
| O | f` ÑSJOÉfvÉé v | | ai | NO | ii | NS | ii p | NS | oii | IR | | | | | | | | |
| P | f` ÑSJOÉkvÉé v | | ai | NO | ii | NS | ii p | NS | | | | | | | | | | |
| Q | f` ÑSIPEfvÉé v | | ai | NO | oii | NS | ii | IR | ii p | N | | | | | | | | |

~éä=íç~Ç= ~éÉé

| | i` çã Ääçãçã | ` ~ÍÉÇóó | u=çíçáó | v=çíçáó | w=çíçáó | ççäí | mççäí | a äíçäí | íÉÇ^ éÉ-É ÉKK pi éÑÄÉñkk |
|---|--------------|----------|---------|---------|---------|------|-------|---------|--------------------------|
| N | eÉä äã~Çé | bi | | | | | | | |
| O | éäçí | pi | | | | N | | | |
| P | éçÑ~äÇñçéä | ai | | | | N | | N | |
| Q | ä É~Ç | ii | | | | | | N | |
| R | Öéí áó | ai | | JN | | | | | |

j Éä ÄÉéã äé äíçäíç~ÇéÉ i` PwççÑ~äÇñçéäF

| | j Éä ÄÉéã ~ÄÉä | a äíçäí | pí-çç ~Çäí Çéäñçäéñ | bäÇç ~Çäí Çéäñçäéñ | pí-çç çã-íçäíçãñBz | bäÇç çã-íçäíçãñBz |
|---|----------------|---------|---------------------|--------------------|--------------------|-------------------|
| N | j P | v | JPUQ | JPUQ | M | M |

o f p ^ J p a = Éããã~NRKQ = xKKKKKKKKK_ ççí äã Öp áã çÇÉÉ ~Äéy ~äíçäí ÉÉÇ_ É~ä çÑ çã ä áãÇÇ= m-ÖÉ-N



`cã é-aó W
a Éã Êé W` çî ááÉó-cã äÖ
gçÄ-k i á ÄÉé W_çî ááÖpää çÇÉ
j çÇÄ-k ~ã É W` çã á á ÷ UNÉÇÄ-ã

^ i ÖNR=OMNT
URU^ j
`UEÄÉÇ_öM|||

j Éã ÄÉéa æãÄiÉÇ-iç~ÇèE i` ÖwäÉç~ÇF

Table with 7 columns: j Éã ÄÉé ~ÄÉa, aæÄiçã, pí-èj ~ÇãÄ ÉãUNçlæñz, báÇj ~ÇãÄ ÉãUNçkpi-èçÄ-içãxNB z, báÇç Ä-içãxNB z. Rows include N, j N, v, JQU, M.

gçÄiç-iç~Çè-aÇ-báñçäÉÇ-a æéä-ÄÉä ÉãíéE i` Öwäççif

Table with 4 columns: gçÄiç~ÄÉa, i la lj, aæÄiçã, j ~ÇãÄ ÉãUNçlæñz-iç-ÇE-ÇEÖUNçk. Rows include N, k R, i, v, JV.

gçÄiç-iç~Çè-aÇ-báñçäÉÇ-a æéä-ÄÉä ÉãíéE i` P-wççÑ-aÇ~ñççäF

Table with 4 columns: gçÄiç~ÄÉa, i la lj, aæÄiçã, j ~ÇãÄ ÉãUNçlæñz-iç-ÇE-ÇEÖUNçk. Rows include N, k R, i, v, P.

j Éã ÄÉémçÄiç-iç~ÇèE

Table with 4 columns: j Éã ÄÉé ~ÄÉa, aæÄiçã, j ~ÇãÄ ÉãUNçz, i çÄ-içãxNB z. Row includes k ç-a ~í~iç-mäi=kk.

bãíÉäçÉÉççÄ íóÉ-Äíäçäë

Grid table with columns: gçÄí, u=áz, i`, v=áz, i`, w=áz, i`, j u=áUNçz, i`, j v=áUNçz, i`, j w=áUNçz, i`. Rows include N, O, P, Q, R, S, T, U, V, NM with various combinations of ã ~ñ and ä ä.

bãíÉäçÉÉ-j Éã ÄÉépÉÄiçã-a ÉNÉÄiçãäë

Grid table with columns: j Éã ÄÉé, pÉÄ, ñ=áz, i`, ó=áz, i`, ò=áz, i`, ñççí-íÉ=ÖKK i`, ÉãFí Lòç ~íç i`, ÉãFí Lòç ~íç i`. Rows include N, O, P, Q, R, S, T, U, V, NM, NN, NO with various combinations of ã ~ñ and ä ä.



` çã é-âó W
a ÊãÄÈ W` çî äáÉó-cãä Ö
gçÄk i ä ÄÈ W_ çî ääÖp äã çÇÈ
j çÇÈk ~ã È W` çã ä äã ÜÈÇÄÈ-ã

^ i ÖNR=OMT
URU=j
` ÜEÄÈÇ_ òM || | |

bãîÉäçéÉ-j Èã ÄÈèpÉÁÍçã-cçÄÈÈ

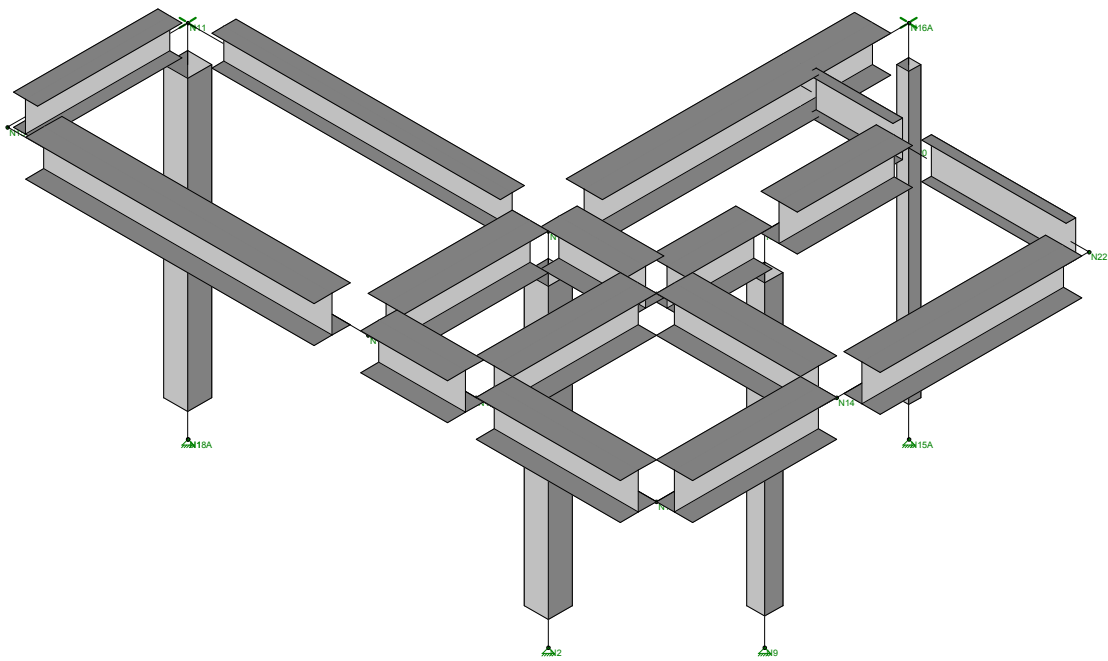
Table with 14 columns: j Èã ÄÈè, pÉÁ, ^ ñããz i', òpÜÈ-èaz i', òpÜÈ-èaz i', ççèl ÈãÜz i', òbj çã ÈkKì, òbj çã ÈãÜz i', i'. Rows include N, O, P, Q, R, S, T, U, V, NM, NN, NO.

bãîÉäçéÉ-j Èã ÄÈèpÉÁÍçã-píÈèèÈÈ

Table with 14 columns: j Èã ÄÈè, pÉÁ, ^ ñããz i', òpÜÈ-èkKì, òpÜÈ-èkKì, òj çãèz i', òj çãèz i', òj çãèz i', òj çãèz i'. Rows include N, O, P, Q, R, S, T, U, V, NM, NN, NO.

bãîÉäçéÉ= fp` =ÖãÇWioca-píÈè= çÇÈ= ÜÈÄäè

Table with 14 columns: j Èã ÄÈè, pÜ-èÉ, ` çÇÈ= kKì çÄz i', pÜ-èkKì çÄz aä i', éÜãÄãz éÜãÄãz éÜãÄãz éÜãÄãz éÜãÄãz ä-èkKì Ä beã. Rows include N, O.



Envelope Only Solution

| |
|---------|
| Canyons |
| CRF |
| |

Browning Ski Lodge - Corner Deck Framing

| |
|-------------------------|
| SK - 1 |
| Aug 21, 2017 at 2:08 PM |
| Corner Deck Frame.r3d |



` çã é~áo W` ~áoçãè
 a ÉããÉè W` oc
 gçÄkiã ÄÉè W
 j çÇk~ãÉ W_ççí ããÖpãã çÇÇç# çããÉãÉãã~ããÖ

^i Ö=ON=OMNT
 OMFmj
 ` ÜÉãÉÇ_öM|||

e ç í o ç ä Ë Ç p í É É ä m ç è ç é É ä í ä è

| | i ~ÄÉa | b ðæz | d ðæz | ki | qÜÉä | FNbKk | ÉããóãLÑK | v ðæz | oó | ci ðæz | oí |
|---|-----------------|-------|-------|----|------|-------|----------|-------|----|--------|----|
| N | ^ VVO | OMMM | NNRQ | IP | KSR | KQV | RM | NKI | SR | NKI | |
| O | ^ PS-d ðPS | OMMM | NNRQ | IP | KSR | KQV | PS | NIR | RU | NO | |
| P | ^ RTO-d ðRM | OMMM | NNRQ | IP | KSR | KQV | RM | NKI | SR | NKI | |
| Q | ^ RMM-d ðK ð ka | OMMM | NNRQ | IP | KSR | KROT | QO | NIQ | RU | NIR | |
| R | ^ RMM-d ðK ð ÉÄ | OMMM | NNRQ | IP | KSR | KROT | QS | NIQ | RU | NIR | |
| S | ^ RP-d ðK | OMMM | NNRQ | IP | KSR | KQV | PR | NIS | SM | NO | |
| T | ^ NMUR | OMMM | NNRQ | IP | KSR | KQV | RM | NIQ | SR | NIR | |

e ç í o ç ä Ë Ç p í É É ä p É Ä í ç ä p É ä è

| | i ~ÄÉa | pÜ~éÉ | qóéÉ | a Éããã ð äí | j ~ÍÉãã | a Éããã~oi äé | ^ ðÇz | fóóãÇz | fóóãÇz | g~ãÇz |
|---|--------|----------|------|-------------|---------|--------------|-------|--------|--------|-------|
| N | c NM | t NÇSR | É~ã | k çãÉ | ^ VVO | qóéã~ä | NMN | NTQ | RPP | OKIU |
| O | c V | t NMÇR | É~ã | k çãÉ | ^ VVO | qóéã~ä | NMP | RPIQ | OQU | NIRN |
| P | p` O | eppSñSñU | É~ã | k çãÉ | ^ VVO | qóéã~ä | VKTQ | QUP | QUP | UNKN |
| Q | p` P | eppUñNM | É~ã | k çãÉ | ^ VVO | qóéã~ä | NSIQ | NGS | NGS | OQQ |
| R | p` Q | eppQñQñQ | É~ã | k çãÉ | ^ VVO | qóéã~ä | PIPT | TKU | TKU | NOU |
| S | c U | ` NÇPM | É~ã | k çãÉ | ^ VVO | qóéã~ä | UKUN | RKIO | NSO | KUSN |

gçãí= ççÇçã~íÉè~ãÇ~çÉã éÉè~ñÉè

| | i ~ÄÉa | u ðñz | v ðñz | w ðñz | qÉã é~cz | a É~ÄÜççã çãã~éKk |
|----|--------|-------|-------|-------|----------|-------------------|
| N | k N | M | M | M | M | |
| O | k O | NM | M | M | M | |
| P | k V | NP | M | JP | M | |
| Q | k NN | M | NM | M | M | |
| R | k NO | NM | NM | M | M | |
| S | k NP | NP | NM | M | M | |
| T | k NR | M | NM | R | M | |
| U | k NS | NM | NM | R | M | |
| V | k NT | NP | NM | R | M | |
| NM | k NU | NU | NM | R | M | |
| NN | k NV | NP | NM | JP | M | |
| NO | k OM | NP | NM | JT | M | |
| NP | k OO | NU | NM | JT | M | |
| NQ | k NQ | NU | NM | M | M | |
| NR | k NR^ | NM | M | JNM | M | |
| NS | k NS^ | NM | NM | JNM | M | |
| NT | k NT^ | NM | NM | JT | M | |
| NU | k NU^ | M | M | M | M | |

gçãí= çlãÇ~éó= çãÇããçãè

| | gçãí~ÄÉa | u ðãlãz | v ðãlãz | w ðãlãz | u ðçíããÑLÉ~Çz | v ðçíããÑLÉ~Çz | w ðçíããÑLÉ~Çz |
|---|----------|----------|----------|----------|---------------|---------------|---------------|
| N | k N | o É~Äíçã | o É~Äíçã | o É~Äíçã | | | |
| O | k O | o É~Äíçã | o É~Äíçã | o É~Äíçã | | | |
| P | k V | o É~Äíçã | o É~Äíçã | o É~Äíçã | | | |
| Q | k NR^ | o É~Äíçã | o É~Äíçã | o É~Äíçã | | | |
| R | k NN | o É~Äíçã | | o É~Äíçã | | | |
| S | k NS^ | o É~Äíçã | | o É~Äíçã | | | |

o fp^ JPa ð Éããã~NRMQ ~xKKKKK~H ð ÉãããÉçy_ççí ããÖpãã çÇÇç# ~äçy çããÉãÉãã~ããÖ ÉãÇz= m~É~N



` çā é-áo W` ~áoçāē
 a ÉāÉē W` oc
 çĀk i ā ÄÉē W
 j çĀk ~ā É W_ çĀ āāōpāā çĀÉç çāÉēā Éāē-ā āō

^ i Ö-ON-OMNT
 OMRmj
 ` ÜÉāÉç_ōM|||

gçāí= çĀāç-éō= çāçāāçāē= çāíāīÉçF

| | gçāí= ~ÄÉā | u=āāz | v=āāz | w=āāz | u=çĀā.ŃĒ-ç | v=çĀā.ŃĒ-ç | w=çĀā.ŃĒ-ç |
|---|------------|---------|---------|---------|------------|------------|------------|
| T | k OM | o É-Äāā | o É-Äāā | o É-Äāā | | | |

~ēā-īç-ç= ~ēÉē

| | i` =āÉāçāā | `-īÉçōō | u=çĀ-īáo | v=çĀ-īáo | w=çĀ-īáo | gçāí | mçāí | aāīāā īÉç^É-É ÉKk piēāÉēKk |
|---|-------------------|---------|----------|----------|----------|------|------|----------------------------|
| N | i āÉ | ii | | | | | | O |
| O | a É-ç | ai | | | | | | O |
| P | | ai | | JN | | | | |
| Q | i` =çĀ-āēāā=Éē-Kk | k çāÉ | | | | | | NR |
| R | i` =çĀ-āēāā=Éē-Kk | k çāÉ | | | | | | NR |

j Éā ÄÉē^ éÉ~īç-çēÉ i` =NwīāīÉF

| | gçāí= | gçāí= | gçāí= | gçāí= | aāÉÄāā | aāīāā īāā | j ~çāā çÉāēñ |
|---|-------|-------|-------|-------|--------|-----------|--------------|
| N | k NR | k NN | k NQ | k NU | v | J | JMS |
| O | k NP | k OM | k OO | k NQ | v | J | JMS |

j Éā ÄÉē^ éÉ~īç-çēÉ i` =OwaÉ~çF

| | gçāí= | gçāí= | gçāí= | gçāí= | aāÉÄāā | aāīāā īāā | j ~çāā çÉāēñ |
|---|-------|-------|-------|-------|--------|-----------|--------------|
| N | k NR | k NN | k NQ | k NU | v | J | JMR |
| O | k OM | k NP | k NQ | k OO | v | J | JMR |

bāīÉçéÉççāí āÉ-Äāāē

| | gçāí | u=āz | i` | v=āz | i` | w=āz | i` | j u=āñz | i` | j v=āñz | i` | j w=āñz | i` |
|----|--------|------|------|------|-------|------|------|---------|----|---------|----|---------|----|
| N | k N | ā ~ñ | JMUU | N | OXTT | O | KSRV | O | M | N | M | N | N |
| O | | ā ā | JKSN | O | OXPO | N | KRTT | N | M | N | M | N | N |
| P | k O | ā ~ñ | KSRN | O | NQRTV | O | KTQS | O | M | N | M | N | N |
| Q | | ā ā | KPVR | N | VIRUR | N | KQGV | N | M | N | M | N | N |
| R | k V | ā ~ñ | KONO | O | NQSMR | O | KIRU | O | M | N | M | N | N |
| S | | ā ā | KIOU | N | VKIT | N | KMT | N | M | N | M | N | N |
| T | k NR^ | ā ~ñ | KMW | O | JNKU | N | KMM | N | M | N | M | N | N |
| U | | ā ā | KMR | N | JPKON | O | KMS | O | M | N | M | N | N |
| V | k NN | ā ~ñ | JPV | N | M | N | KPUS | N | M | N | M | N | N |
| NM | | ā ā | JSOV | O | M | N | KSTQ | O | M | N | M | N | N |
| NN | k NS^ | ā ~ñ | M | N | M | N | KPTO | N | M | N | M | N | N |
| NO | | ā ā | M | O | M | N | KSNJ | O | M | N | M | N | N |
| NP | k OM | ā ~ñ | KVRN | N | KTCV | N | KVRS | N | M | N | M | N | N |
| NQ | | ā ā | JMUQ | O | JNKVO | O | KORS | O | M | N | M | N | N |
| NR | qçí~āW | ā ~ñ | M | O | OTRQT | O | M | O | | | | | |
| NS | | ā ā | M | N | NKPU | N | M | N | | | | | |

bāīÉçéÉççāí āāēā-ÄÉā Éā ē

| | gçāí | u=āz | i` | v=āz | i` | w=āz | i` | u=çĀ-īKki` | v=çĀ-īāā=Kki` | w=çĀ-īāā=Kki` | | | | |
|---|------|------|----|------|----|------|----|------------|---------------|---------------|-----------|---|-----------|---|
| N | k N | ā ~ñ | M | O | M | N | M | N | JOSOMKk | N | QISVOÉJMS | O | JSHKQÉJMR | N |
| O | | ā ā | M | N | M | O | M | O | JQRVRKk | O | OKPTÉJMS | N | JNKQÉJMQ | O |
| P | k O | ā ~ñ | M | N | M | N | M | N | JPKQÉJKk | N | PKTSSÉJMS | O | QRNRÉJMQ | O |
| Q | | ā ā | M | O | M | O | M | O | JRKUTKk | O | OKOSTÉJMS | N | OKTPVÉJMQ | N |

o fp^ Jpa = Éāçā-NRMQ = xKkKkKkMh = āāÉāÉēç_çĀ āāōpāā çĀÉç ~āēç çāÉēā Éāē-ā Éāçç = m-çēō



` çã é~áó W` ~áoçãè
 a ÉãÄÉè W` oc
 ççÄã i ä ÄÉè W
 j çÇÉã ~ã É W_ ççí áã Öp áã çÇÉã çãÉã ÉÄã é~ã ä Ö

^ i Ö~ON~OMNT
 OMFRmj
 ` ÜÉÄÉÇ_ öM |||

bã îÉçéÉ~ççã íã äéä ÄÉã Éã é~É çãíã iÉÇF

| | ççãí | u~ãz | i` | v~ãz | i` | w~ãz | i` | u~ççí~íKki` | v~ççí~íã~Kki` | w~ççí~íã~Kki` | i` | | | |
|----|-------|------|----|------|------|------|----|-------------|---------------|---------------|------------|---|------------|---|
| R | k V | ã ~ñ | M | N | M | N | M | N | JKVSNKK | N | JUKVUEJMU | N | QQRUEJMQ | O |
| S | | ã ä | M | O | M | O | M | O | JPKRRKK | O | JNKSPÉJMT | O | QSVNÉJMQ | N |
| T | k NN | ã ~ñ | M | O | M | N | M | O | VKNQÉKK | O | QISVOÉJMS | O | QKOVQÉJMQ | O |
| U | | ã ä | M | N | M | O | M | N | RKUSÉKK | N | OKUPTÉJMS | N | NKORUÉJMQ | N |
| V | k NO | ã ~ñ | M | O | JKMP | N | M | O | NKVTÉKK | O | PKTSSÉJMS | O | JRISRUÉJMQ | N |
| NM | | ã ä | M | N | JKMQ | O | M | N | SKNTÉKK | N | OKOSTÉJMS | N | JMRQUÉJMQ | O |
| NN | k NP | ã ~ñ | M | O | JKPN | N | M | O | NOVOÉKK | O | JRKPVPÉJMT | N | JMKWVÉJMQ | N |
| NO | | ã ä | M | N | JKR | O | M | N | TKVROÉKK | N | JUKMDÉJMT | O | JNKQNEJMP | O |
| NP | k NR | ã ~ñ | M | O | JKQ | N | M | O | NKQÉJMP | O | NKQRSÉJMS | O | JNKIPOÉJMQ | N |
| NQ | | ã ä | M | N | JKT | O | M | N | SKVRÉKK | N | SKQRÉJMT | N | JNKORNÉJMQ | O |
| NR | k NS | ã ~ñ | M | O | JKSQ | N | M | O | NKFRÉKK | O | NKRSÉJMS | O | JQISPSÉJMQ | N |
| NS | | ã ä | M | N | JKMR | O | M | N | NKTOÉKK | N | UKVTÉJMT | N | JTRVUÉJMQ | O |
| NT | k NT | ã ~ñ | M | O | JKUS | N | M | O | NQWÉKK | O | PKVOTÉJMS | O | JSKTNEJMQ | N |
| NU | | ã ä | M | N | JKPV | O | M | N | VKPCÉKK | N | NKONTÉJMS | N | JNKVSTÉJMP | O |
| NV | k NU | ã ~ñ | M | O | JKPO | N | M | N | UKNÉKK | O | UKQUÉJMT | O | JTKVTPÉJMQ | N |
| OM | | ã ä | M | N | JKNP | O | M | O | RKRREKK | N | RKNÉJMT | N | JNKOTQÉJMP | O |
| ON | k NV | ã ~ñ | M | O | JKMR | N | M | O | SKUTÉKK | O | JUKVUEJMU | N | JRKRPOÉJMQ | N |
| OO | | ã ä | M | N | JKMU | O | M | N | QKLNÉKK | N | JNKSPÉJMT | O | JMKISQÉJMQ | O |
| OP | k OM | ã ~ñ | M | O | M | O | M | O | NKROÉKK | O | NKQPÉJMR | O | JRKRSTÉJMQ | N |
| OQ | | ã ä | M | N | M | N | M | N | SKVSÉKK | N | UKTUPÉJMS | N | JMKOUNÉJMQ | O |
| OR | k OO | ã ~ñ | M | O | JKR | N | M | N | VSMUÉKK | O | PKUQÉJMS | O | JMSTNÉJMQ | N |
| OS | | ã ä | M | N | JKUT | O | M | O | SKINREKK | N | OKRRÉJMS | N | JNISRVEJMP | N |
| OT | k NQ | ã ~ñ | M | O | JKVV | N | M | N | NKRNÉKK | O | OKUTÉJMS | O | JNKKTOÉJMP | N |
| OU | | ã ä | M | N | JKSO | O | M | O | RKROÉKK | N | NKQUÉJMS | N | JNKVCSÉJMP | O |
| OV | k NR^ | ã ~ñ | M | N | M | O | M | O | OKMRÉKK | O | JKOSVÉJMT | N | NKOPTÉJMQ | O |
| PM | | ã ä | M | O | M | N | M | N | NOVDÉKK | N | JPKTPÉJMT | O | SKVPSÉJMR | N |
| PN | k NS^ | ã ~ñ | M | O | KMR | O | M | O | JKQVKK | N | JKOSVÉJMT | N | JNKRVSÉJMQ | N |
| PO | | ã ä | M | N | KMP | N | M | N | JKQNTKK | O | JPKTPÉJMT | O | JKQVÉJMQ | O |
| PP | k NT^ | ã ~ñ | M | O | KON | O | M | O | NKPTSKK | N | NKKNÉJMS | O | JKKQÉJMQ | N |
| PQ | | ã ä | M | N | KNO | N | M | N | JKPSTKK | O | TKKQPÉJMT | N | JKKUUÉJMQ | O |
| PR | k NU^ | ã ~ñ | M | N | M | N | M | N | M | N | M | N | M | N |
| PS | | ã ä | M | N | M | N | M | N | M | N | M | N | M | N |

bã îÉçéÉ~j Éã ÄÉèp ÉÄíã ççÄÉè

| | j Éã ÄÉè | pÉÄ | ^ rããz | i` | öpÜÉ~éaz | i` | öpÜÉ~éaz | i` | ççèi Éãüzi` | òbj çã ÉKKi` | òbj çã Éãüzi` | i` | | | |
|----|----------|-----|--------|------|----------|-------|----------|------|-------------|--------------|---------------|------|---|--------|---|
| N | j N | N | ã ~ñ | OKTT | O | KSN | O | KSRV | O | M | N | M | N | | |
| O | | | ã ä | OKPO | N | KUU | N | KRTT | N | M | N | M | N | | |
| P | | O | ã ~ñ | OKUM | O | KSN | O | KSRV | O | M | N | NKQJ | O | JKO | N |
| Q | | | ã ä | NKPT | N | KUU | N | KRTT | N | M | N | KVCP | N | JKQN | O |
| R | | P | ã ~ñ | OKSO | O | KSN | O | KSRV | O | M | N | PKVR | O | JKQ | N |
| S | | | ã ä | NKSN | N | KUU | N | KRTT | N | M | N | NKUR | N | JKMP | O |
| T | | Q | ã ~ñ | OKTQ | O | KSN | O | KSRV | O | M | N | OKVQ | O | JKSSN | N |
| U | | | ã ä | NKQS | N | KUU | N | KRTT | N | M | N | OKUJ | N | JNKOMQ | O |
| V | | R | ã ~ñ | OKMT | O | KSN | O | KSRV | O | M | N | SKRN | O | JKUN | N |
| NM | | | ã ä | NKRN | N | KUU | N | KRTT | N | M | N | PKTN | N | JNKSMS | O |
| NN | j O | N | ã ~ñ | JKT | N | KROT | N | JKMP | N | JKMQ | N | KP | O | JKOS | N |
| NO | | | ã ä | JKTR | O | JNKUD | O | JKMS | O | JKMQ | O | KVNU | N | JNKSTP | O |
| NP | | O | ã ~ñ | JKT | N | KSUR | N | JKMP | N | JKMQ | N | KVNR | O | NOVD | O |
| NQ | | | ã ä | JKTR | O | JNKOU | O | JKMS | O | JKMQ | O | KVW | N | KRUV | N |
| NR | | P | ã ~ñ | JKT | N | JKUQ | N | JKMP | N | JKMQ | N | M | O | QKNT | O |

o fp^ JPa s Éãã~NRKQ ~KKKKKK~H~ã ÉãÄÉèy ççí áã Öp áã çÇÉã ~äy çãÉã ÉÄã é~ã ÉãÇ= m~ÇÉP



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| | j Éã ÄÉë | pÉÄ | ^ raaz | i` | öpÜÉ-éaz i` | öpÜÉ-éaz i` | qçéel ÉãÜiz i` | öbç çã Ékki` | öbç çã ÉãããÜiz | i` | | | | | |
|----|----------|-----|--------|------|-------------|-------------|----------------|--------------|----------------|------|---|-----|---|-------|---|
| NS | | | ã ä | JKTR | O | JNPRQ | O | JKMS | O | JKMQ | O | M | N | OQW | N |
| NT | | Q | ã ~ñ | JQT | N | JNMD | N | JMP | N | JMQ | N | JMJ | N | TK/TN | O |
| NU | | | ã ä | JKTR | O | JNQV | O | JMS | O | JMQ | O | JNQ | O | QMS | N |
| NV | | R | ã ~ñ | JQT | N | JNIS | N | JMP | N | JMQ | N | JNT | N | NNUSR | O |
| OM | | | ã ä | JKTR | O | JNSCR | O | JMS | O | JMQ | O | JMJ | O | TRW | N |
| ON | j P | | ã ~ñ | JMT | N | NKQ | O | KSV | O | JRSO | N | JPS | N | NUSW | O |
| OO | | | ã ä | JQR | O | NKRO | N | KCO | N | JUR | O | JSN | O | NNR/N | N |
| OP | | O | ã ~ñ | JMT | N | NKUN | O | KSV | O | JRSO | N | JMR | N | NTORN | O |
| OQ | | | ã ä | JQR | O | NKLU | N | KCO | N | JUR | O | JMV | O | NMSTU | N |
| OR | | P | ã ~ñ | JMT | N | NKTP | O | KSV | O | JRSO | N | KCP | O | NKPT | O |
| OS | | | ã ä | JQR | O | NKNS | N | KCO | N | JUR | O | KCS | N | VKUR | N |
| OT | | Q | ã ~ñ | JMT | N | NKSSQ | O | KSV | O | JRSO | N | KMR | O | NQSST | O |
| OU | | | ã ä | JQR | O | NKQU | N | KCO | N | JUR | O | KRT | N | VKMQ | N |
| OV | | R | ã ~ñ | JMT | N | NKMS | O | KSV | O | JRSO | N | KQT | O | NPKQ | O |
| PM | | | ã ä | JQR | O | K/TV | N | KCO | N | JUR | O | KUV | N | UKQ | N |
| PN | j S | | ã ~ñ | JMV | N | JQUV | N | JMR | N | JMT | N | KCO | O | KST | O |
| PO | | | ã ä | JNQ | O | JTUO | O | JMV | O | JMT | O | KOR | N | KQR | N |
| PP | | O | ã ~ñ | JMV | N | JRNT | N | JMR | N | JMT | N | KO | O | QOST | O |
| PQ | | | ã ä | JNQ | O | JVTT | O | JMV | O | JMT | O | KNO | N | NKRP | N |
| PR | | P | ã ~ñ | JMV | N | JTQQ | N | JMR | N | JMT | N | M | N | QV/RQ | O |
| PS | | | ã ä | JNQ | O | JNKTO | O | JMV | O | JMT | O | JMN | O | QSP | N |
| PT | | Q | ã ~ñ | JMV | N | JVTO | N | JMR | N | JMT | N | JNQ | N | UKOV | O |
| PU | | | ã ä | JNQ | O | JNRST | O | JMV | O | JMT | O | JMP | O | QTR | N |
| PV | | R | ã ~ñ | JMV | N | JNKW | N | JMR | N | JMT | N | JMT | N | NNVN | O |
| QM | | | ã ä | JNQ | O | JNRSO | O | JMV | O | JMT | O | JMR | O | TKU | N |
| QN | j T | | ã ~ñ | M | N | NKUN | O | KPR | O | KSQ | O | JMQ | N | NNSPP | O |
| QO | | | ã ä | M | O | NKMT | N | KCN | N | KMU | N | KSS | O | TKMS | N |
| QP | | O | ã ~ñ | M | N | NKOP | O | KPR | O | KSQ | O | JMQ | N | NKGSV | O |
| QQ | | | ã ä | M | O | NKMD | N | KCN | N | KMU | N | JMQ | O | SKOV | N |
| QR | | P | ã ~ñ | M | N | NKSSQ | O | KPR | O | KSQ | O | JMV | N | VPRQ | O |
| QS | | | ã ä | M | O | K/PP | N | KCN | N | KMU | N | JNQ | O | RKMP | N |
| QT | | Q | ã ~ñ | M | N | NKMS | O | KPR | O | KSQ | O | KNO | O | UKTP | O |
| QU | | | ã ä | M | O | KSR | N | KCN | N | KMU | N | KMT | N | RKOV | N |
| QV | | R | ã ~ñ | M | N | NKQT | O | KPR | O | KSQ | O | KPU | O | TKQ | O |
| RM | | | ã ä | M | O | K/VT | N | KCN | N | KMU | N | KCP | N | QSMR | N |
| RN | j U | | ã ~ñ | JMO | N | NKSSU | O | JMP | N | KRPT | O | KCO | O | SKVR | O |
| RO | | | ã ä | JMQ | O | NKQU | N | JMR | O | KNO | N | KNR | N | QKN | N |
| RP | | O | ã ~ñ | JMO | N | NKPT | O | JMP | N | KRPT | O | KNU | O | RKON | O |
| RQ | | | ã ä | JMQ | O | K/PR | N | JMR | O | KNO | N | KNN | N | PKTN | N |
| RR | | P | ã ~ñ | JMO | N | NKTP | O | JMP | N | KRPT | O | KNO | O | PKT | O |
| RS | | | ã ä | JMQ | O | KCN | N | JMR | O | KNO | N | KMT | N | QMTQ | N |
| RT | | Q | ã ~ñ | JMO | N | NKTR | O | JMP | N | KRPT | O | KMS | O | NKQ | O |
| RU | | | ã ä | JMQ | O | KMT | N | JMR | O | KNO | N | KMQ | N | NKIN | N |
| RV | | R | ã ~ñ | JMO | N | NKITU | O | JMP | N | KRPT | O | M | O | KRPO | O |
| SM | | | ã ä | JMQ | O | KVP | N | JMR | O | KNO | N | M | N | KMS | N |
| SN | j U^ | | ã ~ñ | JMR | N | KTUO | O | KNQ | O | KST | O | JMR | N | KMT | O |
| SO | | | ã ä | JMV | O | KUV | N | KMV | N | KOR | N | JMQ | O | KQT | N |
| SP | | O | ã ~ñ | JMR | N | KOOT | N | KNQ | O | KST | O | KNR | N | KMU | N |
| SQ | | | ã ä | JMV | O | KOS | O | KMV | N | KOR | N | JMQ | O | KORT | O |
| SR | | P | ã ~ñ | JMR | N | KTQQ | N | KNQ | O | KST | O | JMQ | N | KON | O |
| SS | | | ã ä | JMV | O | JNRMP | O | KMV | N | KOR | N | JMS | O | KSNR | N |
| ST | | Q | ã ~ñ | JMR | N | NKOSN | N | KNQ | O | KST | O | KNO | O | PKMD | O |

o fp^ JPa s Éãçã-NKMQ = xKkKkKkH-a ÉãÇÄÉëy çÇi äãÖp äã çÇÖÉ ~äë çãÉëa ÉÄãé-ä ÉäÇ= m-ÖÉ=Q



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^ i Ö-ON-OMNT
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| | j Éã ÄÉë | pÉÄ | ^ ñããz | i` | öpÜÉ-éãz i` | öpÜÉ-éãz i` | ççéel Éãñiz i` | öbj çã Ékki` | öbj çã Éãñiz i` | | | | | | |
|----|----------|-----|--------|-------|-------------|-------------|----------------|--------------|-----------------|------|---|------|---|-------|---|
| SU | | | ã ä | JKMV | O | JOPGS | O | KMM | N | KVQR | N | KMT | N | NKUSU | N |
| SV | | R | ã ~ñ | JKMR | N | JNRTT | N | KVQ | O | KVST | O | KP | O | SRUS | O |
| TM | | | ã ä | JKMV | O | JPRUV | O | KMM | N | KVQR | N | KVNU | N | PKTST | N |
| TN | j V | N | ã ~ñ | KVQ | O | JOKSV | N | KMU | N | KMP | N | KVO | O | JFRR | N |
| TO | | | ã ä | KVDS | N | JPKVQ | O | KVQ | O | KVRU | O | KVP | N | JVPQ | O |
| TP | | O | ã ~ñ | KVQ | O | JOKVO | N | KMU | N | KMP | N | KMR | O | PKVQ | O |
| TQ | | | ã ä | KVDS | N | JQRMV | O | KVQ | O | KVRU | O | KVP | N | OKMV | N |
| TR | | P | ã ~ñ | KVQ | O | JKSPQ | N | KMU | N | KMP | N | KMU | N | NMKPU | O |
| TS | | | ã ä | KVDS | N | JRUTQ | O | KVQ | O | KVRU | O | KVP | O | SKVQ | N |
| TT | | Q | ã ~ñ | KVQ | O | JQRTN | N | KMU | N | KMP | N | KVNU | N | NKRPQ | O |
| TU | | | ã ä | KVDS | N | JTKPV | O | KVQ | O | KVRU | O | KP | O | NNKVQ | N |
| TV | | R | ã ~ñ | KVQ | O | JQVW | N | KMU | N | KMP | N | KVO | N | OKPR | O |
| UM | | | ã ä | KVDS | N | JKSMQ | O | KVQ | O | KVRU | O | KMT | O | NTKNS | N |
| UN | j NM | N | ã ~ñ | KVQ | N | JKV | O | KVP | O | KVR | N | KVQ | O | KOT | O |
| UO | | | ã ä | KVQ | O | JKRN | N | KVO | N | JKQR | O | KMU | N | KVS | N |
| UP | | O | ã ~ñ | KVQ | N | JKTR | N | KVP | O | KVR | N | KVNU | O | NKVR | O |
| UQ | | | ã ä | KVQ | O | JKVU | O | KVO | N | JKQR | O | KVN | N | KU | N |
| UR | | P | ã ~ñ | KVQ | N | JNKTV | N | KVP | O | KVR | N | KVO | O | OKVN | O |
| US | | | ã ä | KVQ | O | JKUTR | O | KVO | N | JKQR | O | KVP | N | NKUV | N |
| UT | | Q | ã ~ñ | KVQ | N | JKSGP | N | KVP | O | KVR | N | KVDS | O | RKTP | O |
| UU | | | ã ä | KVQ | O | JOKTP | O | KVO | N | JKQR | O | KNS | N | PKQT | N |
| UV | | R | ã ~ñ | KVQ | N | JOKMS | N | KVP | O | KVR | N | KP | O | VKMD | O |
| VM | | | ã ä | KVQ | O | JKSP | O | KVO | N | JKQR | O | KVNU | N | SKMN | N |
| VN | j NN | N | ã ~ñ | KVSN | N | JKRTT | N | KV | N | OKMD | O | KNS | O | URNV | O |
| VO | | | ã ä | KVMN | O | JKRV | O | KVQ | O | NKMS | N | KP | N | RKPO | N |
| VP | | O | ã ~ñ | KVSN | N | JKRU | N | KV | N | OKMD | O | KVR | O | NKVO | O |
| VQ | | | ã ä | KVMN | O | JKUTT | O | KVQ | O | NKMS | N | KVP | N | TKVN | N |
| VR | | P | ã ~ñ | KVSN | N | JKTV | N | KV | N | OKMD | O | KVQ | N | NTKPO | O |
| VS | | | ã ä | KVMN | O | JSOU | O | KVQ | O | NKMS | N | KMT | O | NKTMN | N |
| VT | | Q | ã ~ñ | KVSN | N | JKTS | N | KV | N | OKMD | O | KVTN | N | OKPP | O |
| VU | | | ã ä | KVMN | O | JSRTQ | O | KVQ | O | NKMS | N | KVNU | O | NKSV | N |
| VV | | R | ã ~ñ | KVSN | N | JKNO | N | KV | N | OKMD | O | KVP | N | OKNTQ | O |
| NM | | | ã ä | KVMN | O | JKMN | O | KVQ | O | NKMS | N | KP | O | NSRT | N |
| NM | j NO | N | ã ~ñ | KVRU | N | TKMS | O | KVP | O | KVDS | N | KVP | N | OKVP | O |
| NM | | | ã ä | KVRU | O | QKUS | N | KVP | N | KVNU | O | KP | O | NKSR | N |
| NM | | O | ã ~ñ | KVRU | N | SKUV | O | KVP | O | KVDS | N | KV | N | NKQV | O |
| NM | | | ã ä | KVRU | O | QKVT | N | KVP | N | KVNU | O | KVS | O | NKQR | N |
| NM | | P | ã ~ñ | KVRU | N | SKUV | O | KVP | O | KVDS | N | KVSO | N | NKVN | O |
| NM | | | ã ä | KVRU | O | PKVT | N | KVP | N | KVNU | O | KMP | O | TKUV | N |
| NM | | Q | ã ~ñ | KVRU | N | RKV | O | KVP | O | KVDS | N | KVQ | N | RKST | O |
| NM | | | ã ä | KVRU | O | PKSN | N | KVP | N | KVNU | O | KVQ | O | PKRV | N |
| NM | | R | ã ~ñ | KVRU | N | RKNO | O | KVP | O | KVDS | N | KVQ | O | KNO | O |
| NM | | | ã ä | KVRU | O | PKST | N | KVP | N | KVNU | O | KVQ | N | KMR | N |
| NN | j NP | N | ã ~ñ | NKSVR | O | KKOU | N | KVRU | O | M | N | M | N | M | N |
| NM | | | ã ä | KVMT | N | KKNO | O | KMT | N | M | N | M | N | M | N |
| NM | | O | ã ~ñ | NKSVS | O | KKOU | N | KVRU | O | M | N | KVR | O | KRP | O |
| NM | | | ã ä | UKRVQ | N | KKNO | O | KMT | N | M | N | KCP | N | KPO | N |
| NM | | P | ã ~ñ | NKQVS | O | KKOU | N | KVRU | O | M | N | KVN | O | NKVS | O |
| NM | | | ã ä | UKVPU | N | KKNO | O | KMT | N | M | N | KUS | N | KSQ | N |
| NM | | Q | ã ~ñ | NKQVT | O | KKOU | N | KVRU | O | M | N | NKUS | O | NRV | O |
| NM | | | ã ä | UKTOO | N | KKNO | O | KMT | N | M | N | KOV | N | KVS | N |
| NM | | R | ã ~ñ | NKQVT | O | KKOU | N | KVRU | O | M | N | NKVO | O | OKNO | O |

o fp ^ JPa s Éãçã-NKMQ — xKVKVKMh-a ÉãÇÉëy ççí áãÖp áã çÇÖÉ ~äë çãÉëã ÉÄãé-ã ÉäÇ= m-ÖÉ-R



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bã iÉçéÉ-j Éã ÄÉè pÉÄ áããz i` ópÜÉ-éáz i` ópÜÉ-éáz i` ççéel Éãüiz i` öbj çã ÉKKi` öbj çã Éãüiz i`

| | j Éã ÄÉè | pÉÄ | áããz | i` | ó pÜÉ-éáz i` | ó pÜÉ-éáz i` | ççéel Éãüiz i` | öbj çã ÉKKi` | öbj çã Éãüiz i` | i` | | | | | |
|-----|----------|-----|------|-------|--------------|--------------|----------------|--------------|-----------------|------|---|-------|---|-------|---|
| NOM | | | ã ä | UKMS | N | JKNO | O | KMT | N | M | N | K/TN | N | NQU | N |
| NON | j NQ | N | ã ~ñ | NRMM | O | KSRN | O | KQS | O | M | N | JQUT | N | SRNO | O |
| NOO | | | ã ä | UKMQ | N | KVR | N | KQV | N | M | N | JTKRV | O | PKR | N |
| NOP | | O | ã ~ñ | NQMS | O | KSRN | O | KQS | O | M | N | JPRSR | N | QJLQ | O |
| NOQ | | | ã ä | UKW | N | KVR | N | KQV | N | M | N | JRVR | O | QVSP | N |
| NOR | | P | ã ~ñ | NQOQ | O | KSRN | O | KQS | O | M | N | JKQP | N | PKFS | O |
| NOS | | | ã ä | VKMQ | N | KVR | N | KQV | N | M | N | JPTP | O | NKTR | N |
| NOT | | Q | ã ~ñ | NQNN | O | KSRN | O | KQS | O | M | N | JNKOO | N | NCO | O |
| NOU | | | ã ä | VIRV | N | KVR | N | KQV | N | M | N | JKUSR | O | KUU | N |
| NOV | | R | ã ~ñ | NQRTV | O | KSRN | O | KQS | O | M | N | M | N | M | N |
| NPM | | | ã ä | VRUR | N | KVR | N | KQV | N | M | N | M | N | M | N |
| NPN | j NU | N | ã ~ñ | JKMO | N | NKSN | O | JKMO | N | JKO | N | K/N | O | TKVT | O |
| NPO | | | ã ä | JKMP | O | NK/NP | N | JKMP | O | JKPN | O | KMS | N | QSMQ | N |
| NPP | | O | ã ~ñ | JKMO | N | NRSU | O | JKMO | N | JKO | N | KMS | O | RK/W | O |
| NPQ | | | ã ä | JKMP | O | K/S | N | JKMP | O | JKPN | O | KMQ | N | PKTN | N |
| NPR | | P | ã ~ñ | JKMO | N | NROP | O | JKMO | N | JKO | N | KMO | O | PKTU | O |
| NPS | | | ã ä | JKMP | O | K/MJ | N | JKMP | O | JKPN | O | KMN | N | QOMP | N |
| NPT | | Q | ã ~ñ | JKMO | N | NQTU | O | JKMO | N | JKO | N | KMN | N | NK/MO | O |
| NPU | | | ã ä | JKMP | O | KRS | N | JKMP | O | JKPN | O | JKMO | O | NKI | N |
| NPV | | R | ã ~ñ | JKMO | N | NQPP | O | JKMO | N | JKO | N | JKMQ | N | KUP | O |
| NQM | | | ã ä | JKMP | O | KMP | N | JKMP | O | JKPN | O | KMS | O | K/SQ | N |
| NQN | j NR | N | ã ~ñ | KMR | O | NKMTU | O | JKMO | N | JKMS | N | M | O | KPT | O |
| NQO | | | ã ä | KMP | N | KVP | N | JKMQ | O | JKPO | O | M | N | KNO | N |
| NQP | | O | ã ~ñ | KMR | O | KVP | O | JKMO | N | JKMS | N | JKMP | N | JKOO | N |
| NQQ | | | ã ä | KMP | N | KSN | N | JKMQ | O | JKPO | O | JKMQ | O | JKQQ | O |
| NQR | | P | ã ~ñ | KMR | O | KTO | N | JKMO | N | JKMS | N | JKMS | N | JKQN | N |
| NQS | | | ã ä | KMP | N | KVO | O | JKMQ | O | JKPO | O | K/M | O | JKVQ | O |
| NQT | | Q | ã ~ñ | KMR | O | KMQ | N | JKMO | N | JKMS | N | K/M | N | JKQP | N |
| NQU | | | ã ä | KMP | N | JSTT | O | JKMQ | O | JKPO | O | K/MQ | O | JKNP | O |
| NQV | | R | ã ~ñ | KMR | O | JTPT | N | JKMO | N | JKMS | N | KMN | N | K/V | O |
| NRM | | | ã ä | KMP | N | NKSO | O | JKMQ | O | JKPO | O | K/M | O | KSSV | N |
| NRN | j NS | N | ã ~ñ | JKMO | N | NKQP | O | KMP | O | KUP | O | KMN | N | NRFU | O |
| NRO | | | ã ä | JKMP | O | NKRV | N | KMO | N | K/SQ | N | KMU | O | KSS | N |
| NRP | | O | ã ~ñ | JKMO | N | NKNO | O | KMP | O | KUP | O | KMT | N | JKNS | N |
| NRQ | | | ã ä | JKMP | O | KSP | N | KMO | N | K/SQ | N | KNO | O | JKPO | O |
| NRR | | P | ã ~ñ | JKMO | N | KUN | O | KMP | O | KUP | O | JKMP | N | JKUS | N |
| NRS | | | ã ä | JKMP | O | KNT | N | KMO | N | K/SQ | N | KMS | O | JKVQ | O |
| NRT | | Q | ã ~ñ | JKMO | N | JKVO | N | KMP | O | KUP | O | M | O | JKMO | N |
| NRU | | | ã ä | JKMP | O | JTPS | O | KMO | N | K/SQ | N | M | N | JKUTP | O |
| NRV | | R | ã ~ñ | JKMO | N | JKMP | N | KMP | O | KUP | O | KMS | O | KPN | O |
| NSM | | | ã ä | JKMP | O | NKPP | O | KMO | N | K/SQ | N | KMQ | N | KO | N |
| NSN | j NT | N | ã ~ñ | KMT | O | PK/S | O | KMU | O | KRV | O | JKOQ | N | NKUU | O |
| NSO | | | ã ä | KMQ | N | OKR | N | KMR | N | KMS | N | JKPV | O | VTKR | N |
| NSP | | O | ã ~ñ | KMT | O | PKVU | O | KMU | O | KRV | O | KNT | N | NNRTV | O |
| NSQ | | | ã ä | KMQ | N | OKPT | N | KMR | N | KMS | N | JKO | O | TKMP | N |
| NSR | | P | ã ~ñ | KMT | O | PKMN | O | KMU | O | KRV | O | KMN | N | TKVO | O |
| NSS | | | ã ä | KMQ | N | OKOP | N | KMR | N | KMS | N | K/M | O | QOMP | N |
| NST | | Q | ã ~ñ | KMT | O | PKMP | O | KMU | O | KRV | O | KMR | N | PKU | O |
| NSU | | | ã ä | KMQ | N | NK/M | N | KMR | N | KMS | N | K/M | O | NK/S | N |
| NSV | | R | ã ~ñ | KMT | O | PKMS | O | KMU | O | KRV | O | KMN | O | JPT | N |
| NTM | | | ã ä | KMQ | N | NKVR | N | KMR | N | KMS | N | M | N | JKSNR | O |
| NTN | j NU^ | N | ã ~ñ | NK/SN | N | K/M | O | K/M | N | M | N | KRV | O | KMQ | O |

o fp^ JPa s Éãä-NR/MQ = xKKKKKMH-a ÉãÄÉèy çÇÄ* äãÖp äã çÇÖÉ ~äy çãÉëa ÉÄã-é-ä ÉäÇ= m-Ö-S



` çã é~áó W` ~áoçãè
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^i Ö-ON-OMNT
 OMRmj
 ` ÜÉÄÉÇ_ öM|||

bãIÉçéÉ-j Éã ÄÉè pÉÄiãã-ÉÑÉÄiãã èÉ çãIãIÉÇF

| | j Éã ÄÉè | pÉÄ | ñãz | i` | óãz | i` | óãz | i` | ñ-ççi-É-ççk i` | ÉãFí Lóè ~iã i` | ÉãFí Lóè ~iã i` | | | | |
|----|----------|-----|------|----|-----|------|-----|----|----------------|-----------------|-----------------|----------|---|----|---|
| NV | | R | ã ~ñ | M | O | JMP | N | M | O | NKSTÉJM | O | k` | N | k` | N |
| OM | | | ã ä | M | N | JMQ | O | M | N | SKNTÉJM | N | k` | N | k` | N |
| ON | j P | N | ã ~ñ | M | O | JMP | N | M | O | NKSTÉJM | O | k` | N | k` | N |
| OO | | | ã ä | M | N | JMQ | O | M | N | SKNTÉJM | N | k` | N | k` | N |
| OP | | O | ã ~ñ | M | O | JMV | N | M | O | NKIPÉJM | O | SORSKITT | N | k` | N |
| OQ | | | ã ä | M | N | JMQ | O | M | N | SKMDÉJM | N | PUNNKMS | O | k` | N |
| OR | | P | ã ~ñ | M | O | JMR | N | M | O | NKLUÉJM | O | OMRKRUQ | N | k` | N |
| OS | | | ã ä | M | N | JMR | O | M | N | TKLUSÉJM | N | NTTTKMP | O | k` | N |
| OT | | Q | ã ~ñ | M | O | JMP | N | M | O | NKPSÉJM | O | NUOSKMN | N | k` | N |
| OÜ | | | ã ä | M | N | JMPT | O | M | N | TKRTÉJM | N | NNNQKNO | O | k` | N |
| OV | | R | ã ~ñ | M | O | JPN | N | M | O | NKOVOÉJM | O | NOVRKRO | N | k` | N |
| PM | | | ã ä | M | N | JMR | O | M | N | TKVRQÉJM | N | TVMKUU | O | k` | N |
| PN | j S | N | ã ~ñ | M | O | JMQ | N | M | O | NKIGÉJM | O | k` | N | k` | N |
| PO | | | ã ä | M | N | JMT | O | M | N | SKSVRÉJM | N | k` | N | k` | N |
| PP | | O | ã ~ñ | M | O | JMP | N | M | O | NKOUVÉJM | O | k` | N | k` | N |
| PQ | | | ã ä | M | N | JMP | O | M | N | TKTMDEJM | N | k` | N | k` | N |
| PR | | P | ã ~ñ | M | O | JMT | N | M | O | NKPUÉJM | O | k` | N | k` | N |
| PS | | | ã ä | M | N | JMTU | O | M | N | UKTMUÉJM | N | k` | N | k` | N |
| PT | | Q | ã ~ñ | M | O | JRQ | N | M | O | NKRUSÉJM | O | UPTISON | N | k` | N |
| PU | | | ã ä | M | N | JMU | O | M | N | VKTRÉJM | N | SROMS | O | k` | N |
| PV | | R | ã ~ñ | M | O | JMSQ | N | M | O | NKTPRÉJM | O | RMMKQRV | N | k` | N |
| QM | | | ã ä | M | N | JMR | O | M | N | NKMTÓÉJM | N | PQNNKQV | O | k` | N |
| QN | j T | N | ã ~ñ | M | O | JMSQ | N | M | O | NKTPRÉJM | O | k` | N | k` | N |
| QO | | | ã ä | M | N | JMR | O | M | N | NKMTÓÉJM | N | k` | N | k` | N |
| QP | | O | ã ~ñ | M | O | JMSV | N | M | O | NKSTSÉJM | O | TTSQKTS | N | k` | N |
| QQ | | | ã ä | M | N | JNO | O | M | N | NKMPUÉJM | N | QUTOKU | O | k` | N |
| QR | | P | ã ~ñ | M | O | JMTQ | N | M | O | NKSTÉJM | O | PSTRKTVR | N | k` | N |
| QS | | | ã ä | M | N | JNO | O | M | N | NKMPÉJM | N | OPMTKMD | O | k` | N |
| QT | | Q | ã ~ñ | M | O | JMU | N | M | O | NRRUÉJM | O | OPPRIOTP | N | k` | N |
| QU | | | ã ä | M | N | JNOV | O | M | N | VISUNÉJM | N | NGSSRTNQ | O | k` | N |
| QV | | R | ã ~ñ | M | O | JMS | N | M | O | NKQVÉJM | O | NSTUKPVT | N | k` | N |
| RM | | | ã ä | M | N | JPV | O | M | N | VPRPQÉJM | N | NMRQCOO | O | k` | N |
| RN | j U | N | ã ~ñ | M | O | JMS | N | M | O | NKQVÉJM | O | k` | N | k` | N |
| RO | | | ã ä | M | N | JPV | O | M | N | VPRPQÉJM | N | k` | N | k` | N |
| RP | | O | ã ~ñ | M | O | JMT | N | M | O | NKPRÉJM | O | RRTNKSRO | N | k` | N |
| RQ | | | ã ä | M | N | JRS | O | M | N | UKRTVÉJM | N | PRVRISP | O | k` | N |
| RR | | P | ã ~ñ | M | O | JMU | N | M | N | NKITÉJM | O | OSVUKQR | N | k` | N |
| RS | | | ã ä | M | N | JNTQ | O | M | O | TKQRÉJM | N | NSVTKOSN | O | k` | N |
| RT | | Q | ã ~ñ | M | O | JNO | N | M | N | NKMSÉJM | O | NTRSKUSU | N | k` | N |
| RU | | | ã ä | M | N | JWP | O | M | O | SKQTEJM | N | NNVQKMQ | O | k` | N |
| RV | | R | ã ~ñ | M | O | JPO | N | M | N | UKQNEJM | O | NOVRKQD | N | k` | N |
| SM | | | ã ä | M | N | JNP | O | M | O | RKRREJM | N | UNPKPSN | O | k` | N |
| SN | j U^ | N | ã ~ñ | M | N | JMQ | N | M | O | NKORÉJM | O | NRVRISR | N | k` | N |
| SO | | | ã ä | M | O | JMT | O | M | N | NKIPÓÉJM | N | UTOKMS | O | k` | N |
| SP | | O | ã ~ñ | M | N | JMP | N | M | O | RPRQÉJM | N | OMPRKVSU | N | k` | N |
| SQ | | | ã ä | M | O | JRO | O | M | N | PKSQTEJM | O | NNTQRTSS | O | k` | N |
| SR | | P | ã ~ñ | M | N | JMD | N | M | O | SKNTÉJM | N | PNPKVNU | N | k` | N |
| SS | | | ã ä | M | O | JMPQ | O | M | N | RKONÉJM | O | NUMKSOQ | O | k` | N |
| ST | | Q | ã ~ñ | M | N | JMN | N | M | O | SKSVLÉJM | N | SRTTKTOP | N | k` | N |
| SU | | | ã ä | M | O | JMT | O | M | N | NKQVÉJM | O | PTSUKNQ | O | k` | N |
| SV | | R | ã ~ñ | M | N | M | N | M | N | NKRLÉJM | N | k` | N | k` | N |
| TM | | | ã ä | M | N | M | O | M | N | JKOQÉJM | O | k` | N | k` | N |

o fp^ Jpã Éãäã-NKMQ — xKKKKKkMh-a ÉãÄÉèy çç äã Öp äã çÇÖÉ ~äë çãÉã ÉÄã é~ã ÉÉÇF= m-ÖÉU



` çã é-áó W` ~áoçãè
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^i Ö-ON-OMNT
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 ` ÜÉÄÉÇ_ öM|||

bãíÉçéÉ-j Éã ÄÉë pÉÄíçã-ÉÑÉÄíçãè-É çãíäíÉÇF

| | j Éã ÄÉë | pÉÄ | ñãz | i` | óãz | i` | óãz | i` | ñ-çí-íÉççk i` | Éãí Lóë ~íç i` | Éãí Lóë ~íç i` | | | | |
|-----|----------|-----|------|-----|-----|------|-----|-----|---------------|----------------|----------------|----------|---|---------|---|
| TN | j V | N | ã ~ñ | M | N | JMSQ | N | M | O | TRVUÉJMQ | O | VTSKOPO | N | k` | N |
| TO | | | ã ä | M | O | JMNR | O | M | N | QSPSÉJMQ | N | RVUKQP | O | k` | N |
| TP | | O | ã ~ñ | M | N | JMQT | N | M | O | TKUNÉJMQ | O | NPRSIOPU | N | k` | N |
| TQ | | | ã ä | M | O | JMTT | O | M | N | QKMNÉJMQ | N | UCUISVR | O | k` | N |
| TR | | P | ã ~ñ | M | N | JMPN | N | M | O | URSPÉJMQ | O | ONTNKUSN | N | k` | N |
| TS | | | ã ä | M | O | JMR | O | M | N | RKQTEJMQ | N | NPOOKRU | O | k` | N |
| TT | | Q | ã ~ñ | M | N | JMNR | N | M | O | UKQREJMQ | O | QTVPKQVT | N | k` | N |
| TU | | | ã ä | M | O | JMCR | O | M | N | RKQDEJMQ | N | OMVRKIRO | O | k` | N |
| TV | | R | ã ~ñ | M | N | JMP | N | M | O | VROUÉJMQ | O | k` | N | k` | N |
| UM | | | ã ä | M | O | JMQ | O | M | N | RISRUEJMQ | N | k` | N | k` | N |
| UN | j NM | N | ã ~ñ | M | N | JMUS | N | M | O | NKSTÉJMP | O | NMUJR | N | k` | N |
| UO | | | ã ä | M | O | JKPV | O | M | N | SKNÉJMQ | N | STQKQS | O | k` | N |
| UP | | O | ã ~ñ | M | N | JMTN | N | M | O | NKITPÉJMP | O | NQTNRRRO | N | k` | N |
| UQ | | | ã ä | M | O | JKNS | O | M | N | TRMTÉJMQ | N | VNMKUCU | O | k` | N |
| UR | | P | ã ~ñ | M | N | JMRT | N | M | O | NKOTVÉJMP | O | COORQTUR | N | k` | N |
| US | | | ã ä | M | O | JMP | O | M | N | TKVQÉJMQ | N | NPVPHUV | O | k` | N |
| UT | | Q | ã ~ñ | M | N | JMQQ | N | M | O | NKURÉJMP | O | QSRQRQD | N | k` | N |
| UU | | | ã ä | M | O | JMTN | O | M | N | URMDÉJMQ | N | OUTMSQS | O | k` | N |
| UV | | R | ã ~ñ | M | N | JMPN | N | M | O | NKQNEJMP | O | k` | N | k` | N |
| VM | | | ã ä | M | O | JMR | O | M | N | VKMWÉJMQ | N | k` | N | k` | N |
| VN | j NN | N | ã ~ñ | M | N | JMPN | N | M | O | NKQNEJMP | O | NPUQKVN | N | k` | N |
| VO | | | ã ä | M | O | JMR | O | M | N | VKMWÉJMQ | N | UQK/SR | O | k` | N |
| VP | | O | ã ~ñ | M | N | JMCP | N | M | O | NKQTEJMP | O | NVSPKINS | N | k` | N |
| VQ | | | ã ä | M | O | JMPU | O | M | N | UKQTEJMP | N | NOMQOV | O | k` | N |
| VR | | P | ã ~ñ | M | N | JMNS | N | M | O | NKQPEJMP | O | PNUPKUR | N | k` | N |
| VS | | | ã ä | M | O | JMS | O | M | N | TRNREJMQ | N | NVROKRVU | O | k` | N |
| VT | | Q | ã ~ñ | M | N | JMN | N | M | O | NKSEJMP | O | TMPPIKUV | N | k` | N |
| VU | | | ã ä | M | O | JMS | O | M | N | SKQCEJMQ | N | QPNOMQD | O | k` | N |
| VV | | R | ã ~ñ | M | N | JMR | N | M | O | VKISQÉJMQ | O | k` | N | k` | N |
| NMM | | | ã ä | M | O | JMJ | O | M | N | RIRPOÉJMQ | N | k` | N | k` | N |
| NMN | j NO | N | ã ~ñ | M | N | JMR | N | M | O | VKISQÉJMQ | O | k` | N | k` | N |
| NMO | | | ã ä | M | O | JMJ | O | M | N | RIRPOÉJMQ | N | SOTQKITT | O | k` | N |
| NMP | | O | ã ~ñ | M | N | JMO | N | M | O | VKMPÉJMQ | O | k` | N | k` | N |
| NMQ | | | ã ä | M | O | JMP | O | M | N | RKQNEJMQ | N | k` | N | k` | N |
| NMR | | P | ã ~ñ | M | N | M | N | M | O | VKQDEJMQ | O | k` | N | k` | N |
| NMS | | | ã ä | M | O | M | O | M | N | RKQVÉJMQ | N | k` | N | k` | N |
| NMT | | Q | ã ~ñ | M | N | M | O | M | O | VKQREJMQ | O | k` | N | k` | N |
| NMU | | | ã ä | M | O | M | N | M | N | RKQVÉJMQ | N | k` | N | k` | N |
| NMW | | R | ã ~ñ | M | N | M | N | M | N | VKUNÉJMQ | O | k` | N | k` | N |
| NNM | | | ã ä | M | N | M | N | M | N | RIRSTÉJMQ | N | k` | N | k` | N |
| NNN | j NP | N | ã ~ñ | M | N | M | N | M | N | JKVLÉJMU | N | k` | N | k` | N |
| NNO | | | ã ä | M | N | M | N | M | N | JKSPÉJMT | O | k` | N | k` | N |
| NNP | | O | ã ~ñ | JMN | N | KNP | O | JMS | N | JKVLÉJMU | N | k` | N | k` | N |
| NNQ | | | ã ä | JMO | O | KMU | N | JMN | O | JKSPÉJMT | O | VPVSKTR | O | k` | N |
| NNR | | P | ã ~ñ | JMO | N | KO | O | JMV | N | JKVLÉJMU | N | VTOUKUV | N | k` | N |
| NNS | | | ã ä | JMQ | O | KNO | N | JMR | O | JKSPÉJMT | O | RUTOX/SV | O | TUTOXTO | O |
| NNT | | Q | ã ~ñ | JMQ | N | KNT | O | JMJ | N | JKVLÉJMU | N | k` | N | k` | N |
| NNU | | | ã ä | JMS | O | KNN | N | JMP | O | JKSPÉJMT | O | STNNK/SQ | O | UWSKVS | O |
| NNV | | R | ã ~ñ | JMR | N | M | N | M | O | JKVLÉJMU | N | k` | N | k` | N |
| NOM | | | ã ä | JMJ | O | M | O | M | N | JKSPÉJMT | O | k` | N | k` | N |
| NON | j NQ | N | ã ~ñ | KMQ | O | M | N | M | N | JKSTÉJMS | N | k` | N | k` | N |
| NOO | | | ã ä | KMP | N | M | O | M | O | PKTSSÉJMS | O | k` | N | k` | N |

o fp^ Jpa s Éãçã-NRMQ = xKXKXKXmH-a ÉãÇÄÉëy çÇi äãÖpää çÇÖç ~äë çääÉa ÉÄãé-ã ÉíÇ= m-ÖÉV



` çã é-áó W` ~áoçãè
 a Éã ÄÉè W` oc
 çÇÄk i ä ÄÉè W
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^i Ö-ON-OMNT
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bã iÉçéÉ-j Éã ÄÉè pÉÄíçã-ä ÉÑÉÄíçã èÉ çã iä iÉÇF

| | j Éã ÄÉè | pÉÄ | ñãz | i` | óãz | i` | óãz | i` | ñ-ççí-Éççk i` | Éã Fí Lóç ~iç i` | Éã Fí Lóç ~iç i` | | | | |
|-----|----------|-----|------|-----|-----|------|-----|-----|---------------|------------------|------------------|----------|---|----------|---|
| NCP | | O | ã ~ñ | KMP | O | KNU | O | KON | O | JKSTÉJM | N | k` | N | VRUSKUP | N |
| NQ | | | ã ä | KMO | N | KNN | N | KNO | N | PKTSSÉJM | O | SSMQRTUN | O | RTSSKISO | O |
| NCR | | P | ã ~ñ | KMO | O | KON | O | KDQ | O | JKSTÉJM | N | VROTRVO | N | UPUKPR | N |
| NCS | | | ã ä | KMN | N | KNP | N | KNQ | N | PKTSSÉJM | O | RTTVKIUQ | O | RMQRHVO | O |
| NOT | | Q | ã ~ñ | KMN | O | KNP | O | KNR | O | JKSTÉJM | N | k` | N | k` | N |
| NCU | | | ã ä | M | N | KMJ | N | KMW | N | PKTSSÉJM | O | VOQSHVQ | O | UMTOSOT | O |
| NOV | | R | ã ~ñ | M | N | M | N | M | N | JKSTÉJM | N | k` | N | k` | N |
| NPM | | | ã ä | M | N | M | N | M | N | PKTSSÉJM | O | k` | N | k` | N |
| NPN | j NU | N | ã ~ñ | M | N | M | N | M | N | NKROÉJM | O | k` | N | k` | N |
| NPO | | | ã ä | M | N | M | N | M | N | SKVSEJM | N | k` | N | k` | N |
| NPP | | O | ã ~ñ | M | O | KVN | N | M | N | PKOSÉJM | O | SNOSKMP | N | k` | N |
| NPQ | | | ã ä | M | N | KNT | O | M | O | OKRPÉJM | N | PRSNKIUO | O | k` | N |
| NPR | | P | ã ~ñ | M | O | KMO | N | M | N | RKPEJM | O | OTORRLO | N | k` | N |
| NPS | | | ã ä | M | N | KPU | O | M | O | PKMTÉJM | N | NRUTKOR | O | k` | N |
| NPT | | Q | ã ~ñ | M | O | KPS | N | M | N | TKVQÉJM | O | NSTRKVSU | N | k` | N |
| NPU | | | ã ä | M | N | KSN | O | M | O | QKTSNÉJM | N | VTSKMSO | O | k` | N |
| NPV | | R | ã ~ñ | M | O | KVR | N | M | N | VISMÉJM | O | NNMMKN | N | k` | N |
| NQM | | | ã ä | M | N | KUT | O | M | O | SKINRÉJM | N | SVPRQV | O | k` | N |
| NGN | j NR | N | ã ~ñ | M | O | KPO | N | M | O | NKOTÉJM | O | k` | N | k` | N |
| NGO | | | ã ä | M | N | KNP | O | M | N | TKVPEJM | N | k` | N | k` | N |
| NGP | | O | ã ~ñ | M | O | KNO | N | M | O | NKPTÉJM | O | k` | N | k` | N |
| NGQ | | | ã ä | M | N | KO | O | M | N | UKMVEJM | N | k` | N | k` | N |
| NGR | | P | ã ~ñ | M | O | KNS | N | M | O | NKSEJM | O | k` | N | k` | N |
| NGS | | | ã ä | M | N | KUT | O | M | N | VKUREJM | N | k` | N | k` | N |
| NGT | | Q | ã ~ñ | M | O | KNT | N | M | O | NKSPÉJM | O | k` | N | k` | N |
| NCU | | | ã ä | M | N | KNTQ | O | M | N | NKMTUÉJM | N | k` | N | k` | N |
| NQV | | R | ã ~ñ | M | O | KVV | N | M | O | NKVOSEJM | O | k` | N | k` | N |
| NRM | | | ã ä | M | N | KNSO | O | M | N | NKITOÉJM | N | k` | N | k` | N |
| NRN | j NS | N | ã ~ñ | M | O | KVV | N | M | O | NKVOSEJM | O | k` | N | k` | N |
| NRO | | | ã ä | M | N | KNSO | O | M | N | NKITOÉJM | N | k` | N | k` | N |
| NRP | | O | ã ~ñ | M | O | KUT | N | M | O | NKORVÉJM | O | k` | N | k` | N |
| NRQ | | | ã ä | M | N | KNO | O | M | N | NKIONÉJM | N | k` | N | k` | N |
| NRR | | P | ã ~ñ | M | O | KTR | N | M | O | NKVOÉJM | O | k` | N | k` | N |
| NRS | | | ã ä | M | N | KNS | O | M | N | NKMSVÉJM | N | k` | N | k` | N |
| NRT | | Q | ã ~ñ | M | O | KSP | N | M | O | NKOSÉJM | O | k` | N | k` | N |
| NRU | | | ã ä | M | N | KMS | O | M | N | NKMUÉJM | N | k` | N | k` | N |
| NRV | | R | ã ~ñ | M | O | KVR | N | M | O | NKSRVÉJM | O | k` | N | k` | N |
| NSM | | | ã ä | M | N | KUT | O | M | N | VISTNÉJM | N | k` | N | k` | N |
| NSN | j NT | N | ã ~ñ | M | O | KPN | N | M | O | NKVOÉJM | O | k` | N | k` | N |
| NSO | | | ã ä | M | N | KVR | O | M | N | TKVRQÉJM | N | k` | N | k` | N |
| NSP | | O | ã ~ñ | M | O | KNS | N | M | O | NKIUOÉJM | O | PVOURTP | N | k` | N |
| NSQ | | | ã ä | M | N | KTR | O | M | N | TKVRQÉJM | N | OPVUSUS | O | k` | N |
| NSR | | P | ã ~ñ | M | O | KSP | N | M | O | NKMPÉJM | O | NUTMRRV | N | k` | N |
| NSS | | | ã ä | M | N | KMP | O | M | N | SKTRPÉJM | N | NNQNRV | O | k` | N |
| NST | | Q | ã ~ñ | M | O | KUN | N | M | N | VISOVÉJM | O | NOMPKTSO | N | k` | N |
| NSU | | | ã ä | M | N | KPO | O | M | O | SKIRPÉJM | N | TPQCOV | O | k` | N |
| NSV | | R | ã ~ñ | M | O | KVV | N | M | N | UKRPNÉJM | O | UUNKUQ | N | k` | N |
| NTM | | | ã ä | M | N | KNSO | O | M | O | RKRROÉJM | N | RPTKRV | O | k` | N |
| NTN | j NU^ | N | ã ~ñ | KMP | N | M | N | M | N | PKTPPÉJM | O | k` | N | k` | N |
| NTO | | | ã ä | KMR | O | M | N | M | N | OKOSVÉJM | N | k` | N | k` | N |
| NTP | | O | ã ~ñ | KMO | N | KMR | O | KMR | N | PKTPPÉJM | O | k` | N | k` | N |
| NTQ | | | ã ä | KMQ | O | KMP | N | KMU | O | OKOSVÉJM | N | k` | N | k` | N |

o fp^ JPa s Éãçã-NRMQ — xKKKKKKKK_ ççí äã Öp äã çÇÉç ~Äéy çääÉa ÉÄa-é-ä ÉÇÇ=

m-Ö-NN



` çã é~áo W` ~áoçãè
 a ÈãÄÈÈ W` oc
 gçÄk i ä ÄÈÈ W
 j çÇÈk ~ã È W_ ççì äã Öp äã çÇÈç çãÈã ÈÄã è-ã äÖ

^ i Ö-ON-OMNT
 OMFRmj
 ` ÜÈÄÈÇ_ öM |||

bã i Èã ÈÉ-j Èã ÄÈÈ p ÈÄÈ çã ä ÈÄÈ ÄÈÄÈ ä è È çã i ä ÈÇF

| | j Èã ÄÈÈ | p ÈÄÈ | ñ~ãz | i` | ó~ãz | i` | ò~ãz | i` | ñ-ççì-ÈÈ-ÖK i` | ÈÄÈ Lóè ~iç i` | ÈÄÈ Lóè ~iç i` | | | | |
|-----|----------|-------|------|-----|------|-----|------|-----|----------------|----------------|----------------|---------|---|----|---|
| NTR | | P | ã ~ñ | KMN | N | KMS | O | KMR | N | PKTPÉJM | O | k` | N | k` | N |
| NTS | | | ã ä | KMP | O | KMP | N | KMM | O | OKOSVÉJM | N | k` | N | k` | N |
| NTT | | Q | ã ~ñ | M | N | KMP | O | KMP | N | PKTPÉJM | O | k` | N | k` | N |
| NTU | | | ã ä | KMN | O | KMO | N | KMS | O | OKOSVÉJM | N | k` | N | k` | N |
| NTV | | R | ã ~ñ | M | N | M | N | M | N | PKTPÉJM | O | k` | N | k` | N |
| NUM | | | ã ä | M | N | M | N | M | N | OKOSVÉJM | N | k` | N | k` | N |
| NUN | j NV | N | ã ~ñ | M | N | KMR | O | M | N | JNKVSÉJM | N | k` | N | k` | N |
| NUG | | | ã ä | M | N | KMP | N | M | N | JKQVÉJM | O | k` | N | k` | N |
| NUP | | O | ã ~ñ | M | O | KNV | O | M | O | JKNSÉJM | N | k` | N | k` | N |
| NUQ | | | ã ä | M | N | KNN | N | M | N | JKQVÉJM | O | TPTPHSS | O | k` | N |
| NUR | | P | ã ~ñ | M | O | KVQ | O | M | N | PKRTQÉJM | N | URSNKVO | N | k` | N |
| NUS | | | ã ä | M | N | KVQ | N | M | O | JKRTQÉJM | O | QVNRPO | O | k` | N |
| NUT | | Q | ã ~ñ | M | O | KVU | O | M | N | JKNSÉJM | N | k` | N | k` | N |
| NUU | | | ã ä | M | N | KV | N | M | O | JKRTQÉJM | O | SNMRKN | O | k` | N |
| NUV | | R | ã ~ñ | M | O | KMP | N | M | N | JKRLÉJM | N | k` | N | k` | N |
| NMM | | | ã ä | M | N | KMQ | O | M | O | JKVQVÉJM | O | k` | N | k` | N |
| NMN | j OM | N | ã ~ñ | M | N | M | N | M | N | JKVSÉJM | N | k` | N | k` | N |
| NMO | | | ã ä | M | N | M | N | M | N | JKVQVÉJM | O | k` | N | k` | N |
| NMP | | O | ã ~ñ | M | N | KMQ | N | M | O | JKVTEJM | N | k` | N | k` | N |
| NMQ | | | ã ä | M | O | KMT | O | M | N | JKVQVÉJM | O | k` | N | k` | N |
| NMR | | P | ã ~ñ | M | N | KMT | N | M | O | SKMTRÉJM | O | k` | N | k` | N |
| NMS | | | ã ä | M | O | KMP | O | M | N | PKRUNÉJM | N | k` | N | k` | N |
| NMT | | Q | ã ~ñ | M | N | KMN | N | M | O | NKUTÉJM | O | k` | N | k` | N |
| NUJ | | | ã ä | M | O | KMT | O | M | N | UKRTÉJM | N | k` | N | k` | N |
| NV | | R | ã ~ñ | M | N | KNO | N | M | O | OKRSTÉJM | O | k` | N | k` | N |
| OM | | | ã ä | M | O | KON | O | M | N | NKRTSÉJM | N | k` | N | k` | N |

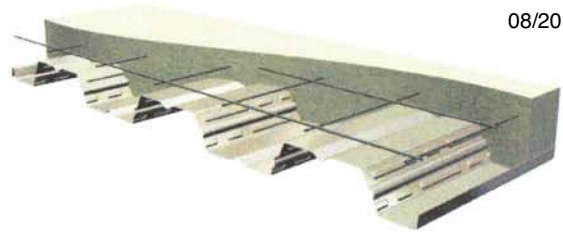
bã i Èã ÈÉ= fp` ñOÛPMSNMW# pa p ÈÈã çÇÈ= ÜÈÄÈ

| | j Èã ÄÈÈ | p Ü-ÈÈ | ` çÇÈ= KK çÄViz i` | p ÜÈ-ÖKK içÄViz aã i` | mãÄçã ðáz | mãilçã ðáz | j áóólçã KK áóólçã KK Ä | bèã | | | | | | |
|----|----------|-------------|--------------------|-----------------------|-----------|------------|-------------------------|-----|---|---------|---------|---------|---------|-----------|
| N | j N | eppLfiLfiNM | KVTS | NM | O | KMR | M | ó | O | QPSKQV | QNKVNU | NNIKROT | NNIKROT | KKKe NUNÄ |
| O | j O | t NMiQR | KVUV | NM | O | KVP | NM | ó | O | PMSKPR | PVKVQV | RMSQV | NPSK/TS | KKKe NUNÄ |
| P | j P | t NQiSR | KVMP | M | O | KVO | NKV | ó | O | RSRK/PV | RTNKURS | NVSK/UR | OPTK/MO | KKKe NUNÄ |
| Q | j S | t NQiSR | KVRS | NM | O | KVT | VK/SP | ó | O | RM/KQ | RTNKURS | NVSK/UR | OPTK/MO | KKKe NUNÄ |
| R | j T | t NQiSR | KVTQ | M | O | KVU | NKV | ó | O | RSRK/PV | RTNKURS | NVSK/UR | OPTK/MO | KKKe NUNÄ |
| S | j U | t NQiSR | KVRQ | M | O | KVU | OK/PN | ó | O | RRRRT | RTNKURS | NVSK/UR | OPTK/MO | KKKe NUNÄ |
| T | j U^ | t NMiQR | KVRS | R | O | KVU | R | ó | O | PTOK/PR | PVKVQV | RMSQV | NPSK/TS | KKKe NUNÄ |
| U | j V | t NQiSR | KVU | R | O | KVN | R | ó | O | RRRRT | RTNKURS | NVSK/UR | OPTK/MO | KKKe NUNÄ |
| V | j NM | t NQiSR | KVRT | R | O | KVU | R | ó | O | RRRRT | RTNKURS | NVSK/UR | OPTK/MO | KKKe NUNÄ |
| NM | j NN | t NQiSR | KVTT | P | O | KVTS | OKVU | ó | O | RSRK/PV | RTNKURS | NVSK/UR | OPTK/MO | KKKe NUNÄ |
| NN | j NO | t NQiSR | KVNN | M | O | KVU | M | ó | O | RSNK/TV | RTNKURS | NVSK/UR | OPTK/MO | KKKe NUNÄ |
| NO | j NP | eppSiSiU | KVNR | NM | O | KVP | M | ó | O | OKRKO | OMNSNT | QKQVN | QKQVN | KKKe NUNÄ |
| NP | j NQ | eppLfiLfiNM | KVQN | M | O | KVS | M | ó | O | QPSKQV | QNKVNU | NNIKROT | NNIKROT | KKKe NUNÄ |
| NQ | j NU | ` NQiPM | KVMQ | M | O | KVN | OKVO | ó | O | NSTKSVT | OSPRTTO | UKVU | UQKPN | KKKe NUNÄ |
| NR | j NR | t NQiSR | KVOV | R | O | KVP | R | ó | O | RRRRT | RTNKURS | NVSK/UR | OPTK/MO | KKKe NUNÄ |
| NS | j NS | t NQiSR | KVNN | QKQV | O | KVO | M | ó | O | RQKRTN | RTNKURS | NVSK/UR | OPTK/MO | KKKe NUNÄ |
| NT | j NT | t NQiSR | KVUQ | M | O | KVP | NKTN | ó | O | RRRRT | RTNKURS | NVSK/UR | OPTK/MO | KKKe NUNÄ |
| NU | j NU^ | eppQiQiQ | KVPV | M | O | KVN | M | ó | O | SQKVN | NMKVU | NKTM | NKTM | KKKe NUNÄ |
| NV | j NV | t NQiSR | KVV | NM | O | KVP | OKVT | ó | O | RM/KQ | RTNKURS | NVSK/UR | OPTK/MO | KKKe NUNÄ |
| OM | j OM | ` NQiPM | KVNR | M | O | KVT | NKVS | ó | O | OKKVT | OSPRTTO | UKVU | UQKPN | KKKe NUNÄ |

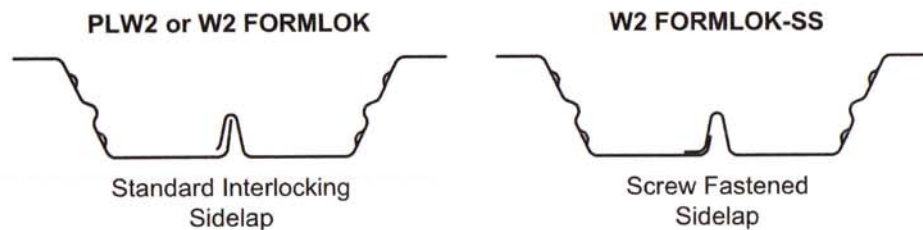
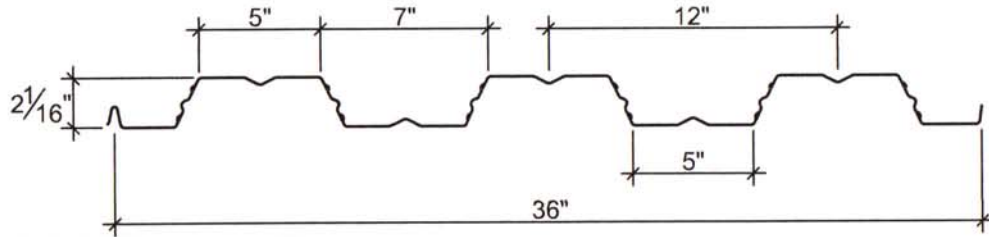
PLW2™ or W2 FORMLOK™

08/2017

- 2 in. Deep FORMLOK Deck
- Phosphatized/Painted or Galvanized
- PLW2 FORMLOK used with PunchLok II System
- W2 FORMLOK used with TSWs or BPs
- W2 FORMLOK-SS used with Screws



Dimensions

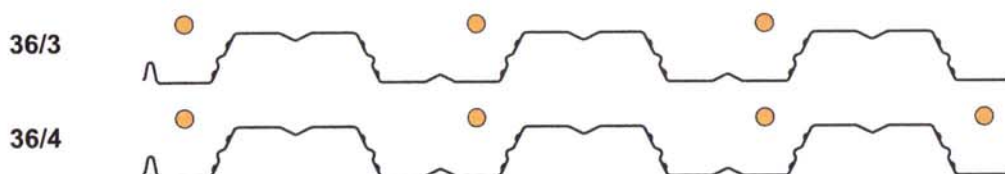


Deck Weight and Section Properties

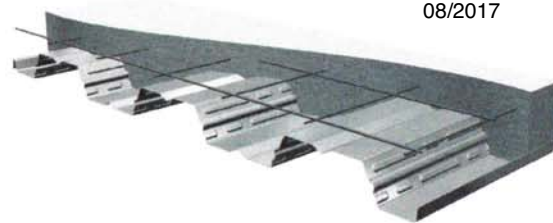
| Gage | Weight | | I_d for Deflection | | Moment | | Allowable Reactions per ft of Width (lb) due to Web Crippling | | | | | | | | | |
|------|---------------|------------------|---------------------------------------|--------------------------------------|---------------------------------------|---------------------------------------|---|------|------|-------------------------|------|--------------------|------|------|-------------------------|------|
| | Galv (psf) | Painted (psf) | Single Span (in. ⁴ /ft) | Multi Span (in. ⁴ /ft) | + S_{eff} (in. ³ /ft) | - S_{eff} (in. ³ /ft) | One Flange Loading | | | | | Two Flange Loading | | | | |
| | | | | | | | End Bearing Length | | | Interior Bearing Length | | End Bearing Length | | | Interior Bearing Length | |
| | | | | | | | 2" | 3" | 4" | 4" | 6" | 2" | 3" | 4" | 4" | 6" |
| 22 | 1.8 | 1.7 | 0.340 | 0.340 | 0.246 | 0.256 | 412 | 475 | 527 | 793 | 911 | 405 | 454 | 495 | 956 | 1108 |
| 21 | 2.0 | 1.9 | 0.381 | 0.381 | 0.283 | 0.294 | 492 | 565 | 626 | 945 | 1084 | 499 | 557 | 607 | 1148 | 1329 |
| 20 | 2.1 | 2.0 | 0.422 | 0.422 | 0.323 | 0.333 | 577 | 661 | 732 | 1109 | 1269 | 602 | 671 | 729 | 1356 | 1566 |
| 19 | 2.4 | 2.3 | 0.503 | 0.503 | 0.405 | 0.415 | 765 | 874 | 966 | 1472 | 1678 | 836 | 928 | 1006 | 1818 | 2092 |
| 18 | 2.7 | 2.6 | 0.564 | 0.564 | 0.471 | 0.481 | 940 | 1071 | 1182 | 1808 | 2056 | 1058 | 1172 | 1268 | 2247 | 2580 |
| 16 | 3.3 | 3.2 | 0.707 | 0.707 | 0.623 | 0.638 | 1424 | 1613 | 1773 | 2738 | 3097 | 1697 | 1868 | 2013 | 3441 | 3931 |

- Notes:**
1. Section properties are based on $F_y = 50,000$ psi.
 2. I_d is for deflection due to uniform loads.
 3. S_{eff} (+ or -) is the effective section modulus.
 4. Allowable (ASD) reactions are based on web crippling, per AISI S100 Section C3.4, where $\Omega_w = 1.70$ for end bearing and 1.75 for interior bearing. Nominal reactions may be determined by multiplying the table values by Ω_w . LRFD reactions may be determined by multiplying nominal reactions by $\phi_w = 0.9$ for end reactions and 0.85 for interior reactions.

Attachment Patterns to Supports



Note: ● indicates location of arc spot weld, power actuated fastener, or screw as indicated in the load tables.



Footnotes for Maximum Unshored Clear Span, Allowable Superimposed Loads, and Allowable Diaphragm Shear Strength Tables

1. Shoring calculations are based on the following:
 - Deck supporting dead load of concrete plus 20 psf uniform construction load or 150 pound concentrated construction live load for flexure. 4 psf is added for normal weight concrete and 3 psf is added for light weight concrete to account for ponding due to deck deflection between support members.
 - Dead load deflection limited to $L/180$ of span length, not to exceed $3/4"$.
 - Minimum end bearing of 2" for all gages and minimum interior bearing of 2" for 16, 18, and 19 gage. Minimum interior bearing varies from 2" to 5.25" for 20, 21, and 22 gage, depending on deck gage and slab thickness. Required bearing should be determined based on allowable reactions shown on page 50.
2. Concrete fill to have minimum 28-day compressive strength $f'_c = 3,000$ psi.
3. Total slab depth is nominal depth from top of concrete to bottom of steel deck.
4. Shoring is required at midspan for allowable superimposed loads in the shaded area to the right of the heavy line.
5. Nominal diaphragm shear strengths may be determined by multiplying the tabulated strengths by $\Omega = 3.0$. LRFD diaphragm shear strength may be determined by multiplying nominal diaphragm shear strength by $\phi = 0.55$.
6. PLW2-36 and W2-36 FORMLOK decks with structural concrete have a Flexibility Factor of $F < 1$.
7. To obtain allowable diaphragm shear strengths using mechanical fasteners, multiply the tabulated strengths by the appropriate adjustment factor, A_q listed in the following table.

| Attachment Pattern | Adjustment Factor | Total Slab Depth (in.) | | | | | | | | |
|--------------------|-------------------|------------------------|------|------|------|------|-----------------------|------|------|------|
| | | Normal Weight Concrete | | | | | Light Weight Concrete | | | |
| | | 4 | 4½ | 5 | 5½ | 6½ | 4 | 4½ | 5¼ | 6¼ |
| 36/3 | A_{q3} | 0.77 | 0.68 | 0.60 | 0.54 | 0.45 | 0.65 | 0.71 | 0.74 | 0.63 |
| 36/4 | A_{q4} | 0.67 | 0.73 | 0.75 | 0.68 | 0.57 | 0.56 | 0.62 | 0.69 | 0.76 |

Notes:

- a. Mechanical fastener attachment patterns are to match the listed attachment patterns for welds.
- b. Applicable mechanical fasteners are limited to the following: Hilti Fasteners, Pneutek Fasteners and SDI Recognized #12 or #14 Screws produced by Buildex, Elco, Hilti or Simpson Strong-Tie. Comply with minimum and maximum substrate thickness requirements for applicable mechanical fasteners. Note that these adjustment factors are based on the most conservative value for all listed connectors.
- c. Nominal diaphragm shear strengths for mechanically fastened FORMLOK slabs may be determined by multiplying the adjusted table values by $\Omega = 3.25$. LRFD diaphragm shear values for mechanically fastened FORMLOK slabs may be determined by multiplying the adjusted nominal values by $\phi = 0.50$.
- d. Consult fastener manufacturer for applicable fire-resistance assembly ratings where mechanical fasteners are required.

Footnotes for Allowable Uniform Load Tables for Deck without Concrete Fill

1. Stress = Allowable uniform load based on maximum allowable flexural stress in deck.
2. $L/360$, $L/240$ or $L/180$ = Uniform load which produces selected deflection in deck.
3. The symbol ♦♦ indicates allowable uniform load based on deflection exceeds allowable uniform load based on stress.
4. Nominal uniform loads governed by stress may be determined by multiplying the allowable loads in the table by $\Omega_b = 1.67$. LRFD loads may be determined by multiplying nominal loads by $\phi_b = 0.95$.

Footnotes for Diaphragm Shear Strength and Flexibility Factor Tables for Deck without Concrete Fill

1. VSC2 = Verco Sidlap Connection 2; BP = Button Punch; TSW = Top Seam Weld. Sidlap connections are not required at support locations.
2. The end dimension to the first and last sidlap connection within each span is to be no more than one-half of specified sidlap spacing.
3. R is the ratio of vertical span (L_v) of the deck to the length (L_s) of the deck sheet: $R = L_v / L_s$.
4. Interpolation of diaphragm shear strength between adjacent spans or sidlap spacings is permissible. For interpolation of the diaphragm flexibility factor between adjacent spans, use the flexibility factor for the closest adjacent span length.
5. Interpolation of diaphragm shear strengths for sidlap fasteners placed at spacings other than those in the table should be based on the number of sidlap fasteners in each span.
6. The allowable diaphragm shear strengths in the tables utilize a factor of safety, $\Omega = 3.0$ (limited by connections), with the exception of the shaded table strengths, which utilize a factor of safety of $\Omega = 2.0$ (limited by panel buckling).

- 5½ in. TOTAL SLAB DEPTH
- Normal Weight Concrete
- 1 Hour Fire Rating



Maximum Unshored Clear Span (ft.-in.)

| Deck Gage | Number of Deck Spans | | |
|-----------|----------------------|---------|--------|
| | 1 | 2 | 3 |
| 22 | 6'-10" | 7'-11" | 8'-0" |
| 21 | 7'-5" | 8'-6" | 8'-9" |
| 20 | 8'-1" | 9'-0" | 9'-4" |
| 19 | 8'-11" | 10'-1" | 10'-5" |
| 18 | 9'-3" | 10'-10" | 11'-2" |
| 16 | 9'-11" | 12'-5" | 12'-0" |

Concrete Properties

| Density (pcf) | Uniform Weight (psf) | Uniform Volume (yd ³ /100 ft ²) | Compressive Strength, f _c (psi) |
|---------------|----------------------|--|--|
| 145 | 54.4 | 1.389 | 3000 |

Notes:

1. Volumes and weights do not include allowance for deflection.
2. Weights are for concrete only and do not include weight of steel deck.
3. Total slab depth is nominal depth from top of concrete to bottom of steel deck.

Shoring is required for spans greater than those shown above. See Footnote 1 on page 51 for required bearing.

Allowable Superimposed Loads (psf)

| Deck Gage | Number of Deck Spans | Span (ft.-in.) | | | | | | | | | | | | | | | |
|-----------|----------------------|----------------|-------|-------|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--|
| | | 6'-0" | 7'-0" | 7'-6" | 8'-0" | 8'-6" | 9'-0" | 9'-6" | 10'-0" | 10'-6" | 11'-0" | 11'-6" | 12'-0" | 12'-6" | 13'-0" | 14'-0" | |
| 22 | 1 | 400 | 313 | 273 | 240 | 212 | 188 | 167 | 149 | 134 | 120 | 108 | 97 | 87 | 78 | 63 | |
| | 2 | 400 | 365 | 325 | 240 | 212 | 188 | 167 | 149 | 134 | 120 | 108 | 97 | 87 | 78 | 63 | |
| | 3 | 400 | 365 | 325 | 292 | 212 | 188 | 167 | 149 | 134 | 120 | 108 | 97 | 87 | 78 | 63 | |
| 21 | 1 | 400 | 400 | 311 | 274 | 243 | 216 | 193 | 173 | 155 | 140 | 126 | 114 | 103 | 93 | 76 | |
| | 2 | 400 | 400 | 364 | 326 | 295 | 216 | 193 | 173 | 155 | 140 | 126 | 114 | 103 | 93 | 76 | |
| | 3 | 400 | 400 | 364 | 326 | 295 | 216 | 193 | 173 | 155 | 140 | 126 | 114 | 103 | 93 | 76 | |
| 20 | 1 | 400 | 400 | 400 | 361 | 274 | 245 | 219 | 197 | 177 | 160 | 145 | 132 | 120 | 109 | 90 | |
| | 2 | 400 | 400 | 400 | 361 | 327 | 297 | 219 | 197 | 177 | 160 | 145 | 132 | 120 | 109 | 90 | |
| | 3 | 400 | 400 | 400 | 361 | 327 | 297 | 219 | 197 | 177 | 160 | 145 | 132 | 120 | 109 | 90 | |
| 19 | 1 | 400 | 400 | 400 | 400 | 391 | 303 | 272 | 246 | 222 | 202 | 184 | 168 | 153 | 140 | 118 | |
| | 2 | 400 | 400 | 400 | 400 | 391 | 355 | 325 | 298 | 222 | 202 | 184 | 168 | 153 | 140 | 118 | |
| | 3 | 400 | 400 | 400 | 400 | 391 | 355 | 325 | 298 | 222 | 202 | 184 | 168 | 153 | 140 | 118 | |
| 18 | 1 | 400 | 400 | 400 | 400 | 400 | 400 | 318 | 287 | 261 | 237 | 217 | 198 | 182 | 167 | 141 | |
| | 2 | 400 | 400 | 400 | 400 | 400 | 400 | 370 | 340 | 314 | 237 | 217 | 198 | 182 | 167 | 141 | |
| | 3 | 400 | 400 | 400 | 400 | 400 | 400 | 370 | 340 | 314 | 290 | 217 | 198 | 182 | 167 | 141 | |
| 16 | 1 | 400 | 400 | 400 | 400 | 400 | 400 | 368 | 284 | 258 | 235 | 214 | 196 | 179 | 165 | 139 | |
| | 2 | 400 | 400 | 400 | 400 | 400 | 400 | 368 | 338 | 311 | 288 | 267 | 249 | 179 | 165 | 139 | |
| | 3 | 400 | 400 | 400 | 400 | 400 | 400 | 368 | 338 | 311 | 288 | 267 | 249 | 179 | 165 | 139 | |

See footnotes on page 51.

Shoring required in shaded areas to right of heavy line.

Allowable Diaphragm Shear Strengths, q (plf) and Flexibility Factors, F (in./lb. x 10⁶)

| Attachment Pattern | Deck Gage | Span (ft.-in.) | | | | | | | | | | | | | | | |
|--------------------|-----------|----------------|-------|-------|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| | | 6'-0" | 7'-0" | 7'-6" | 8'-0" | 8'-6" | 9'-0" | 9'-6" | 10'-0" | 10'-6" | 11'-0" | 11'-6" | 12'-0" | 12'-6" | 13'-0" | 14'-0" | |
| 36/3 | 22 | q | 2391 | 2352 | 2336 | 2323 | 2311 | 2300 | 2291 | 2282 | 2274 | 2267 | 2261 | 2255 | 2249 | 2244 | 2235 |
| | 21 | q | 2397 | 2355 | 2337 | 2323 | 2309 | 2298 | 2287 | 2278 | 2269 | 2261 | 2254 | 2248 | 2242 | 2236 | 2226 |
| | 20 | q | 2407 | 2360 | 2341 | 2325 | 2310 | 2298 | 2286 | 2276 | 2267 | 2258 | 2250 | 2243 | 2237 | 2231 | 2220 |
| | 19 | q | 2431 | 2376 | 2355 | 2336 | 2319 | 2304 | 2290 | 2278 | 2268 | 2258 | 2249 | 2240 | 2233 | 2226 | 2213 |
| | 18 | q | 2456 | 2395 | 2370 | 2349 | 2330 | 2314 | 2299 | 2285 | 2273 | 2262 | 2252 | 2242 | 2234 | 2226 | 2212 |
| | 16 | q | 2527 | 2450 | 2419 | 2393 | 2369 | 2348 | 2329 | 2312 | 2297 | 2283 | 2270 | 2259 | 2248 | 2238 | 2220 |
| 36/4 | 22 | q | 2551 | 2480 | 2451 | 2426 | 2403 | 2384 | 2366 | 2350 | 2336 | 2323 | 2311 | 2300 | 2290 | 2281 | 2264 |
| | 21 | q | 2584 | 2505 | 2474 | 2446 | 2422 | 2400 | 2380 | 2363 | 2347 | 2333 | 2320 | 2308 | 2297 | 2286 | 2268 |
| | 20 | q | 2619 | 2533 | 2499 | 2468 | 2442 | 2418 | 2397 | 2378 | 2361 | 2345 | 2331 | 2318 | 2306 | 2294 | 2274 |
| | 19 | q | 2694 | 2594 | 2554 | 2518 | 2487 | 2460 | 2435 | 2413 | 2393 | 2374 | 2358 | 2342 | 2328 | 2315 | 2292 |
| | 18 | q | 2761 | 2648 | 2603 | 2564 | 2529 | 2498 | 2471 | 2446 | 2423 | 2403 | 2384 | 2367 | 2351 | 2337 | 2311 |
| | 16 | q | 2930 | 2788 | 2732 | 2682 | 2639 | 2600 | 2565 | 2534 | 2506 | 2480 | 2457 | 2435 | 2416 | 2397 | 2365 |

See footnotes on page 51.

■ Without Concrete Fill



Allowable Uniform Loads (psf)

| SPAN | DECK GAGE | CRITERIA | SPAN (ft.-in.) | | | | | | | | | | | | | | | | |
|--------|-----------|----------|----------------|-------|-------|-------|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | | | 6'-0" | 6'-6" | 7'-0" | 7'-6" | 8'-0" | 8'-6" | 9'-0" | 9'-6" | 10'-0" | 10'-6" | 11'-0" | 11'-6" | 12'-0" | 12'-6" | 13'-0" | 13'-6" | 14'-0" |
| TRIPLE | 22 | Stress | 178 | 151 | 131 | 114 | 100 | 89 | 79 | 71 | 64 | 58 | 53 | 48 | 44 | 41 | 38 | 35 | 33 |
| | | L/360 | 130 | 102 | 82 | 66 | 55 | 46 | 38 | 33 | 28 | 24 | 21 | 18 | 16 | 14 | 13 | 11 | 10 |
| | | L/240 | ◆◆◆ | ◆◆◆ | 123 | 100 | 82 | 68 | 58 | 49 | 42 | 36 | 32 | 28 | 24 | 22 | 19 | 17 | 15 |
| | | L/180 | ◆◆◆ | ◆◆◆ | ◆◆◆ | ◆◆◆ | ◆◆◆ | ◆◆◆ | 77 | 65 | 56 | 48 | 42 | 37 | 32 | 29 | 26 | 23 | 20 |
| | 21 | Stress | 204 | 174 | 150 | 131 | 115 | 102 | 91 | 81 | 74 | 67 | 61 | 56 | 51 | 47 | 43 | 40 | 38 |
| | | L/360 | 145 | 114 | 92 | 74 | 61 | 51 | 43 | 37 | 31 | 27 | 24 | 21 | 18 | 16 | 14 | 13 | 11 |
| | | L/240 | ◆◆◆ | 172 | 137 | 112 | 92 | 77 | 65 | 55 | 47 | 41 | 35 | 31 | 27 | 24 | 21 | 19 | 17 |
| | | L/180 | ◆◆◆ | ◆◆◆ | ◆◆◆ | ◆◆◆ | ◆◆◆ | ◆◆◆ | 86 | 73 | 63 | 54 | 47 | 41 | 36 | 32 | 29 | 26 | 23 |
| | 20 | Stress | 231 | 197 | 170 | 148 | 130 | 115 | 103 | 92 | 83 | 76 | 69 | 63 | 58 | 53 | 49 | 46 | 42 |
| | | L/360 | 161 | 127 | 101 | 82 | 68 | 57 | 48 | 41 | 35 | 30 | 26 | 23 | 20 | 18 | 16 | 14 | 13 |
| | | L/240 | ◆◆◆ | 190 | 152 | 124 | 102 | 85 | 72 | 61 | 52 | 45 | 39 | 34 | 30 | 27 | 24 | 21 | 19 |
| | | L/180 | ◆◆◆ | ◆◆◆ | ◆◆◆ | ◆◆◆ | ◆◆◆ | 113 | 95 | 81 | 70 | 60 | 52 | 46 | 40 | 36 | 32 | 28 | 25 |
| 19 | Stress | 288 | 246 | 212 | 184 | 162 | 144 | 128 | 115 | 104 | 94 | 86 | 78 | 72 | 66 | 61 | 57 | 53 | |
| | L/360 | 192 | 151 | 121 | 98 | 81 | 68 | 57 | 48 | 41 | 36 | 31 | 27 | 24 | 21 | 19 | 17 | 15 | |
| | L/240 | 288 | 227 | 181 | 147 | 122 | 101 | 85 | 73 | 62 | 54 | 47 | 41 | 36 | 32 | 28 | 25 | 23 | |
| | L/180 | ◆◆◆ | ◆◆◆ | ◆◆◆ | ◆◆◆ | 162 | 135 | 114 | 97 | 83 | 72 | 62 | 55 | 48 | 42 | 38 | 34 | 30 | |
| 18 | Stress | 300 | 285 | 245 | 214 | 188 | 166 | 148 | 133 | 120 | 109 | 99 | 91 | 84 | 77 | 71 | 66 | 61 | |
| | L/360 | 215 | 169 | 136 | 110 | 91 | 76 | 64 | 54 | 47 | 40 | 35 | 31 | 27 | 24 | 21 | 19 | 17 | |
| | L/240 | ◆◆◆ | 254 | 203 | 165 | 136 | 114 | 96 | 81 | 70 | 60 | 52 | 46 | 40 | 36 | 32 | 28 | 25 | |
| | L/180 | ◆◆◆ | ◆◆◆ | ◆◆◆ | ◆◆◆ | 182 | 151 | 128 | 109 | 93 | 80 | 70 | 61 | 54 | 48 | 42 | 38 | 34 | |
| 16 | Stress | 300 | 300 | 300 | 284 | 249 | 221 | 197 | 177 | 160 | 145 | 132 | 121 | 111 | 102 | 94 | 88 | 81 | |
| | L/360 | 270 | 212 | 170 | 138 | 114 | 95 | 80 | 68 | 58 | 50 | 44 | 38 | 34 | 30 | 27 | 24 | 21 | |
| | L/240 | ◆◆◆ | ◆◆◆ | 255 | 207 | 171 | 142 | 120 | 102 | 87 | 76 | 66 | 58 | 51 | 45 | 40 | 36 | 32 | |
| | L/180 | ◆◆◆ | ◆◆◆ | ◆◆◆ | 276 | 228 | 190 | 160 | 136 | 117 | 101 | 88 | 77 | 67 | 60 | 53 | 47 | 42 | |

See footnotes on page 51.

- Without Concrete Fill
- 36/4 Weld Pattern at Supports
- Sidelaps connected with PunchLok II Tool



Allowable Diaphragm Shear Strengths, q (plf) and Flexibility Factors, F (in./lb. x 10⁶)

| DECK GAGE | SIDELAP ATTACHMENT | SPAN (ft.-in.) | | | | | | | | | |
|-----------|--------------------|----------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| | | 6'-0" | 7'-0" | 8'-0" | 9'-0" | 10'-0" | 11'-0" | 12'-0" | 13'-0" | 14'-0" | |
| 22 | VSC2 @ 24" | q | 473 | 491 | 441 | 459 | 420 | 437 | 407 | 422 | 397 |
| | | F | 11.4+25R | 11.6+21R | 13.1+18R | 13.1+16R | 14.4+14R | 14.2+12R | 15.3+11R | 15+10R | 16+9R |
| | VSC2 @ 12" | q | 675 | 664 | 655 | 648 | 642 | 637 | 633 | 629 | 626 |
| | | F | 8.2+26R | 8.7+22R | 9.1+19R | 9.5+17R | 9.8+15R | 10+14R | 10.2+13R | 10.4+12R | 10.6+11R |
| | VSC2 @ 8" | q | 800 | 806 | 787 | 794 | 779 | 786 | 774 | 749 | 646 |
| | | F | 6.6+27R | 6.8+23R | 7.3+20R | 7.4+18R | 7.7+16R | 7.8+14R | 8.1+13R | 8.1+12R | 8.3+11R |
| VSC2 @ 4" | q | 955 | 953 | 951 | 950 | 949 | 949 | 879 | 749 | 646 | |
| | F | 4.5+27R | 4.8+23R | 5+20R | 5.2+18R | 5.4+16R | 5.5+15R | 5.6+14R | 5.6+13R | 5.7+12R | |
| 21 | VSC2 @ 24" | q | 564 | 585 | 525 | 547 | 501 | 522 | 485 | 504 | 473 |
| | | F | 10.4+19R | 10.5+16R | 11.9+14R | 11.7+12R | 12.9+11R | 12.7+10R | 13.6+8R | 13.4+8R | 14.2+7R |
| | VSC2 @ 12" | q | 805 | 791 | 780 | 772 | 765 | 759 | 754 | 750 | 745 |
| | | F | 7.4+20R | 7.9+17R | 8.2+15R | 8.5+13R | 8.7+12R | 8.9+11R | 9.1+10R | 9.2+9R | 9.3+8R |
| | VSC2 @ 8" | q | 952 | 960 | 937 | 946 | 928 | 936 | 922 | 864 | 745 |
| | | F | 6+21R | 6.2+18R | 6.6+16R | 6.6+14R | 6.9+12R | 6.9+11R | 7.2+10R | 7.1+10R | 7.3+9R |
| VSC2 @ 4" | q | 1135 | 1133 | 1131 | 1130 | 1129 | 1128 | 1014 | 864 | 745 | |
| | F | 4.2+21R | 4.4+18R | 4.6+16R | 4.7+14R | 4.8+13R | 4.9+12R | 5+11R | 5.1+10R | 5.1+9R | |
| 20 | VSC2 @ 24" | q | 658 | 682 | 613 | 638 | 585 | 608 | 565 | 587 | 552 |
| | | F | 9.5+15R | 9.5+13R | 10.7+11R | 10.5+10R | 11.5+8R | 11.2+8R | 12.1+7R | 11.8+6R | 12.5+6R |
| | VSC2 @ 12" | q | 940 | 923 | 911 | 901 | 893 | 886 | 880 | 875 | 849 |
| | | F | 6.7+16R | 7.1+14R | 7.3+12R | 7.5+11R | 7.7+10R | 7.9+9R | 8+8R | 8.1+7R | 8.2+7R |
| | VSC2 @ 8" | q | 1113 | 1122 | 1095 | 1105 | 1084 | 1094 | 1077 | 984 | 849 |
| | | F | 5.4+17R | 5.5+14R | 5.9+13R | 5.9+11R | 6.2+10R | 6.2+9R | 6.3+8R | 6.3+8R | 6.5+7R |
| VSC2 @ 4" | q | 1329 | 1326 | 1324 | 1322 | 1321 | 1320 | 1155 | 984 | 849 | |
| | F | 3.8+17R | 4+15R | 4.2+13R | 4.3+11R | 4.4+10R | 4.4+9R | 4.5+9R | 4.5+8R | 4.6+7R | |
| 19 | VSC2 @ 24" | q | 857 | 888 | 796 | 828 | 758 | 789 | 733 | 761 | 714 |
| | | F | 7.7+10R | 7.6+9R | 8.5+7R | 8.3+7R | 9+6R | 8.8+5R | 9.4+5R | 9.1+4R | 9.7+4R |
| | VSC2 @ 12" | q | 1226 | 1204 | 1187 | 1173 | 1162 | 1153 | 1145 | 1138 | 1069 |
| | | F | 5.4+11R | 5.6+10R | 5.8+8R | 5.9+7R | 6.1+7R | 6.1+6R | 6.2+6R | 6.3+5R | 6.3+5R |
| | VSC2 @ 8" | q | 1458 | 1470 | 1434 | 1446 | 1418 | 1430 | 1408 | 1240 | 1069 |
| | | F | 4.4+12R | 4.5+10R | 4.7+9R | 4.7+8R | 4.9+7R | 4.9+6R | 5+6R | 5+5R | 5.1+5R |
| VSC2 @ 4" | q | 1753 | 1749 | 1747 | 1744 | 1742 | 1732 | 1455 | 1240 | 1069 | |
| | F | 3.2+12R | 3.3+10R | 3.4+9R | 3.5+8R | 3.5+7R | 3.6+6R | 3.6+6R | 3.7+5R | 3.7+5R | |
| 18 | VSC2 @ 24" | q | 1034 | 1068 | 958 | 995 | 910 | 946 | 878 | 911 | 854 |
| | | F | 6.5+8R | 6.4+7R | 7.1+6R | 6.9+5R | 7.4+4R | 7.2+4R | 7.7+4R | 7.5+3R | 7.9+3R |
| | VSC2 @ 12" | q | 1482 | 1453 | 1431 | 1414 | 1399 | 1387 | 1377 | 1369 | 1263 |
| | | F | 4.6+9R | 4.7+7R | 4.8+6R | 4.9+6R | 5+5R | 5.1+5R | 5.1+4R | 5.2+4R | 5.2+4R |
| | VSC2 @ 8" | q | 1769 | 1783 | 1737 | 1753 | 1717 | 1732 | 1703 | 1465 | 1263 |
| | | F | 3.7+9R | 3.8+7R | 3.9+7R | 3.9+6R | 4.1+5R | 4.1+5R | 4.2+4R | 4.1+4R | 4.2+4R |
| VSC2 @ 4" | q | 2145 | 2140 | 2136 | 2133 | 2130 | 2047 | 1720 | 1465 | 1263 | |
| | F | 2.8+9R | 2.9+8R | 2.9+7R | 3+6R | 3+5R | 3.1+5R | 3.1+4R | 3.1+4R | 3.2+4R | |
| 16 | VSC2 @ 24" | q | 1367 | 1418 | 1273 | 1325 | 1215 | 1264 | 1175 | 1220 | 1146 |
| | | F | 5.4+4R | 5.3+4R | 5.8+3R | 5.6+3R | 6.1+2R | 5.9+2R | 6.3+2R | 6+2R | 6.4+2R |
| | VSC2 @ 12" | q | 1953 | 1919 | 1893 | 1872 | 1855 | 1841 | 1829 | 1819 | 1777 |
| | | F | 3.8+5R | 3.9+4R | 4+4R | 4+3R | 4.1+3R | 4.1+3R | 4.2+2R | 4.2+2R | 4.2+2R |
| | VSC2 @ 8" | q | 2313 | 2332 | 2277 | 2297 | 2254 | 2273 | 2238 | 2060 | 1777 |
| | | F | 3.1+5R | 3.1+4R | 3.2+4R | 3.2+3R | 3.3+3R | 3.3+3R | 3.4+2R | 3.3+2R | 3.4+2R |
| VSC2 @ 4" | q | 2762 | 2757 | 2753 | 2750 | 2747 | 2745 | 2418 | 2060 | 1777 | |
| | F | 2.4+5R | 2.4+4R | 2.4+4R | 2.5+3R | 2.5+3R | 2.5+3R | 2.5+3R | 2.5+2R | 2.6+2R | |

See footnotes on page 51.

- Without Concrete Fill
- 36/4 Weld Pattern at Supports
- Sidelaps connected with Button Punch or 1/2" Top Seam Weld



Allowable Diaphragm Shear Strengths, q (plf) and Flexibility Factors, F (in./lb. x 10⁶)

| DECK GAGE | SIDELAP ATTACHMENT | SPAN (ft.-in.) | | | | | | | | | |
|-----------|--------------------|----------------|----------|----------|----------|----------|---------|---------|---------|---------|---------|
| | | 6'-0" | 7'-0" | 8'-0" | 9'-0" | 10'-0" | 11'-0" | 12'-0" | 13'-0" | 14'-0" | |
| 22 | BP @ 24" | q | 188 | 171 | 150 | 141 | 127 | 122 | 112 | 109 | 101 |
| | | F | 18.2+20R | 20.4+16R | 23.2+12R | 24.9+9R | 27.6+6R | 29+4R | 31.5+2R | 32.8+1R | 35.1-1R |
| | BP @ 12" | q | 224 | 202 | 186 | 173 | 163 | 155 | 148 | 142 | 137 |
| | | F | 16.3+22R | 18.3+17R | 20.1+14R | 21.7+11R | 23.2+9R | 24.6+7R | 25.9+6R | 27.1+4R | 28.2+3R |
| | TSW @ 24" | q | 530 | 553 | 501 | 523 | 482 | 503 | 470 | 489 | 461 |
| | | F | 5.4+27R | 5.3+23R | 6+20R | 5.9+18R | 6.4+16R | 6.2+15R | 6.6+13R | 6.4+12R | 6.8+11R |
| | TSW @ 12" | q | 743 | 734 | 726 | 721 | 716 | 712 | 709 | 706 | 646 |
| | | F | 3.8+27R | 4.1+23R | 4.3+20R | 4.4+18R | 4.6+16R | 4.7+15R | 4.7+14R | 4.8+13R | 4.9+12R |
| 21 | BP @ 24" | q | 226 | 204 | 179 | 168 | 152 | 146 | 134 | 130 | 121 |
| | | F | 17.5+15R | 19.5+11R | 22.1+8R | 23.8+6R | 26.3+3R | 27.7+2R | 30+0R | 31.2-1R | 33.5-3R |
| | BP @ 12" | q | 270 | 241 | 222 | 207 | 195 | 185 | 177 | 170 | 164 |
| | | F | 15.6+16R | 17.5+12R | 19.2+10R | 20.7+8R | 22.1+6R | 23.4+4R | 24.7+3R | 25.8+2R | 26.9+1R |
| | TSW @ 24" | q | 615 | 641 | 579 | 605 | 557 | 580 | 541 | 563 | 530 |
| | | F | 5.3+21R | 5.2+18R | 5.8+16R | 5.6+14R | 6.1+13R | 5.9+12R | 6.3+11R | 6.1+10R | 6.4+9R |
| | TSW @ 12" | q | 866 | 854 | 845 | 838 | 832 | 828 | 823 | 820 | 745 |
| | | F | 3.7+21R | 4+18R | 4.1+16R | 4.3+14R | 4.4+13R | 4.4+12R | 4.5+11R | 4.6+10R | 4.6+9R |
| 20 | BP @ 24" | q | 267 | 240 | 210 | 198 | 178 | 172 | 157 | 153 | 142 |
| | | F | 16.8+11R | 18.7+8R | 21.2+5R | 22.8+3R | 25.2+1R | 26.5+0R | 28.7-2R | 29.8-3R | 32-4R |
| | BP @ 12" | q | 319 | 284 | 262 | 244 | 230 | 219 | 209 | 201 | 194 |
| | | F | 15+12R | 16.8+9R | 18.4+7R | 19.8+5R | 21.2+4R | 22.4+2R | 23.6+1R | 24.7+0R | 25.7+0R |
| | TSW @ 24" | q | 704 | 733 | 661 | 690 | 635 | 661 | 616 | 641 | 603 |
| | | F | 5.1+17R | 5+15R | 5.5+13R | 5.4+11R | 5.8+10R | 5.6+9R | 6+8R | 5.8+8R | 6.1+7R |
| | TSW @ 12" | q | 996 | 981 | 970 | 962 | 955 | 949 | 944 | 940 | 849 |
| | | F | 3.7+17R | 3.8+15R | 4+13R | 4.1+12R | 4.2+10R | 4.2+9R | 4.3+9R | 4.3+8R | 4.4+7R |
| 19 | BP @ 24" | q | 360 | 323 | 281 | 265 | 239 | 230 | 211 | 205 | 191 |
| | | F | 15.7+6R | 17.4+4R | 19.6+1R | 21.1+0R | 23.2-2R | 24.5-3R | 26.5-4R | 27.6-5R | 29.5-6R |
| | BP @ 12" | q | 430 | 383 | 351 | 328 | 309 | 294 | 281 | 270 | 261 |
| | | F | 14+7R | 15.6+5R | 17+3R | 18.3+2R | 19.6+1R | 20.7+0R | 21.8-1R | 22.8-2R | 23.7-2R |
| | TSW @ 24" | q | 897 | 931 | 838 | 873 | 801 | 834 | 776 | 807 | 758 |
| | | F | 4.8+11R | 4.7+10R | 5.1+9R | 5+8R | 5.3+7R | 5.2+6R | 5.5+6R | 5.3+5R | 5.6+5R |
| | TSW @ 12" | q | 1276 | 1256 | 1240 | 1227 | 1217 | 1208 | 1201 | 1195 | 1069 |
| | | F | 3.5+12R | 3.6+10R | 3.7+9R | 3.7+8R | 3.8+7R | 3.9+6R | 3.9+6R | 3.9+5R | 4+5R |
| 18 | BP @ 24" | q | 447 | 402 | 347 | 328 | 295 | 285 | 261 | 254 | 236 |
| | | F | 14.8+3R | 16.4+1R | 18.5+0R | 19.9-1R | 21.9-3R | 23.1-4R | 25-5R | 26-5R | 27.8-6R |
| | BP @ 12" | q | 535 | 478 | 435 | 407 | 384 | 365 | 349 | 336 | 325 |
| | | F | 13.2+4R | 14.7+3R | 16.1+1R | 17.3+0R | 18.4-1R | 19.5-1R | 20.5-2R | 21.4-3R | 22.3-3R |
| | TSW @ 24" | q | 1071 | 1110 | 997 | 1037 | 950 | 988 | 919 | 954 | 896 |
| | | F | 4.5+9R | 4.4+7R | 4.8+6R | 4.6+6R | 5+5R | 4.8+5R | 5.1+4R | 4.9+4R | 5.2+4R |
| | TSW @ 12" | q | 1530 | 1503 | 1482 | 1466 | 1452 | 1441 | 1432 | 1424 | 1263 |
| | | F | 3.3+9R | 3.4+8R | 3.4+7R | 3.5+6R | 3.6+5R | 3.6+5R | 3.6+4R | 3.7+4R | 3.7+4R |
| 16 | BP @ 24" | q | 602 | 548 | 473 | 447 | 402 | 391 | 359 | 352 | 327 |
| | | F | 13.2+0R | 14.6-1R | 16.5-3R | 17.7-3R | 19.5-4R | 20.5-5R | 22.2-6R | 23.1-6R | 24.7-7R |
| | BP @ 12" | q | 741 | 667 | 612 | 571 | 542 | 518 | 498 | 481 | 466 |
| | | F | 11.8+1R | 13.1+0R | 14.2-1R | 15.3-2R | 16.4-2R | 17.3-3R | 18.2-3R | 19-4R | 19.8-4R |
| | TSW @ 24" | q | 1407 | 1462 | 1315 | 1370 | 1258 | 1310 | 1219 | 1266 | 1190 |
| | | F | 4+5R | 3.9+4R | 4.2+3R | 4+3R | 4.3+3R | 4.2+3R | 4.4+2R | 4.3+2R | 4.5+2R |
| | TSW @ 12" | q | 2002 | 1970 | 1945 | 1926 | 1910 | 1896 | 1885 | 1876 | 1777 |
| | | F | 2.9+5R | 2.9+4R | 3+4R | 3+3R | 3.1+3R | 3.1+3R | 3.1+2R | 3.1+2R | 3.1+2R |

See footnotes on page 51.

#2 D.Fir Laminated WOOD COLUMNS (braced in weak axis by drywall/wood sheathing)

- Unbraced length: $l_i := (i + 7) \cdot \text{ft}$
- Ke effective length factor: $K_e := 1.00$
- Allowable compressive stress: $F_c := 1350 \cdot \text{psi}$ DF #2
- Load duration factor: $ldf := 1.00$
- Modulus of elasticity: $E_{\min} := 580000 \cdot \text{psi}$ DF #2
- Effective length: $l_e := l_i \cdot K_e$
- Limitation on le/d $\text{slender}_{i,j} := \text{if} \left(\frac{l_e}{d_j} < 50, 1, 0 \right)$
- Column Area: $A_{i,j} := b_j \cdot d_j \cdot \text{slender}_{i,j}$
- Reduction factor for built up columns $C_{\text{naill}} := 0.60$ NDS 15.3.2
- $c := 0.8$ 0.8 for sawn lumber
0.85 for round timber piles
0.9 for G.L. timbers

$$F_{cE_{i,j}} := \frac{0.822 \cdot E_{\min}}{\left(\frac{l_e}{d_j} \right)^2}$$

$$F_{c_{i,j}} := F_c \cdot \left[\frac{1 + \frac{F_{cE_{i,j}}}{F_c}}{2 \cdot c} - \sqrt{\left(\frac{1 + \frac{F_{cE_{i,j}}}{F_c}}{2 \cdot c} \right)^2 - \left(\frac{F_{cE_{i,j}}}{F_c} \right)} \right] \cdot ldf \cdot C_{\text{naill}}$$

Allowable Load: $Pa_{i,j} := F_{c_{i,j}} \cdot A_{i,j}$

Allowable load vs height

| HEIGHT | 2-2x4 | 3-2x4 | 4-2x4 | 5-2x4 | 2-2x6 | 3-2x6 | 4-2x6 | 5-2x6 | 6-2x6 |
|---------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| $l_i =$ | $Pa_{i,1} =$ | $Pa_{i,2} =$ | $Pa_{i,3} =$ | $Pa_{i,4} =$ | $Pa_{i,5} =$ | $Pa_{i,6} =$ | $Pa_{i,7} =$ | $Pa_{i,8} =$ | $Pa_{i,9} =$ |
| ft | lbf | lbf | lbf | lbf | lbf | lbf | lbf | lbf | lbf |
| 8 | 3502 | 5253 | 7004 | 8755 | 9883 | 14824 | 19766 | 24707 | 29648 |
| 9 | 2864 | 4296 | 5727 | 7159 | 8819 | 13229 | 17638 | 22048 | 26457 |
| 10 | 2372 | 3558 | 4743 | 5929 | 7763 | 11645 | 15527 | 19408 | 23290 |
| 11 | 1990 | 2985 | 3980 | 4975 | 6791 | 10187 | 13582 | 16978 | 20374 |
| 12 | 1691 | 2536 | 3381 | 4226 | 5937 | 8905 | 11873 | 14842 | 17810 |
| 13 | 1452 | 2178 | 2904 | 3630 | 5203 | 7805 | 10407 | 13009 | 15610 |
| 14 | 1260 | 1890 | 2520 | 3150 | 4581 | 6871 | 9162 | 11452 | 13743 |
| 15 | 0 | 0 | 0 | 0 | 4054 | 6081 | 8108 | 10134 | 12161 |
| 16 | 0 | 0 | 0 | 0 | 3607 | 5410 | 7213 | 9016 | 10820 |
| 17 | 0 | 0 | 0 | 0 | 3226 | 4838 | 6451 | 8064 | 9677 |
| 18 | 0 | 0 | 0 | 0 | 2900 | 4349 | 5799 | 7249 | 8699 |

DETERMINE THE ALLOWABLE AXIAL LOAD ON A STEEL COLUMN

*** HSS3-1/2x3-1/2x3/8 ***

Column properties

Area := 4.09·in² cross sectional area of column
 r := 1.26·in radius of gyration
 L := 18·ft length of column
 K := 1.0
 Fy := 46·ksi
 E := 29000·ksi

Design Procedure

$$KLr := K \cdot \frac{L}{r} \qquad KLr = 171.4$$

$$Cc := \sqrt{\frac{2 \cdot \pi^2 \cdot E}{Fy}} \qquad Cc = 111.6$$

$$A := \left[1 - \frac{KLr^2}{(2 \cdot Cc^2)} \right] \cdot Fy$$

$$B := \left(\frac{5}{3} \right) + \left[\frac{3 \cdot KLr}{(8 \cdot Cc)} \right] - \frac{KLr^3}{(8 \cdot Cc^3)}$$

$$FA := \frac{A}{B} \qquad FA = -4.6 \text{ ksi}$$

$$Faa := \frac{(12 \cdot \pi^2) \cdot E}{(23 \cdot KLr^2)} \qquad Faa = 5.1 \text{ ksi}$$

$$Fa := \text{if}(KLr < Cc, FA, Faa) \qquad Fa = 5.1 \text{ ksi}$$

$$P_{\text{allowable}} := Fa \cdot \text{Area} \qquad P_{\text{allowable}} = 20.8 \text{ kip}$$

$$\text{kip} \equiv 1000 \cdot \text{lb} \qquad \text{ksi} \equiv 1000 \cdot \frac{\text{lb}}{\text{in}^2}$$

DETERMINE THE ALLOWABLE AXIAL LOAD ON A STEEL COLUMN

*** HSS4x4x1/4 ***

Column properties

Area := $3.37 \cdot \text{in}^2$ cross sectional area of column

$r := 1.52 \cdot \text{in}$ radius of gyration

$L := 12 \cdot \text{ft}$ length of column

$K := 1.0$

$F_y := 46 \cdot \text{ksi}$

$E := 29000 \cdot \text{ksi}$

Design Procedure

$KLr := K \cdot \frac{L}{r}$ $KLr = 94.7$

$Cc := \sqrt{\frac{2 \cdot \pi^2 \cdot E}{F_y}}$ $Cc = 111.6$

$A := \left[1 - \frac{KLr^2}{(2 \cdot Cc^2)} \right] \cdot F_y$

$B := \left(\frac{5}{3} \right) + \left[\frac{3 \cdot KLr}{(8 \cdot Cc)} \right] - \frac{KLr^3}{(8 \cdot Cc^3)}$

$FA := \frac{A}{B}$ $FA = 15.4 \text{ ksi}$

$F_{aa} := \frac{(12 \cdot \pi^2) \cdot E}{(23 \cdot KLr^2)}$ $F_{aa} = 16.6 \text{ ksi}$

$F_a := \text{if}(KLr < Cc, FA, F_{aa})$ $F_a = 15.4 \text{ ksi}$

$P_{\text{allowable}} := F_a \cdot \text{Area}$ $P_{\text{allowable}} = 51.9 \text{ kip}$

$\text{kip} \equiv 1000 \cdot \text{lb}$ $\text{ksi} \equiv 1000 \cdot \frac{\text{lb}}{\text{in}^2}$

DETERMINE THE ALLOWABLE AXIAL LOAD ON A STEEL COLUMN

*** HSS5x5x1/4 ***

Column properties

Area := 4.30·in² cross sectional area of column
 r := 1.93·in radius of gyration
 L := 28·ft length of column
 K := 1.0
 Fy := 46·ksi
 E := 29000·ksi

Design Procedure

$$KLr := K \cdot \frac{L}{r} \qquad KLr = 174.1$$

$$Cc := \sqrt{\frac{2 \cdot \pi^2 \cdot E}{Fy}} \qquad Cc = 111.6$$

$$A := \left[1 - \frac{KLr^2}{(2 \cdot Cc^2)} \right] \cdot Fy$$

$$B := \left(\frac{5}{3} \right) + \left[\frac{3 \cdot KLr}{(8 \cdot Cc)} \right] - \frac{KLr^3}{(8 \cdot Cc^3)}$$

$$FA := \frac{A}{B} \qquad FA = -5.6 \text{ ksi}$$

$$Faa := \frac{(12 \cdot \pi^2) \cdot E}{(23 \cdot KLr^2)} \qquad Faa = 4.9 \text{ ksi}$$

$$Fa := \text{if}(KLr < Cc, FA, Faa) \qquad Fa = 4.9 \text{ ksi}$$

$$P_{\text{allowable}} := Fa \cdot \text{Area} \qquad P_{\text{allowable}} = 21.2 \text{ kip}$$

$$\text{kip} \equiv 1000 \cdot \text{lb} \qquad \text{ksi} \equiv 1000 \cdot \frac{\text{lb}}{\text{in}^2}$$

DESIGNER: Cambria M. Flowers, P.E., S.E.

TrusJoist Parallam COLUMNS, 2.0E long dim in plane of wall (short dim w/ stud size)

- Unbraced length: $l_i := (i + 6) \cdot \text{ft}$
- Ke effective length factor: $K_e := 1.00$
- Allowable compressive stress: $F_c := 2900 \cdot \text{psi}$ 2.0E PSL
- Load duration factor: $ldf := 1.00$
- Modulus of elasticity: $E := 2000000 \cdot \text{psi}$ 2.0E PSL
- Effective length: $l_e := l_i \cdot K_e$
- Limitation on le/d: $\text{slender}_{i,j} := \text{if} \left(\frac{l_e}{d_j} < 50, 1, 0 \right)$
- Column Area: $A_{i,j} := b_j \cdot d_j \cdot \text{slender}_{i,j}$
- $K_{cE} := 0.273$
- $c := 0.1$

$$F_{cE_{i,j}} := \frac{K_{cE} \cdot E}{\left(\frac{l_e}{d_j} \right)^2}$$

$$F_{c_{i,j}} := F_c \cdot \left[\frac{1 + \frac{F_{cE_{i,j}}}{F_c}}{2 \cdot c} - \sqrt{\left(\frac{1 + \frac{F_{cE_{i,j}}}{F_c}}{2 \cdot c} \right)^2 - \left(\frac{F_{cE_{i,j}}}{F_c} \right)} \right] \cdot ldf$$

$$\text{Allowable Load: } Pa_{i,j} := F_{c_{i,j}} \cdot A_{i,j} \cdot \left[1 + \left(\frac{l_i}{l_1} - 1 \right) \cdot \frac{1}{4} \right]$$

Allowable load at various

| HEIGHT | 4 x 4 | 4 x 6 heights | 4 x 8 | 4 x 6 | 6 x 6 | 6 x 8 |
|-----------------|---------------------|--------------------------|---------------------|---------------------|---------------------|---------------------|
| | 2x4 wall | 2x4 wall | 2x4 wall | 2x6 wall | 2x6 wall | 2x6 wall |
| | $Pa_{i,1} =$ lbf | $Pa_{i,2} =$ lbf | $Pa_{i,3} =$ lbf | $Pa_{i,4} =$ lbf | $Pa_{i,5} =$ lbf | $Pa_{i,6} =$ lbf |
| $l_i =$ 7 ft | 8920 | 13380 | 17840 | 23162 | 34744 | 46325 |
| 8 | 7487 | 11230 | 14973 | 20362 | 30544 | 40725 |
| 9 | 6373 | 9559 | 12746 | 17971 | 26957 | 35943 |
| 10 | 5496 | 8244 | 10992 | 15946 | 23918 | 31891 |
| 11 | 4796 | 7194 | 9592 | 14232 | 21348 | 28463 |
| 12 | 4229 | 6344 | 8458 | 12779 | 19168 | 25558 |
| 13 | 3764 | 5647 | 7529 | 11542 | 17314 | 23085 |
| 14 | 3378 | 5068 | 6757 | 10484 | 15727 | 20969 |
| 15 | 0 | 0 | 0 | 9574 | 14361 | 19147 |
| 16 | 0 | 0 | 0 | 8785 | 13178 | 17571 |
| 17 | 0 | 0 | 0 | 8099 | 12148 | 16197 |
| 18 | 0 | 0 | 0 | 7497 | 11246 | 14994 |

DESIGNER: Dany JP Tremblay, PE, PEng.

#1 D.Fir Solid WOOD COLUMNS (braced in weak axis by drywall/sheathing) (stand-alone for 6x6, 8x8, 10x10, 12x12)

- Unbraced length: $l_i := (i + 6) \cdot \text{ft}$
- Ke effective length factor: $K_e := 1.00$
- Allowable compressive stress: $F_c := 1500 \text{ psi}$ DF #1
- Load duration factor: $ldf := 1.00$
- Modulus of elasticity: $E_{\min} := 580000 \text{ psi}$ DF #1
- Effective length: $l_e := l_i \cdot K_e$
- Limitation on le/d $\text{slender}_{i,j} := \text{if} \left(\frac{l_e}{d_j} < 50, 1, 0 \right)$
- Column Area: $A_{i,j} := b_j \cdot d_j \cdot \text{slender}_{i,j}$
- $c := 0.8$ 0.8 for sawn lumber
0.85 for round timber piles
0.9 for G.L. timbers

$$F_{cE_{i,j}} := \frac{0.822 E_{\min}}{\left(\frac{l_e}{d_j} \right)^2}$$

$$F_{c_{i,j}} := F_c \cdot \left[\frac{1 + \frac{F_{cE_{i,j}}}{F_c}}{2 \cdot c} - \sqrt{\left(\frac{1 + \frac{F_{cE_{i,j}}}{F_c}}{2 \cdot c} \right)^2 - \left(\frac{F_{cE_{i,j}}}{F_c} \right)} \right] \cdot ldf$$

Allowable Load: $Pa_{i,j} := F_{c_{i,j}} \cdot A_{i,j} \cdot br_j$

Allowable load vs height

| HEIGHT | 2x4 wall | 2x4 wall | 2x6 wall | 2x6 wall | ←----- stand alone -----> | | | |
|---------|--------------|--------------|--------------|--------------|---------------------------|--------------|--------------|--------------|
| | 4x4 | 4x6 | 4x6 | 6x6 | 6x6 | 8x8 | 10x10 | 12x12 |
| $l_i =$ | $Pa_{i,1} =$ | $Pa_{i,3} =$ | $Pa_{i,2} =$ | $Pa_{i,4} =$ | $Pa_{i,5} =$ | $Pa_{i,6} =$ | $Pa_{i,7} =$ | $Pa_{i,8} =$ |
| | lbf | lbf | lbf | lbf | lbf | lbf | lbf | lbf |
| 7 ft | 8617 | 13542 | 22692 | 35658 | 28527 | 60795 | 113917 | 166956 |
| 8 | 6925 | 10883 | 20369 | 32008 | 25607 | 58191 | 111735 | 164950 |
| 9 | 5635 | 8855 | 17929 | 28174 | 22539 | 55010 | 109080 | 162549 |
| 10 | 4653 | 7312 | 15607 | 24526 | 19621 | 51304 | 105893 | 159705 |
| 11 | 3896 | 6123 | 13542 | 21280 | 17024 | 47237 | 102133 | 156366 |
| 12 | 3305 | 5194 | 11769 | 18494 | 14795 | 43045 | 97795 | 152486 |
| 13 | 2836 | 4457 | 10273 | 16144 | 12915 | 38956 | 92928 | 148033 |
| 14 | 2459 | 3864 | 9017 | 14170 | 11336 | 35132 | 87647 | 142997 |
| 15 | 0 | 0 | 7962 | 12512 | 10010 | 31656 | 82118 | 137408 |
| 16 | 0 | 0 | 7072 | 11113 | 8891 | 28551 | 76525 | 131337 |
| 17 | 0 | 0 | 6317 | 9927 | 7942 | 25805 | 71037 | 124903 |
| 18 | 0 | 0 | 5673 | 8915 | 7132 | 23386 | 65785 | 118249 |

DESIGNER: Cambria M. Flowers, P.E., S.E.

6.5ft Net Backfill, 8" wall, rebar at inside face option

fndn_height := 7·ft

Fndn_thick := 8·in

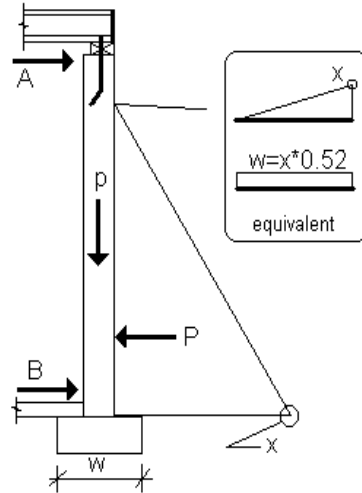
f_c := 2500·psi

f_y := 60000·psi

φ := 0.9

backfill := 6.5·ft

pressure := 40·pcf



b := 12·in

Section width

cover := 1.75·in

cover (tension side)

horz := 0.5·in

#4 horizontal bars

bar_{dia} := 0.5·in

#4 vertical bars

spacing := 24·in

bar spacing

A_{sprovided} = 0.098 in²

section depth d = 5.5 in

$$P := \frac{\text{backfill}^2}{2} \cdot \text{pressure}$$

$$P = 845 \frac{\text{lbf}}{\text{ft}}$$

$$A := P \cdot \frac{\text{backfill}}{3 \cdot \text{fndn_height}}$$

$$A = 262 \text{ plf}$$

$$B := P - A$$

$$B = 583 \text{ plf}$$

$$x := \text{backfill} \cdot \text{pressure}$$

$$x = 260 \text{ psf}$$

$$M := x \cdot 0.52 \cdot \text{ft} \cdot \frac{\text{fndn_height}^2}{8}$$

$$M = 828 \text{ lbf} \cdot \text{ft}$$

$$M_u := M \cdot 1.7$$

$$R_n := \frac{M_u}{\phi \cdot b \cdot d^2}$$

$$R_n = 51.7 \text{ psi}$$

$$\rho := \frac{0.85 \cdot f_c}{f_y} \cdot \left(1 - \sqrt{1 - \frac{2 \cdot R_n}{0.85 \cdot f_c}} \right) \quad \rho = 0.087 \%$$

$$A_{s\text{req}} := \rho \cdot b \cdot d$$

$$A_{s\text{req}} = 0.058 \text{ in}^2$$

$$A_{s\text{provided}} = 0.098 \text{ in}^2$$

OK**6.5ft Net Backfill, 8" wall, rebar at center section option**

fndn_height := 7·ft

Fndn_thick := 8·in

cover := Fndn_thick · 0.5 - 0.5·in

cover (tension side)

cover = 3.5 in

bar_{dia} := 0.5·in

spacing := 24·in

backfill := fndn_height - 6·in

f_c := 2500·psi

A_{sprovided} = 0.098 in²

Reinforcing area provided

φ := 0.9

d = 3.75 in Depth of rebar in section (center)

$$P := \frac{\text{backfill}^2}{2} \cdot \text{pressure}$$

$$P = 845 \frac{\text{lbf}}{\text{ft}}$$

$$A := P \cdot \frac{\text{backfill}}{3 \cdot \text{fndn_height}}$$

$$A = 262 \text{ plf}$$

$$B := P - A$$

$$B = 583 \text{ plf}$$

$$x := \text{backfill} \cdot \text{pressure}$$

$$x = 260 \text{ psf}$$

$$M := x \cdot 0.52 \cdot \text{ft} \cdot \frac{\text{fndn_height}^2}{8}$$

$$M = 828 \text{ lbf} \cdot \text{ft}$$

$$M_u := M \cdot 1.7$$

$$R_n := \frac{M_u}{\phi \cdot b \cdot d^2}$$

$$R_n = 111.2 \text{ psi}$$

$$\rho := \frac{0.85 \cdot f_c}{f_y} \cdot \left(1 - \sqrt{1 - \frac{2 \cdot R_n}{0.85 \cdot f_c}} \right) \quad \rho = 0.191 \%$$

$$A_{s\text{req}} := \rho \cdot b \cdot d$$

$$A_{s\text{req}} = 0.086 \text{ in}^2$$

$$A_{s\text{provided}} = 0.098 \text{ in}^2$$

OK

7.5ft Net Backfill, 8" wall, rebar at inside face option

$$\text{fndn_height} := 8\text{-ft}$$

$$\text{Fndn_thick} := 8\text{-in}$$

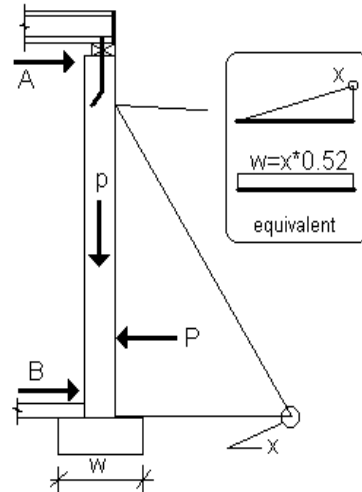
$$f_c := 2500\text{-psi}$$

$$f_y := 60000\text{-psi}$$

$$\phi := 0.9$$

$$\text{backfill} := 7.5\text{-ft}$$

$$\text{pressure} := 40\text{-pcf}$$



$$b := 12\text{-in}$$

Section width

$$\text{cover} := 1.75\text{-in}$$

cover (tension side)

$$\text{horz} := 0.5\text{-in}$$

#4 horizontal bars

$$\text{bar_dia} := 0.5\text{-in}$$

#4 vertical bars

$$\text{spacing} := 24\text{-in}$$

bar spacing

$$A_{s\text{provided}} = 0.098\text{ in}^2$$

$$\text{section depth } d = 5.5\text{ in}$$

$$P := \frac{\text{backfill}^2}{2} \cdot \text{pressure}$$

$$P = 1125 \frac{\text{lbf}}{\text{ft}}$$

$$A := P \cdot \frac{\text{backfill}}{3 \cdot \text{fndn_height}}$$

$$A = 352\text{ plf}$$

$$B := P - A$$

$$B = 773\text{ plf}$$

$$x := \text{backfill} \cdot \text{pressure}$$

$$x = 300\text{ psf}$$

$$M := x \cdot 0.52 \cdot \text{ft} \cdot \frac{\text{fndn_height}^2}{8}$$

$$M = 1248\text{ lbf}\cdot\text{ft}$$

$$M_u := M \cdot 1.7$$

$$R_n := \frac{M_u}{\phi \cdot b \cdot d^2}$$

$$R_n = 77.9\text{ psi}$$

$$\rho := \frac{0.85 \cdot f_c}{f_y} \cdot \left(1 - \sqrt{1 - \frac{2 \cdot R_n}{0.85 \cdot f_c}} \right) \quad \rho = 0.132\%$$

$$A_{s\text{req}} := \rho \cdot b \cdot d$$

$$A_{s\text{req}} = 0.087\text{ in}^2$$

$$A_{s\text{provided}} = 0.098\text{ in}^2 \quad \text{OK}$$

7.5ft Net Backfill, 8" wall, rebar at center section option

$$\text{fndn_height} := 8\text{-ft}$$

$$\text{Fndn_thick} := 8\text{-in}$$

$$\text{cover} := \text{Fndn_thick} \cdot 0.5 - 0.5\text{-in} \quad \text{cover (tension side)} \quad \text{cover} = 3.5\text{ in}$$

$$\text{bar_dia} := 0.5\text{-in}$$

$$\text{spacing} := 18\text{-in}$$

$$\text{backfill} := \text{fndn_height} - 6\text{-in}$$

$$f_c := 2500\text{-psi}$$

$$A_{s\text{provided}} = 0.131\text{ in}^2 \quad \text{Reinforcing area provided}$$

$$\phi := 0.9$$

$$d = 3.75\text{ in} \quad \text{Depth of rebar in section (center)}$$

$$P := \frac{\text{backfill}^2}{2} \cdot \text{pressure}$$

$$P = 1125 \frac{\text{lbf}}{\text{ft}}$$

$$A := P \cdot \frac{\text{backfill}}{3 \cdot \text{fndn_height}}$$

$$A = 352\text{ plf}$$

$$B := P - A$$

$$B = 773\text{ plf}$$

$$x := \text{backfill} \cdot \text{pressure}$$

$$x = 300\text{ psf}$$

$$M := x \cdot 0.52 \cdot \text{ft} \cdot \frac{\text{fndn_height}^2}{8}$$

$$M = 1248\text{ lbf}\cdot\text{ft}$$

$$M_u := M \cdot 1.7$$

$$R_n := \frac{M_u}{\phi \cdot b \cdot d^2}$$

$$R_n = 167.6\text{ psi}$$

$$\rho := \frac{0.85 \cdot f_c}{f_y} \cdot \left(1 - \sqrt{1 - \frac{2 \cdot R_n}{0.85 \cdot f_c}} \right) \quad \rho = 0.291\%$$

$$A_{s\text{req}} := \rho \cdot b \cdot d$$

$$A_{s\text{req}} = 0.131\text{ in}^2$$

$$A_{s\text{provided}} = 0.131\text{ in}^2 \quad \text{OK}$$

8.5ft Net Backfill, 8" wall, rebar at inside face option

$$\text{fndn_height} := 9 \cdot \text{ft}$$

$$\text{Fndn_thick} := 8 \cdot \text{in}$$

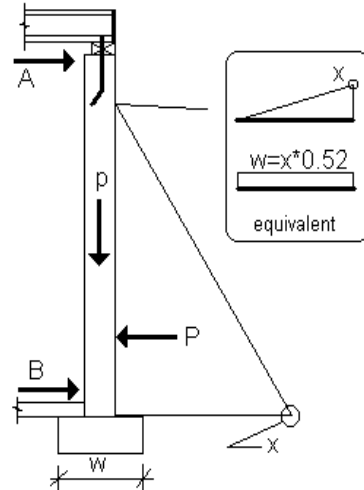
$$f_c := 2500 \cdot \text{psi}$$

$$f_y := 60000 \cdot \text{psi}$$

$$\phi := 0.9$$

$$\text{backfill} := 8.5 \cdot \text{ft}$$

$$\text{pressure} := 40 \cdot \text{pcf}$$



$$b := 12 \cdot \text{in}$$

Section width

$$\text{cover} := 1.75 \cdot \text{in}$$

cover (tension side)

$$\text{horz} := 0.5 \cdot \text{in}$$

#4 horizontal bars

$$\text{bar_dia} := 0.5 \cdot \text{in}$$

#4 vertical bars

$$\text{spacing} := 18 \cdot \text{in}$$

bar spacing

$$A_{s\text{provided}} = 0.131 \text{ in}^2$$

$$\text{section depth} \quad d = 5.5 \text{ in}$$

$$P := \frac{\text{backfill}^2}{2} \cdot \text{pressure}$$

$$P = 1445 \frac{\text{lbf}}{\text{ft}}$$

$$A := P \cdot \frac{\text{backfill}}{3 \cdot \text{fndn_height}}$$

$$A = 455 \text{ plf}$$

$$B := P - A$$

$$B = 990 \text{ plf}$$

$$x := \text{backfill} \cdot \text{pressure}$$

$$x = 340 \text{ psf}$$

$$M := x \cdot 0.52 \cdot \text{ft} \cdot \frac{\text{fndn_height}^2}{8}$$

$$M = 1790 \text{ lbf} \cdot \text{ft}$$

$$M_u := M \cdot 1.7$$

$$R_n := \frac{M_u}{\phi \cdot b \cdot d^2}$$

$$R_n = 111.8 \text{ psi}$$

$$\rho := \frac{0.85 \cdot f_c}{f_y} \cdot \left(1 - \sqrt{1 - \frac{2 \cdot R_n}{0.85 \cdot f_c}} \right) \quad \rho = 0.191 \%$$

$$A_{s\text{req}} := \rho \cdot b \cdot d$$

$$A_{s\text{req}} = 0.126 \text{ in}^2$$

$$A_{s\text{provided}} = 0.131 \text{ in}^2 \quad \text{OK}$$

8.5ft Net Backfill, 8" wall, rebar at center section option

$$\text{fndn_height} := 9 \cdot \text{ft}$$

$$\text{Fndn_thick} := 8 \cdot \text{in}$$

$$\text{cover} := \text{Fndn_thick} \cdot 0.5 - 0.5 \cdot \text{in} \quad \text{cover (tension side)} \quad \text{cover} = 3.5 \text{ in}$$

$$\text{bar_dia} := 0.5 \cdot \text{in}$$

$$\text{spacing} := 12 \cdot \text{in}$$

$$\text{backfill} := \text{fndn_height} - 6 \cdot \text{in}$$

$$f_c := 2500 \cdot \text{psi}$$

$$A_{s\text{provided}} = 0.196 \text{ in}^2 \quad \text{Reinforcing area provided}$$

$$\phi := 0.9$$

$$d = 3.75 \text{ in} \quad \text{Depth of rebar in section (center)}$$

$$P := \frac{\text{backfill}^2}{2} \cdot \text{pressure}$$

$$P = 1445 \frac{\text{lbf}}{\text{ft}}$$

$$A := P \cdot \frac{\text{backfill}}{3 \cdot \text{fndn_height}}$$

$$A = 455 \text{ plf}$$

$$B := P - A$$

$$B = 990 \text{ plf}$$

$$x := \text{backfill} \cdot \text{pressure}$$

$$x = 340 \text{ psf}$$

$$M := x \cdot 0.52 \cdot \text{ft} \cdot \frac{\text{fndn_height}^2}{8}$$

$$M = 1790 \text{ lbf} \cdot \text{ft}$$

$$M_u := M \cdot 1.7$$

$$R_n := \frac{M_u}{\phi \cdot b \cdot d^2}$$

$$R_n = 240.4 \text{ psi}$$

$$\rho := \frac{0.85 \cdot f_c}{f_y} \cdot \left(1 - \sqrt{1 - \frac{2 \cdot R_n}{0.85 \cdot f_c}} \right) \quad \rho = 0.426 \%$$

$$A_{s\text{req}} := \rho \cdot b \cdot d$$

$$A_{s\text{req}} = 0.192 \text{ in}^2$$

$$A_{s\text{provided}} = 0.196 \text{ in}^2 \quad \text{OK}$$

9.5ft Net Backfill, 8" wall, rebar at inside face option

$$\text{fndn_height} := 10\text{-ft}$$

$$\text{Fndn_thick} := 8\text{-in}$$

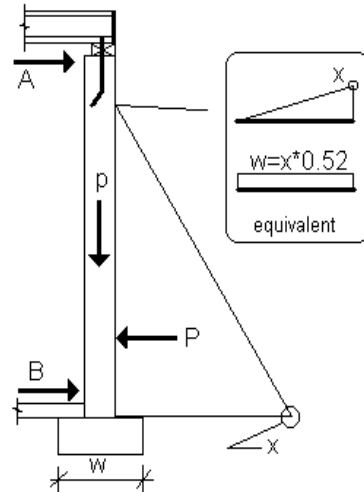
$$f_c := 2500\text{-psi}$$

$$f_y := 60000\text{-psi}$$

$$\phi := 0.9$$

$$\text{backfill} := 9.5\text{-ft}$$

$$\text{pressure} := 40\text{-pcf}$$



$$b := 12\text{-in}$$

Section width

$$\text{cover} := 1.75\text{-in}$$

cover (tension side)

$$\text{horz} := 0.5\text{-in}$$

#4 horizontal bars

$$\text{bar_dia} := 0.625\text{-in}$$

#5 vertical bars

$$\text{spacing} := 18\text{-in}$$

bar spacing

$$A_{s\text{provided}} = 0.205\text{ in}^2$$

section depth

$$d = 5.438\text{ in}$$

$$P := \frac{\text{backfill}^2}{2} \cdot \text{pressure}$$

$$P = 1805 \frac{\text{lb}}{\text{ft}}$$

$$A := P \cdot \frac{\text{backfill}}{3 \cdot \text{fndn_height}}$$

$$A = 572\text{ plf}$$

$$B := P - A$$

$$B = 1233\text{ plf}$$

$$x := \text{backfill} \cdot \text{pressure}$$

$$x = 380\text{ psf}$$

$$M := x \cdot 0.52 \cdot \text{ft} \cdot \frac{\text{fndn_height}^2}{8}$$

$$M = 2470\text{ lbf}\cdot\text{ft}$$

$$M_u := M \cdot 1.7$$

$$R_n := \frac{M_u}{\phi \cdot b \cdot d^2}$$

$$R_n = 157.8\text{ psi}$$

$$\rho := \frac{0.85 \cdot f_c}{f_y} \cdot \left(1 - \sqrt{1 - \frac{2 \cdot R_n}{0.85 \cdot f_c}} \right) \quad \rho = 0.274\%$$

$$A_{s\text{req}} := \rho \cdot b \cdot d$$

$$A_{s\text{req}} = 0.179\text{ in}^2$$

$$A_{s\text{provided}} = 0.205\text{ in}^2 \quad \text{OK}$$

9.5ft Net Backfill, 8" wall, rebar at center section option

$$\text{fndn_height} := 10\text{-ft}$$

$$\text{Fndn_thick} := 8\text{-in}$$

$$\text{cover} := \text{Fndn_thick} \cdot 0.5 - 0.5\text{-in} \quad \text{cover (tension side)} \quad \text{cover} = 3.5\text{ in}$$

$$\text{bar_dia} := 0.625\text{-in}$$

$$\text{spacing} := 10\text{-in}$$

$$\text{backfill} := \text{fndn_height} - 6\text{-in}$$

$$f_c := 2500\text{-psi}$$

$$A_{s\text{provided}} = 0.368\text{ in}^2$$

Reinforcing area provided

$$\phi := 0.9$$

$$d = 3.688\text{ in} \quad \text{Depth of rebar in section (center)}$$

$$P := \frac{\text{backfill}^2}{2} \cdot \text{pressure}$$

$$P = 1805 \frac{\text{lb}}{\text{ft}}$$

$$A := P \cdot \frac{\text{backfill}}{3 \cdot \text{fndn_height}}$$

$$A = 572\text{ plf}$$

$$B := P - A$$

$$B = 1233\text{ plf}$$

$$x := \text{backfill} \cdot \text{pressure}$$

$$x = 380\text{ psf}$$

$$M := x \cdot 0.52 \cdot \text{ft} \cdot \frac{\text{fndn_height}^2}{8}$$

$$M = 2470\text{ lbf}\cdot\text{ft}$$

$$M_u := M \cdot 1.7$$

$$R_n := \frac{M_u}{\phi \cdot b \cdot d^2}$$

$$R_n = 343.1\text{ psi}$$

$$\rho := \frac{0.85 \cdot f_c}{f_y} \cdot \left(1 - \sqrt{1 - \frac{2 \cdot R_n}{0.85 \cdot f_c}} \right) \quad \rho = 0.627\%$$

$$A_{s\text{req}} := \rho \cdot b \cdot d$$

$$A_{s\text{req}} = 0.278\text{ in}^2$$

$$A_{s\text{provided}} = 0.368\text{ in}^2 \quad \text{OK}$$

10.5ft Net Backfill, 10" wall, rebar at inside face option

$$\text{fndn_height} := 11 \cdot \text{ft}$$

$$\text{Fndn_thick} := 10 \cdot \text{in}$$

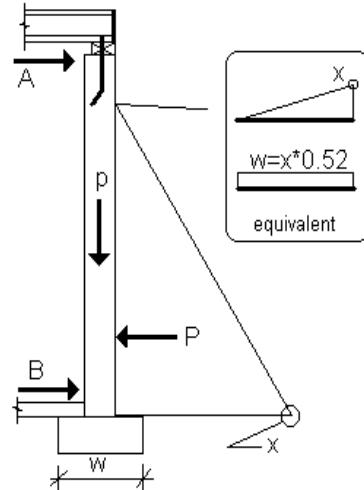
$$f_c := 2500 \cdot \text{psi}$$

$$f_y := 60000 \cdot \text{psi}$$

$$\phi := 0.9$$

$$\text{backfill} := 10.5 \cdot \text{ft}$$

$$\text{pressure} := 40 \cdot \text{pcf}$$



$$b := 12 \cdot \text{in}$$

Section width

$$\text{cover} := 1.75 \cdot \text{in}$$

cover (tension side)

$$\text{horz} := 0.5 \cdot \text{in}$$

#4 horizontal bars

$$\text{bar_dia} := 0.625 \cdot \text{in}$$

#5 vertical bars

$$\text{spacing} := 18 \cdot \text{in}$$

bar spacing

$$A_{s\text{provided}} = 0.205 \text{ in}^2$$

section depth

$$d = 7.438 \text{ in}$$

$$P := \frac{\text{backfill}^2}{2} \cdot \text{pressure}$$

$$P = 2205 \frac{\text{lbf}}{\text{ft}}$$

$$A := P \cdot \frac{\text{backfill}}{3 \cdot \text{fndn_height}}$$

$$A = 702 \text{ plf}$$

$$B := P - A$$

$$B = 1503 \text{ plf}$$

$$x := \text{backfill} \cdot \text{pressure}$$

$$x = 420 \text{ psf}$$

$$M := x \cdot 0.52 \cdot \text{ft} \cdot \frac{\text{fndn_height}^2}{8}$$

$$M = 3303 \text{ lbf} \cdot \text{ft}$$

$$M_u := M \cdot 1.7$$

$$R_n := \frac{M_u}{\phi \cdot b \cdot d^2}$$

$$R_n = 112.8 \text{ psi}$$

$$\rho := \frac{0.85 \cdot f_c}{f_y} \cdot \left(1 - \sqrt{1 - \frac{2 \cdot R_n}{0.85 \cdot f_c}} \right) \quad \rho = 0.193 \%$$

$$A_{s\text{req}} := \rho \cdot b \cdot d$$

$$A_{s\text{req}} = 0.172 \text{ in}^2$$

$$A_{s\text{provided}} = 0.205 \text{ in}^2$$

OK

10.5ft Net Backfill, 10" wall, rebar at center section option

$$\text{fndn_height} := 11 \cdot \text{ft}$$

$$\text{Fndn_thick} := 10 \cdot \text{in}$$

$$\text{cover} := \text{Fndn_thick} \cdot 0.5 - 0.5 \cdot \text{in}$$

cover (tension side)

$$\text{cover} = 4.5 \text{ in}$$

$$\text{bar_dia} := 0.625 \cdot \text{in}$$

$$\text{spacing} := 12 \cdot \text{in}$$

$$\text{backfill} := \text{fndn_height} - 6 \cdot \text{in}$$

$$f_c := 2500 \cdot \text{psi}$$

$$A_{s\text{provided}} = 0.307 \text{ in}^2$$

Reinforcing area provided

$$\phi := 0.9$$

$$d = 4.688 \text{ in} \quad \text{Depth of rebar in section (center)}$$

$$P := \frac{\text{backfill}^2}{2} \cdot \text{pressure}$$

$$P = 2205 \frac{\text{lbf}}{\text{ft}}$$

$$A := P \cdot \frac{\text{backfill}}{3 \cdot \text{fndn_height}}$$

$$A = 702 \text{ plf}$$

$$B := P - A$$

$$B = 1503 \text{ plf}$$

$$x := \text{backfill} \cdot \text{pressure}$$

$$x = 420 \text{ psf}$$

$$M := x \cdot 0.52 \cdot \text{ft} \cdot \frac{\text{fndn_height}^2}{8}$$

$$M = 3303 \text{ lbf} \cdot \text{ft}$$

$$M_u := M \cdot 1.7$$

$$R_n := \frac{M_u}{\phi \cdot b \cdot d^2}$$

$$R_n = 284 \text{ psi}$$

$$\rho := \frac{0.85 \cdot f_c}{f_y} \cdot \left(1 - \sqrt{1 - \frac{2 \cdot R_n}{0.85 \cdot f_c}} \right) \quad \rho = 0.51 \%$$

$$A_{s\text{req}} := \rho \cdot b \cdot d$$

$$A_{s\text{req}} = 0.287 \text{ in}^2$$

$$A_{s\text{provided}} = 0.307 \text{ in}^2$$

OK

11.5ft Net Backfill, 10" wall, rebar at inside face option

$$\text{fndn_height} := 12\text{-ft}$$

$$\text{Fndn_thick} := 10\text{-in}$$

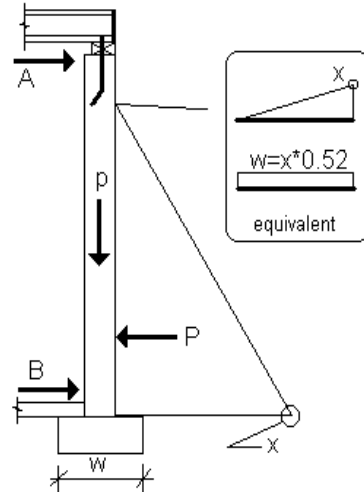
$$f_c := 2500\text{-psi}$$

$$f_y := 60000\text{-psi}$$

$$\phi := 0.9$$

$$\text{backfill} := 11.5\text{-ft}$$

$$\text{pressure} := 40\text{-pcf}$$



$$b := 12\text{-in}$$

Section width

$$\text{cover} := 1.75\text{-in}$$

cover (tension side)

$$\text{horz} := 0.5\text{-in}$$

#4 horizontal bars

$$\text{bar_dia} := 0.625\text{-in}$$

#5 vertical bars

$$\text{spacing} := 12\text{-in}$$

bar spacing

$$A_{s\text{provided}} = 0.307\text{ in}^2$$

section depth

$$d = 7.438\text{ in}$$

$$P := \frac{\text{backfill}^2}{2} \cdot \text{pressure}$$

$$P = 2645 \frac{\text{lbf}}{\text{ft}}$$

$$A := P \cdot \frac{\text{backfill}}{3 \cdot \text{fndn_height}}$$

$$A = 845\text{ plf}$$

$$B := P - A$$

$$B = 1800\text{ plf}$$

$$x := \text{backfill} \cdot \text{pressure}$$

$$x = 460\text{ psf}$$

$$M := x \cdot 0.52 \cdot \text{ft} \cdot \frac{\text{fndn_height}^2}{8}$$

$$M = 4306\text{ lbf}\cdot\text{ft}$$

$$M_u := M \cdot 1.7$$

$$R_n := \frac{M_u}{\phi \cdot b \cdot d^2}$$

$$R_n = 147\text{ psi}$$

$$\rho := \frac{0.85 \cdot f_c}{f_y} \cdot \left(1 - \sqrt{1 - \frac{2 \cdot R_n}{0.85 \cdot f_c}} \right) \quad \rho = 0.254\%$$

$$A_{s\text{req}} := \rho \cdot b \cdot d$$

$$A_{s\text{req}} = 0.227\text{ in}^2$$

$$A_{s\text{provided}} = 0.307\text{ in}^2$$

OK

11.5ft Net Backfill, 10" wall, rebar at center section option

$$\text{fndn_height} := 12\text{-ft}$$

$$\text{Fndn_thick} := 10\text{-in}$$

$$\text{cover} := \text{Fndn_thick} \cdot 0.5 - 0.5\text{-in}$$

cover (tension side)

$$\text{cover} = 4.5\text{ in}$$

$$\text{bar_dia} := 0.625\text{-in}$$

$$\text{spacing} := 8\text{-in}$$

$$\text{backfill} := \text{fndn_height} - 6\text{-in}$$

$$f_c := 2500\text{-psi}$$

$$A_{s\text{provided}} = 0.46\text{ in}^2$$

Reinforcing area provided

$$\phi := 0.9$$

$$d = 4.688\text{ in} \quad \text{Depth of rebar in section (center)}$$

$$P := \frac{\text{backfill}^2}{2} \cdot \text{pressure}$$

$$P = 2645 \frac{\text{lbf}}{\text{ft}}$$

$$A := P \cdot \frac{\text{backfill}}{3 \cdot \text{fndn_height}}$$

$$A = 845\text{ plf}$$

$$B := P - A$$

$$B = 1800\text{ plf}$$

$$x := \text{backfill} \cdot \text{pressure}$$

$$x = 460\text{ psf}$$

$$M := x \cdot 0.52 \cdot \text{ft} \cdot \frac{\text{fndn_height}^2}{8}$$

$$M = 4306\text{ lbf}\cdot\text{ft}$$

$$M_u := M \cdot 1.7$$

$$R_n := \frac{M_u}{\phi \cdot b \cdot d^2}$$

$$R_n = 370.1\text{ psi}$$

$$\rho := \frac{0.85 \cdot f_c}{f_y} \cdot \left(1 - \sqrt{1 - \frac{2 \cdot R_n}{0.85 \cdot f_c}} \right) \quad \rho = 0.683\%$$

$$A_{s\text{req}} := \rho \cdot b \cdot d$$

$$A_{s\text{req}} = 0.384\text{ in}^2$$

$$A_{s\text{provided}} = 0.46\text{ in}^2$$

OK

12.5ft Net Backfill, 10" wall, rebar at inside face option

$$\text{fndn_height} := 13 \cdot \text{ft}$$

$$\text{Fndn_thick} := 10 \cdot \text{in}$$

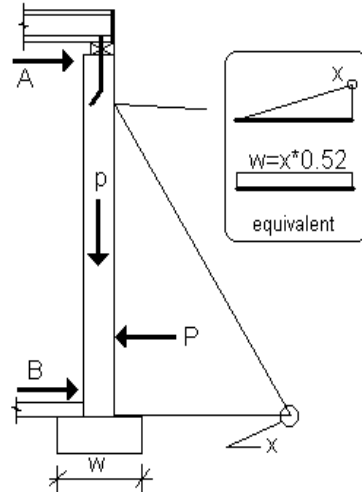
$$f_c := 2500 \cdot \text{psi}$$

$$f_y := 60000 \cdot \text{psi}$$

$$\phi := 0.9$$

$$\text{backfill} := 12.5 \cdot \text{ft}$$

$$\text{pressure} := 40 \cdot \text{pcf}$$



$$b := 12 \cdot \text{in}$$

Section width

$$\text{cover} := 1.75 \cdot \text{in}$$

cover (tension side)

$$\text{horz} := 0.625 \cdot \text{in}$$

#5 horizontal bars

$$\text{bar_dia} := 0.75 \cdot \text{in}$$

#6 vertical bars

$$\text{spacing} := 12 \cdot \text{in}$$

bar spacing

$$A_{s\text{provided}} = 0.442 \text{ in}^2$$

$$\text{section depth} \quad d = 7.25 \text{ in}$$

$$P := \frac{\text{backfill}^2}{2} \cdot \text{pressure}$$

$$P = 3125 \frac{\text{lbf}}{\text{ft}}$$

$$A := P \cdot \frac{\text{backfill}}{3 \cdot \text{fndn_height}}$$

$$A = 1002 \text{ plf}$$

$$B := P - A$$

$$B = 2123 \text{ plf}$$

$$x := \text{backfill} \cdot \text{pressure}$$

$$x = 500 \text{ psf}$$

$$M := x \cdot 0.52 \cdot \text{ft} \cdot \frac{\text{fndn_height}^2}{8}$$

$$M = 5492 \text{ lbf} \cdot \text{ft}$$

$$M_u := M \cdot 1.7$$

$$R_n := \frac{M_u}{\phi \cdot b \cdot d^2}$$

$$R_n = 197.4 \text{ psi}$$

$$\rho := \frac{0.85 \cdot f_c}{f_y} \cdot \left(1 - \sqrt{1 - \frac{2 \cdot R_n}{0.85 \cdot f_c}} \right) \quad \rho = 0.346 \%$$

$$A_{s\text{req}} := \rho \cdot b \cdot d$$

$$A_{s\text{req}} = 0.301 \text{ in}^2$$

$$A_{s\text{provided}} = 0.442 \text{ in}^2$$

OK

12.5ft Net Backfill, 10" wall, rebar at center section option

$$\text{fndn_height} := 13 \cdot \text{ft}$$

$$\text{Fndn_thick} := 10 \cdot \text{in}$$

$$\text{cover} := \text{Fndn_thick} \cdot 0.5 - 0.5 \cdot \text{in}$$

cover (tension side)

$$\text{cover} = 4.5 \text{ in}$$

$$\text{bar_dia} := 0.75 \cdot \text{in}$$

$$\text{spacing} := 8 \cdot \text{in}$$

$$\text{backfill} := \text{fndn_height} - 6 \cdot \text{in}$$

$$f_c := 2500 \cdot \text{psi}$$

$$A_{s\text{provided}} = 0.663 \text{ in}^2$$

Reinforcing area provided

$$\phi := 0.9$$

$$d = 4.5 \text{ in}$$

Depth of rebar in section (center)

$$P := \frac{\text{backfill}^2}{2} \cdot \text{pressure}$$

$$P = 3125 \frac{\text{lbf}}{\text{ft}}$$

$$A := P \cdot \frac{\text{backfill}}{3 \cdot \text{fndn_height}}$$

$$A = 1002 \text{ plf}$$

$$B := P - A$$

$$B = 2123 \text{ plf}$$

$$x := \text{backfill} \cdot \text{pressure}$$

$$x = 500 \text{ psf}$$

$$M := x \cdot 0.52 \cdot \text{ft} \cdot \frac{\text{fndn_height}^2}{8}$$

$$M = 5492 \text{ lbf} \cdot \text{ft}$$

$$M_u := M \cdot 1.7$$

$$R_n := \frac{M_u}{\phi \cdot b \cdot d^2}$$

$$R_n = 512.3 \text{ psi}$$

$$\rho := \frac{0.85 \cdot f_c}{f_y} \cdot \left(1 - \sqrt{1 - \frac{2 \cdot R_n}{0.85 \cdot f_c}} \right) \quad \rho = 0.993 \%$$

$$A_{s\text{req}} := \rho \cdot b \cdot d$$

$$A_{s\text{req}} = 0.536 \text{ in}^2$$

$$A_{s\text{provided}} = 0.663 \text{ in}^2$$

OK

13.5ft Net Backfill, 12" wall, rebar at inside face option

$$\text{fndn_height} := 14 \cdot \text{ft}$$

$$\text{Fndn_thick} := 12 \cdot \text{in}$$

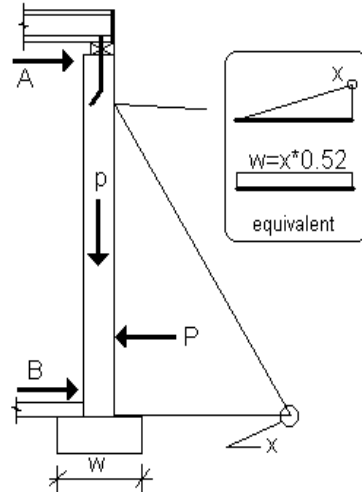
$$f_c := 2500 \cdot \text{psi}$$

$$f_y := 60000 \cdot \text{psi}$$

$$\phi := 0.9$$

$$\text{backfill} := 13.5 \cdot \text{ft}$$

$$\text{pressure} := 40 \cdot \text{pcf}$$



$$b := 12 \cdot \text{in}$$

$$\text{cover} := 1.75 \cdot \text{in}$$

$$\text{horz} := 0.625 \cdot \text{in}$$

$$\text{bar_dia} := 0.75 \cdot \text{in}$$

$$\text{spacing} := 12 \cdot \text{in}$$

Section width
cover (tension side)
#5 horizontal bars
#6 vertical bars
bar spacing

$$A_{S_{\text{provided}}} = 0.442 \text{ in}^2$$

$$\text{section depth} \quad d = 9.25 \text{ in}$$

$$P := \frac{\text{backfill}^2}{2} \cdot \text{pressure}$$

$$P = 3645 \frac{\text{lbf}}{\text{ft}}$$

$$A := P \cdot \frac{\text{backfill}}{3 \cdot \text{fndn_height}}$$

$$A = 1172 \text{ plf}$$

$$B := P - A$$

$$B = 2473 \text{ plf}$$

$$x := \text{backfill} \cdot \text{pressure}$$

$$x = 540 \text{ psf}$$

$$M := x \cdot 0.52 \cdot \text{ft} \cdot \frac{\text{fndn_height}^2}{8}$$

$$M = 6880 \text{ lbf} \cdot \text{ft}$$

$$M_u := M \cdot 1.7$$

$$R_n := \frac{M_u}{\phi \cdot b \cdot d^2}$$

$$R_n = 151.9 \text{ psi}$$

$$\rho := \frac{0.85 \cdot f_c}{f_y} \cdot \left(1 - \sqrt{1 - \frac{2 \cdot R_n}{0.85 \cdot f_c}} \right) \quad \rho = 0.263 \%$$

$$A_{S_{\text{req}}} := \rho \cdot b \cdot d$$

$$A_{S_{\text{req}}} = 0.292 \text{ in}^2$$

$$A_{S_{\text{provided}}} = 0.442 \text{ in}^2$$

OK

| | | |
|---|-------------|---------|
| PROJECT <i>Foundation Wall Schedule</i> | DATE | 08/2017 |
| | March, 2014 | |
| | DESIGNED BY | CMF |

| Height | Thickness | VERT | VERT space | HORZ | HORZ spacing |
|-----------|-----------|------|------------|------|------------------|
| 7 or less | 8" | #4 | 24" | #4 | 24" max |
| 8 | 8" | #4 | 18" | #4 | 5 bars EQ spaced |
| 9 | 8" | #4 | 12" | #4 | 6 bars EQ spaced |
| 10 | 8" | #5 | 10" | #4 | 7 bars EQ spaced |
| 11 | 10" | #5 | 12" | #4 | 8 bars EQ spaced |
| 12 | 10" | #5 | 8" | #4 | 9 bars EQ spaced |

Design Criteria:

$f_c' = 2,500 \text{ psi}$, provide 3,000psi for quality control

$f_y = 60 \text{ ksi}$

Active pressure = 40pcf

Restrained top & bot

Backfill to 6" of T.O.W.

Wall height is T.O.S. to T.O.W.

Steel at center of wall

Note: All walls require min one HORZ bar 4" from TOP & BOT.

Other HORZ bars to be spaced equally between the TOP & BOT bars with the spacing not to exceed that listed in the schedule

Anchor Bolts:

Typical anchor bolts UNO to be 5/8 Simpson Titen bolts w/ 3x3x1/4 washers & 5-1/2" embed per P/S3.

Title Block Line 1
 You can change this area
 using the "Settings" menu item
 and then using the "Printing &
 Title Block" selection.
 Title Block Line 6

Project Title:
 Engineer:
 Project Descr:

08/2017
 Project ID:

Printed: 29 AUG 2016, 9:26AM

File = C:\Users\cambria\Desktop\08CONC-1.EC6
 ENERCALC, INC. 1983-2016, Build:6.16.6.7, Ver:6.16.6.7

Cantilevered Retaining Wall

Lic. # : KW-06009078

Description : 2' wall

Licensee : Canyons Structural Inc

Criteria

| | | |
|--|---|----------|
| Retained Height | = | 2.50 ft |
| Wall height above soil | = | 0.00 ft |
| Slope Behind Wall | = | 0.00 : 1 |
| Height of Soil over Toe | = | 6.00 in |
| Water height over heel | = | 0.0 ft |
| Vertical component of active Lateral soil pressure options: | | |
| NOT USED for Soil Pressure. | | |
| USED for Sliding Resistance. | | |
| NOT USED for Overturning Resistance. | | |

Soil Data

| | | |
|---|---|--------------|
| Allow Soil Bearing | = | 1,500.0 psf |
| Equivalent Fluid Pressure Method | | |
| Heel Active Pressure | = | 40.0 psf/ft |
| Toe Active Pressure | = | 30.0 psf/ft |
| Passive Pressure | = | 320.0 psf/ft |
| Soil Density, Heel | = | 110.00 pcf |
| Soil Density, Toe | = | 0.00 pcf |
| Friction Coeff btwn Ftg & Soil | = | 0.450 |
| Soil height to ignore for passive pressure | = | 0.00 in |

Calculations per ACI 318-14, ACI 530-11, IBC 2015,
 CBC 2016, ASCE 7-10

Design Summary

| | | |
|--|-----|------------|
| Wall Stability Ratios | | |
| Overturning | = | 3.04 OK |
| Sliding | = | 3.19 OK |
| | | |
| Total Bearing Load | = | 700 lbs |
| ...resultant ecc. | = | 2.57 in |
| | | |
| Soil Pressure @ Toe | = | 575 psf OK |
| Soil Pressure @ Heel | = | 125 psf OK |
| Allowable | = | 1,500 psf |
| Soil Pressure Less Than Allowable | | |
| ACI Factored @ Toe | = | 690 psf |
| ACI Factored @ Heel | = | 150 psf |
| Footing Shear @ Toe | = | 0.0 psi OK |
| Footing Shear @ Heel | = | 3.7 psi OK |
| Allowable | = | 75.0 psi |
| Sliding Calcs (Vertical Component Used) | | |
| Lateral Sliding Force | = | 211.3 lbs |
| less 100% Passive Force | = - | 360.0 lbs |
| less 100% Friction Force | = - | 310.8 lbs |
| Added Force Req'd | = | 0.0 lbs OK |
| ...for 1.5 : 1 Stability | = | 0.0 lbs OK |
| | | |
| Load Factors | | |
| Dead Load | | 1.200 |
| Live Load | | 1.600 |
| Earth, H | | 1.600 |
| Wind, W | | 1.600 |
| Seismic, E | | 1.000 |

Stem Construction

| | Top Stem | 2nd |
|--------------------------------|------------|-------------------|
| Design Height Above Ftg | ft = 3.00 | Stem OK 0.00 |
| Wall Material Above "Ht" | = Concrete | Concrete |
| Thickness | in = 6.00 | 6.00 |
| Rebar Size | = # 4 | # 4 |
| Rebar Spacing | in = 18.00 | 18.00 |
| Rebar Placed at | = Edge | Edge |
| Design Data | | |
| fb/FB + fa/Fa | = | 0.000 0.067 |
| Total Force @ Section | lbs = | 0.0 194.0 |
| Moment....Actual | ft-l = | 0.0 165.7 |
| Moment....Allowable | ft-l = | 2,455.6 2,455.6 |
| Shear.....Actual | psi = | 0.0 3.8 |
| Shear.....Allowable | psi = | 75.0 75.0 |
| Wall Weight | psf = | 72.5 72.5 |
| Rebar Depth 'd' | in = | 4.25 4.25 |
| Lap splice if above | in = | 18.72 18.72 |
| Lap splice if below | in = | 18.72 5.04 |
| Hook embed into footing | in = | 18.72 5.04 |
| Concrete Data | | |
| f'c | psi = | 2,500.0 2,500.0 |
| Fy | psi = | 60,000.0 60,000.0 |

Title Block Line 1
 You can change this area
 using the "Settings" menu item
 and then using the "Printing &
 Title Block" selection.
 Title Block Line 6

Project Title:
 Engineer:
 Project Descr:

08/2017
 Project ID:

Printed: 29 AUG 2016, 9:26AM

Cantilevered Retaining Wall

File = C:\Users\cambria\Desktop\08CONC-1.EC6
 ENERCALC, INC. 1983-2016, Build:6.16.6.7, Ver:6.16.6.7
 Licensee : Canyons Structural Inc

Lic. # : KW-06009078

Description : 2' wall

Footing Dimensions & Strengths

| | | |
|--------------------------|--------------|-----------------|
| Toe Width | = | 0.67 ft |
| Heel Width | = | 1.33 |
| Total Footing Width | = | 2.00 |
| Footing Thickness | = | 12.00 in |
| Key Width | = | 0.00 in |
| Key Depth | = | 0.00 in |
| Key Distance from Toe | = | 0.00 ft |
| f'c = | 2,500 psi | Fy = 60,000 psi |
| Footing Concrete Density | = 145.00 pcf | |
| Min. As % | = 0.0018 | |
| Cover @ Top | 2.00 | @ Btm.= 3.00 in |

Footing Design Results

| | Toe | Heel |
|--------------------|------------------|-----------|
| Factored Pressure | = 690 | 150 psf |
| Mu' : Upward | = 141 | 0 ft-lb |
| Mu' : Downward | = 54 | 0 ft-lb |
| Mu : Design | = 87 | 166 ft-lb |
| Actual 1-Way Shear | = 0.00 | 3.67 psi |
| Allow 1-Way Shear | = 75.00 | 75.00 psi |
| Toe Reinforcing | = # 4 @ 18.00 in | |
| Heel Reinforcing | = # 4 @ 18.00 in | |
| Key Reinforcing | = None Spec'd | |

Other Acceptable Sizes & Spacings

Toe: Not req'd, Mu < S * Fr
 Heel: Not req'd, Mu < S * Fr
 Key: No key defined

Summary of Overturning & Resisting Forces & Moments

| Item |OVERTURNING..... | | |RESISTING..... | | | |
|---------------------------------------|-----------------------|-----------------|--------------|---------------------------|------------------|---------------|--------------|
| | Force lbs | Distance ft | Moment ft-lb | Force lbs | Distance ft | Moment ft-lb | |
| Heel Active Pressure | = 245.0 | 1.17 | 285.8 | Soil Over Heel | = 228.3 | 1.59 | 361.8 |
| Surcharge over Heel | = | | | Sloped Soil Over Heel | = | | |
| Toe Active Pressure | = -33.8 | 0.50 | -16.9 | Surcharge Over Heel | = | | |
| Surcharge Over Toe | = | | | Adjacent Footing Load | = | | |
| Adjacent Footing Load | = | | | Axial Dead Load on Stem | = | | |
| Added Lateral Load | = | | | * Axial Live Load on Stem | = | | |
| Load @ Stem Above Soil | = | | | Soil Over Toe | = | 0.34 | |
| | | | | Surcharge Over Toe | = | | |
| | | | | Stem Weight(s) | = 181.3 | 0.92 | 166.8 |
| | | | | Earth @ Stem Transitions | = | | |
| | | | | Footing Weight | = 290.0 | 1.00 | 290.0 |
| | | | | Key Weight | = | | |
| | | | | Vert. Component | = | | |
| Total | = 211.3 | O.T.M. = | 269.0 | Total = | 699.5 lbs | R.M. = | 818.5 |
| Resisting/Overturning Ratio | | = | 3.04 | | | | |
| Vertical Loads used for Soil Pressure | | = | 699.5 lbs | | | | |

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Title Block Line 1
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 Title Block Line 6

Project Title:
 Engineer:
 Project Descr:

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File = C:\Users\cambria\Desktop\08CONC-1.EC6
 ENERCALC, INC. 1983-2016, Build:6.16.6.7, Ver:6.16.6.7

Cantilevered Retaining Wall

Lic. # : KW-06009078

Description : 4' wall

Licensee : Canyons Structural Inc

Criteria

| | | |
|--|---|----------|
| Retained Height | = | 5.50 ft |
| Wall height above soil | = | 0.00 ft |
| Slope Behind Wall | = | 0.00 : 1 |
| Height of Soil over Toe | = | 18.00 in |
| Water height over heel | = | 0.0 ft |
| Vertical component of active Lateral soil pressure options: | | |
| NOT USED for Soil Pressure. | | |
| USED for Sliding Resistance. | | |
| NOT USED for Overturning Resistance. | | |

Soil Data

| | | |
|---|---|--------------|
| Allow Soil Bearing | = | 1,500.0 psf |
| Equivalent Fluid Pressure Method | | |
| Heel Active Pressure | = | 40.0 psf/ft |
| Toe Active Pressure | = | 30.0 psf/ft |
| Passive Pressure | = | 320.0 psf/ft |
| Soil Density, Heel | = | 110.00 pcf |
| Soil Density, Toe | = | 0.00 pcf |
| Friction Coeff btwn Ftg & Soil | = | 0.450 |
| Soil height to ignore for passive pressure | = | 0.00 in |

Calculations per ACI 318-14, ACI 530-11, IBC 2015,
 CBC 2016, ASCE 7-10

Design Summary

| | | |
|--|-----|--------------|
| Wall Stability Ratios | | |
| Overturning | = | 2.11 OK |
| Sliding | = | 2.42 OK |
| | | |
| Total Bearing Load | = | 1,810 lbs |
| ...resultant ecc. | = | 6.64 in |
| | | |
| Soil Pressure @ Toe | = | 1,126 psf OK |
| Soil Pressure @ Heel | = | 0 psf OK |
| Allowable | = | 1,500 psf |
| Soil Pressure Less Than Allowable | | |
| ACI Factored @ Toe | = | 1,351 psf |
| ACI Factored @ Heel | = | 0 psf |
| Footing Shear @ Toe | = | 4.2 psi OK |
| Footing Shear @ Heel | = | 10.5 psi OK |
| Allowable | = | 75.0 psi |
| Sliding Calcs (Vertical Component Used) | | |
| Lateral Sliding Force | = | 751.3 lbs |
| less 100% Passive Force | = - | 1,000.0 lbs |
| less 100% Friction Force | = - | 810.0 lbs |
| Added Force Req'd | = | 0.0 lbs OK |
| ...for 1.5 : 1 Stability | = | 0.0 lbs OK |
| | | |
| Load Factors | | |
| Dead Load | | 1.200 |
| Live Load | | 1.600 |
| Earth, H | | 1.600 |
| Wind, W | | 1.600 |
| Seismic, E | | 1.000 |

Stem Construction

| | Top Stem | 2nd |
|--------------------------------|------------|-------------------|
| Design Height Above Ftg | ft = 6.00 | Stem OK 0.00 |
| Wall Material Above "Ht" | = Concrete | Concrete |
| Thickness | in = 8.00 | 8.00 |
| Rebar Size | = # 4 | # 4 |
| Rebar Spacing | in = 18.00 | 18.00 |
| Rebar Placed at | = Edge | Edge |
| Design Data | | |
| fb/FB + fa/Fa | = | 0.000 0.478 |
| Total Force @ Section | lbs = | 0.0 914.0 |
| Moment....Actual | ft-l = | 0.0 1,747.7 |
| Moment....Allowable | ft-l = | 3,655.6 3,655.6 |
| Shear.....Actual | psi = | 0.0 12.2 |
| Shear.....Allowable | psi = | 75.0 75.0 |
| Wall Weight | psf = | 96.7 96.7 |
| Rebar Depth 'd' | in = | 6.25 6.25 |
| Lap splice if above | in = | 18.72 18.72 |
| Lap splice if below | in = | 18.72 5.04 |
| Hook embed into footing | in = | 18.72 5.04 |
| Concrete Data | | |
| f'c | psi = | 2,500.0 2,500.0 |
| Fy | psi = | 60,000.0 60,000.0 |

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Cantilevered Retaining Wall

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 ENERCALC, INC. 1983-2016, Build:6.16.6.7, Ver:6.16.6.7
 Licensee : Canyons Structural Inc

Lic. # : KW-06009078

Description : 4' wall

Footing Dimensions & Strengths

| | | |
|--------------------------|--------------|-----------------|
| Toe Width | = | 1.25 ft |
| Heel Width | = | 2.00 |
| Total Footing Width | = | 3.25 |
| Footing Thickness | = | 12.00 in |
| Key Width | = | 0.00 in |
| Key Depth | = | 0.00 in |
| Key Distance from Toe | = | 0.00 ft |
| f'c = | 2,500 psi | Fy = 60,000 psi |
| Footing Concrete Density | = 145.00 pcf | |
| Min. As % | = 0.0018 | |
| Cover @ Top | 2.00 | @ Btm.= 3.00 in |

Footing Design Results

| | | <u>Toe</u> | <u>Heel</u> |
|--------------------|---|----------------|-------------|
| Factored Pressure | = | 1,351 | 0 psf |
| Mu' : Upward | = | 919 | 0 ft-lb |
| Mu' : Downward | = | 291 | 800 ft-lb |
| Mu: Design | = | 628 | 800 ft-lb |
| Actual 1-Way Shear | = | 4.24 | 10.53 psi |
| Allow 1-Way Shear | = | 75.00 | 75.00 psi |
| Toe Reinforcing | = | # 4 @ 18.00 in | |
| Heel Reinforcing | = | # 4 @ 18.00 in | |
| Key Reinforcing | = | None Spec'd | |

Other Acceptable Sizes & Spacings

Toe: Not req'd, Mu < S * Fr
 Heel: Not req'd, Mu < S * Fr
 Key: No key defined

Summary of Overturning & Resisting Forces & Moments

| Item |OVERTURNING..... | | |RESISTING..... | | |
|---------------------------------------|-----------------------|----------------|-----------------|---------------------|----------------|-----------------|
| | Force lbs | Distance ft | Moment ft-lb | Force lbs | Distance ft | Moment ft-lb |
| Heel Active Pressure | = | 845.0 | 2.17 | 1,830.8 | | |
| Surcharge over Heel | = | | | | | |
| Toe Active Pressure | = | -93.8 | 0.83 | -78.1 | | |
| Surcharge Over Toe | = | | | | | |
| Adjacent Footing Load | = | | | | | |
| Added Lateral Load | = | | | | | |
| Load @ Stem Above Soil | = | | | | | |
| Total | = | 751.3 | O.T.M. = | 1,752.7 | | |
| Resisting/Overturning Ratio | | | = | 2.11 | | |
| Vertical Loads used for Soil Pressure | = | | | 1,809.6 lbs | | |
| Soil Over Heel | = | | | 806.7 | 2.58 | 2,083.9 |
| Sloped Soil Over Heel | = | | | | | |
| Surcharge Over Heel | = | | | | | |
| Adjacent Footing Load | = | | | | | |
| Axial Dead Load on Stem | = | | | | | |
| * Axial Live Load on Stem | = | | | | | |
| Soil Over Toe | = | | | | 0.63 | |
| Surcharge Over Toe | = | | | | | |
| Stem Weight(s) | = | | | 531.7 | 1.58 | 841.8 |
| Earth @ Stem Transitions | = | | | | | |
| Footing Weight | = | | | 471.3 | 1.63 | 765.8 |
| Key Weight | = | | | | | |
| Vert. Component | = | | | | | |
| Total | = | | | 1,809.6 lbs | R.M. = | 3,691.5 |

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

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 ENERCALC, INC. 1983-2016, Build:6.16.6.7, Ver:6.16.6.7

Cantilevered Retaining Wall

Lic. # : KW-06009078

Description : 6' wall

Licensee : Canyons Structural Inc

Criteria

| | | |
|--|---|----------|
| Retained Height | = | 7.50 ft |
| Wall height above soil | = | 0.00 ft |
| Slope Behind Wall | = | 0.00 : 1 |
| Height of Soil over Toe | = | 18.00 in |
| Water height over heel | = | 0.0 ft |
| Vertical component of active Lateral soil pressure options: | | |
| NOT USED for Soil Pressure. | | |
| USED for Sliding Resistance. | | |
| NOT USED for Overturning Resistance. | | |

Soil Data

| | | |
|---|---|--------------|
| Allow Soil Bearing | = | 1,500.0 psf |
| Equivalent Fluid Pressure Method | | |
| Heel Active Pressure | = | 40.0 psf/ft |
| Toe Active Pressure | = | 30.0 psf/ft |
| Passive Pressure | = | 320.0 psf/ft |
| Soil Density, Heel | = | 110.00 pcf |
| Soil Density, Toe | = | 0.00 pcf |
| Friction Coeff btwn Ftg & Soil | = | 0.450 |
| Soil height to ignore for passive pressure | = | 0.00 in |

Calculations per ACI 318-14, ACI 530-11, IBC 2015,
 CBC 2016, ASCE 7-10

Design Summary

| | | |
|--|-----|--------------|
| Wall Stability Ratios | | |
| Overturning | = | 1.82 OK |
| Sliding | = | 1.51 OK |
| | | |
| Total Bearing Load | = | 2,323 lbs |
| ...resultant ecc. | = | 9.98 in |
| | | |
| Soil Pressure @ Toe | = | 1,092 psf OK |
| Soil Pressure @ Heel | = | 0 psf OK |
| Allowable | = | 1,500 psf |
| Soil Pressure Less Than Allowable | | |
| ACI Factored @ Toe | = | 1,310 psf |
| ACI Factored @ Heel | = | 0 psf |
| Footing Shear @ Toe | = | 7.3 psi OK |
| Footing Shear @ Heel | = | 21.3 psi OK |
| Allowable | = | 75.0 psi |
| Sliding Calcs (Vertical Component Used) | | |
| Lateral Sliding Force | = | 1,351.3 lbs |
| less 100% Passive Force | = - | 1,000.0 lbs |
| less 100% Friction Force | = - | 1,048.8 lbs |
| Added Force Req'd | = | 0.0 lbs OK |
|for 1.5 : 1 Stability | = | 0.0 lbs OK |
| | | |
| Load Factors | | |
| Dead Load | | 1.200 |
| Live Load | | 1.600 |
| Earth, H | | 1.600 |
| Wind, W | | 1.600 |
| Seismic, E | | 1.000 |

Stem Construction

| | | |
|--------------------------|--------|----------|
| | | Top Stem |
| | | Stem OK |
| Design Height Above Ftg | ft = | 8.00 |
| Wall Material Above "Ht" | = | Concrete |
| Thickness | in = | 8.00 |
| Rebar Size | = | # 5 |
| Rebar Spacing | in = | 14.00 |
| Rebar Placed at | = | Edge |
| Design Data | | |
| fb/FB + fa/Fa | = | 0.000 |
| Total Force @ Section | lbs = | 0.0 |
| Moment....Actual | ft-l = | 0.0 |
| Moment....Allowable | ft-l = | 7,023.6 |
| Shear.....Actual | psi = | 0.0 |
| Shear.....Allowable | psi = | 75.0 |
| Wall Weight | psf = | 96.7 |
| Rebar Depth 'd' | in = | 6.19 |
| Lap splice if above | in = | 23.40 |
| Lap splice if below | in = | 10.50 |
| Hook embed into footing | in = | 10.50 |
| Concrete Data | | |
| f'c | psi = | 2,500.0 |
| Fy | psi = | |

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 ENERCALC, INC. 1983-2016, Build:6.16.6.7, Ver:6.16.6.7

Cantilevered Retaining Wall

Lic. #: KW-06009078

Description: 6' wall

Licensee: Canyons Structural Inc

Footing Dimensions & Strengths

| | | |
|--------------------------|-----------|------------------|
| Toe Width | = | 1.75 ft |
| Heel Width | = | 2.75 |
| Total Footing Width | = | 4.50 |
| Footing Thickness | = | 12.00 in |
| Key Width | = | 0.00 in |
| Key Depth | = | 0.00 in |
| Key Distance from Toe | = | 0.00 ft |
| f'c = | 2,500 psi | Fy = 60,000 psi |
| Footing Concrete Density | = | 145.00 pcf |
| Min. As % | = | 0.0018 |
| Cover @ Top | 2.00 | @ Btm. = 3.00 in |

Footing Design Results

| | Toe | Heel |
|--------------------|------------------|-------------|
| Factored Pressure | = 1,310 | 0 psf |
| Mu' : Upward | = 1,731 | 0 ft-lb |
| Mu' : Downward | = 570 | 2,526 ft-lb |
| Mu: Design | = 1,161 | 2,526 ft-lb |
| Actual 1-Way Shear | = 7.27 | 21.27 psi |
| Allow 1-Way Shear | = 75.00 | 75.00 psi |
| Toe Reinforcing | = # 5 @ 14.00 in | |
| Heel Reinforcing | = # 5 @ 14.00 in | |
| Key Reinforcing | = None Spec'd | |

Other Acceptable Sizes & Spacings

Toe: Not req'd, Mu < S * Fr
 Heel: Not req'd, Mu < S * Fr
 Key: No key defined

Summary of Overturning & Resisting Forces & Moments

| Item |OVERTURNING..... | | |RESISTING..... | | | |
|---------------------------------------|-----------------------|-----------------|----------------|---------------------------|--------------------|---------------|----------------|
| | Force lbs | Distance ft | Moment ft-lb | Force lbs | Distance ft | Moment ft-lb | |
| Heel Active Pressure | = 1,445.0 | 2.83 | 4,094.2 | Soil Over Heel | = 1,718.8 | 3.46 | 5,944.0 |
| Surcharge over Heel | = | | | Sloped Soil Over Heel | = | | |
| Toe Active Pressure | = -93.8 | 0.83 | -78.1 | Surcharge Over Heel | = | | |
| Surcharge Over Toe | = | | | Adjacent Footing Load | = | | |
| Adjacent Footing Load | = | | | Axial Dead Load on Stem | = | | |
| Added Lateral Load | = | | | * Axial Live Load on Stem | = | | |
| Load @ Stem Above Soil | = | | | Soil Over Toe | = | 0.88 | |
| | | | | Surcharge Over Toe | = | | |
| | | | | Stem Weight(s) | = -48.3 | 2.08 | -100.7 |
| | | | | Earth @ Stem Transitions | = | | |
| | | | | Footing Weight | = 652.5 | 2.25 | 1,468.1 |
| | | | | Key Weight | = | | |
| | | | | Vert. Component | = | | |
| Total | = 1,351.3 | O.T.M. = | 4,016.0 | Total = | 2,322.9 lbs | R.M. = | 7,311.4 |
| Resisting/Overturning Ratio | | = | 1.82 | | | | |
| Vertical Loads used for Soil Pressure | = | 2,322.9 lbs | | | | | |

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

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 ENERCALC, INC. 1983-2016, Build:6.16.6.7, Ver:6.16.6.7

Cantilevered Retaining Wall

Lic. # : KW-06009078

Description : 8' wall

Licensee : Canyons Structural Inc

Criteria

| | | |
|--|---|----------|
| Retained Height | = | 9.50 ft |
| Wall height above soil | = | 0.00 ft |
| Slope Behind Wall | = | 0.00 : 1 |
| Height of Soil over Toe | = | 18.00 in |
| Water height over heel | = | 0.0 ft |
| Vertical component of active Lateral soil pressure options: | | |
| NOT USED for Soil Pressure. | | |
| USED for Sliding Resistance. | | |
| NOT USED for Overturning Resistance. | | |

Soil Data

| | | |
|---|---|--------------|
| Allow Soil Bearing | = | 1,500.0 psf |
| Equivalent Fluid Pressure Method | | |
| Heel Active Pressure | = | 40.0 psf/ft |
| Toe Active Pressure | = | 30.0 psf/ft |
| Passive Pressure | = | 320.0 psf/ft |
| Soil Density, Heel | = | 110.00 pcf |
| Soil Density, Toe | = | 0.00 pcf |
| Friction Coeff btwn Ftg & Soil | = | 0.450 |
| Soil height to ignore for passive pressure | = | 0.00 in |

Calculations per ACI 318-14, ACI 530-11, IBC 2015,
 CBC 2016, ASCE 7-10

Design Summary

| | | |
|--|-----|--------------|
| Wall Stability Ratios | | |
| Overturning | = | 2.90 OK |
| Sliding | = | 1.68 OK |
| | | |
| Total Bearing Load | = | 5,557 lbs |
| ...resultant ecc. | = | 6.18 in |
| | | |
| Soil Pressure @ Toe | = | 1,262 psf OK |
| Soil Pressure @ Heel | = | 448 psf OK |
| Allowable | = | 1,500 psf |
| Soil Pressure Less Than Allowable | | |
| ACI Factored @ Toe | = | 1,514 psf |
| ACI Factored @ Heel | = | 538 psf |
| Footing Shear @ Toe | = | 11.9 psi OK |
| Footing Shear @ Heel | = | 33.4 psi OK |
| Allowable | = | 75.0 psi |
| Sliding Calcs (Vertical Component Used) | | |
| Lateral Sliding Force | = | 2,168.9 lbs |
| less 100% Passive Force | = - | 1,137.8 lbs |
| less 100% Friction Force | = - | 2,500.8 lbs |
| Added Force Req'd | = | 0.0 lbs OK |
| ...for 1.5 : 1 Stability | = | 0.0 lbs OK |
| Load Factors | | |
| Dead Load | | 1.200 |
| Live Load | | 1.600 |
| Earth, H | | 1.600 |
| Wind, W | | 1.600 |
| Seismic, E | | 1.000 |

Stem Construction

| | Top Stem | 2nd |
|--------------------------------|------------------|-----------------|
| Design Height Above Ftg | | |
| ft = | Stem OK 10.00 | Stem OK 0.00 |
| Wall Material Above "Ht" | Concrete | Concrete |
| Thickness | in = 10.00 | 10.00 |
| Rebar Size | = # 6 | # 5 |
| Rebar Spacing | in = 10.00 | 10.00 |
| Rebar Placed at | = Edge | Edge |
| Design Data | | |
| fb/FB + fa/Fa | = 0.000 | 0.703 |
| Total Force @ Section | lbs = 0.0 | 2,834.0 |
| Moment....Actual | ft-l = 0.0 | 9,118.3 |
| Moment....Allowable | ft-l = 16,636.7 | 12,971.1 |
| Shear.....Actual | psi = 0.0 | 28.8 |
| Shear.....Allowable | psi = 75.0 | 75.0 |
| Wall Weight | psf = 120.8 | 120.8 |
| Rebar Depth 'd' | in = 7.63 | 8.19 |
| Lap splice if above | in = 28.08 | 23.40 |
| Lap splice if below | in = 28.08 | 6.30 |
| Hook embed into footing | in = 28.08 | 6.30 |
| Concrete Data | | |
| f'c | psi = 2,500.0 | 2,500.0 |
| Fy | psi = 60,000.0 | 60,000.0 |

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 ENERCALC, INC. 1983-2016, Build:6.16.6.7, Ver:6.16.6.7
 Licensee : Canyons Structural Inc

Cantilevered Retaining Wall

Lic. # : KW-06009078

Description : 8' wall

Footing Dimensions & Strengths

| | | |
|--------------------------|--------------|-----------------|
| Toe Width | = | 2.50 ft |
| Heel Width | = | 4.00 |
| Total Footing Width | = | 6.50 |
| Footing Thickness | = | 14.00 in |
| Key Width | = | 0.00 in |
| Key Depth | = | 0.00 in |
| Key Distance from Toe | = | 0.00 ft |
| f'c = | 2,500 psi | Fy = 60,000 psi |
| Footing Concrete Density | = 145.00 pcf | |
| Min. As % | = 0.0018 | |
| Cover @ Top | 2.00 | @ Btm.= 3.00 in |

Footing Design Results

| | | <u>Toe</u> | <u>Heel</u> |
|--------------------|---|----------------|-------------|
| Factored Pressure | = | 1,514 | 538 psf |
| Mu' : Upward | = | 4,340 | 0 ft-lb |
| Mu' : Downward | = | 1,253 | 7,305 ft-lb |
| Mu : Design | = | 3,087 | 7,305 ft-lb |
| Actual 1-Way Shear | = | 11.93 | 33.43 psi |
| Allow 1-Way Shear | = | 75.00 | 75.00 psi |
| Toe Reinforcing | = | # 6 @ 10.00 in | |
| Heel Reinforcing | = | # 6 @ 10.00 in | |
| Key Reinforcing | = | None Spec'd | |

Other Acceptable Sizes & Spacings

Toe: Not req'd, Mu < S * Fr
 Heel: #4@ 9.75 in, #5@ 15.00 in, #6@ 21.50 in, #7@ 29.00 in, #8@ 38.25 in, #9@ 48
 Key: No key defined

Summary of Overturning & Resisting Forces & Moments

| Item |OVERTURNING..... | | | |RESISTING..... | | | | |
|---------------------------------------|-----------------------|----------------|-----------------|----------------|---------------------------|-------------|--------------------|---------------|-----------------|
| | Force lbs | Distance ft | Moment ft-lb | | Force lbs | Distance ft | Moment ft-lb | | |
| Heel Active Pressure | = | 2,275.6 | 3.56 | 8,090.9 | Soil Over Heel | = | 3,309.2 | 4.92 | 16,270.1 |
| Surcharge over Heel | = | | | | Sloped Soil Over Heel | = | | | |
| Toe Active Pressure | = | -106.7 | 0.89 | -94.8 | Surcharge Over Heel | = | | | |
| Surcharge Over Toe | = | | | | Adjacent Footing Load | = | | | |
| Adjacent Footing Load | = | | | | Axial Dead Load on Stem | = | | | |
| Added Lateral Load | = | | | | * Axial Live Load on Stem | = | | | |
| Load @ Stem Above Soil | = | | | | Soil Over Toe | = | | 1.25 | |
| | | | | | Surcharge Over Toe | = | | | |
| | | | | | Stem Weight(s) | = | 1,147.9 | 2.92 | 3,348.1 |
| | | | | | Earth @ Stem Transitions | = | | | |
| | | | | | Footing Weight | = | 1,099.6 | 3.25 | 3,573.6 |
| | | | | | Key Weight | = | | | |
| | | | | | Vert. Component | = | | | |
| Total | = | 2,168.9 | O.T.M. = | 7,996.0 | Total | = | 5,556.7 lbs | R.M. = | 23,191.8 |
| Resisting/Overturning Ratio | | | = | 2.90 | | | | | |
| Vertical Loads used for Soil Pressure | = | | 5,556.7 lbs | | | | | | |

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

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 ENERCALC, INC. 1983-2016, Build:6.16.6.7, Ver:6.16.6.7

Cantilevered Retaining Wall

Lic. # : KW-06009078

Description : 10' wall

Licensee : Canyons Structural Inc

Criteria

| | | |
|--|---|----------|
| Retained Height | = | 11.50 ft |
| Wall height above soil | = | 0.00 ft |
| Slope Behind Wall | = | 0.00 : 1 |
| Height of Soil over Toe | = | 18.00 in |
| Water height over heel | = | 0.0 ft |
| Vertical component of active Lateral soil pressure options: | | |
| NOT USED for Soil Pressure. | | |
| USED for Sliding Resistance. | | |
| NOT USED for Overturning Resistance. | | |

Soil Data

| | | |
|---|---|--------------|
| Allow Soil Bearing | = | 1,500.0 psf |
| Equivalent Fluid Pressure Method | | |
| Heel Active Pressure | = | 40.0 psf/ft |
| Toe Active Pressure | = | 30.0 psf/ft |
| Passive Pressure | = | 320.0 psf/ft |
| Soil Density, Heel | = | 110.00 pcf |
| Soil Density, Toe | = | 0.00 pcf |
| Friction Coeff btwn Ftg & Soil | = | 0.450 |
| Soil height to ignore for passive pressure | = | 0.00 in |

Calculations per ACI 318-14, ACI 530-11, IBC 2015,
 CBC 2016, ASCE 7-10

Design Summary

| | | |
|--|-----|--------------|
| Wall Stability Ratios | | |
| Overturning | = | 3.92 OK |
| Sliding | = | 1.78 OK |
| | | |
| Total Bearing Load | = | 9,733 lbs |
| ...resultant ecc. | = | 3.69 in |
| | | |
| Soil Pressure @ Toe | = | 1,303 psf OK |
| Soil Pressure @ Heel | = | 860 psf OK |
| Allowable | = | 1,500 psf |
| Soil Pressure Less Than Allowable | | |
| ACI Factored @ Toe | = | 1,564 psf |
| ACI Factored @ Heel | = | 1,032 psf |
| Footing Shear @ Toe | = | 13.2 psi OK |
| Footing Shear @ Heel | = | 54.0 psi OK |
| Allowable | = | 75.0 psi |
| Sliding Calcs (Vertical Component Used) | | |
| Lateral Sliding Force | = | 3,173.5 lbs |
| less 100% Passive Force | = - | 1,284.4 lbs |
| less 100% Friction Force | = - | 4,379.8 lbs |
| Added Force Req'd | = | 0.0 lbs OK |
| ...for 1.5 : 1 Stability | = | 0.0 lbs OK |
| Load Factors | | |
| Dead Load | | 1.200 |
| Live Load | | 1.600 |
| Earth, H | | 1.600 |
| Wind, W | | 1.600 |
| Seismic, E | | 1.000 |

Stem Construction

| | Top Stem | 2nd |
|--------------------------------|------------|-------------------|
| Design Height Above Ftg | ft = 12.00 | Stem OK 0.00 |
| Wall Material Above "Ht" | = Concrete | Concrete |
| Thickness | in = 12.00 | 12.00 |
| Rebar Size | = # 6 | # 6 |
| Rebar Spacing | in = 8.00 | 8.00 |
| Rebar Placed at | = Edge | Edge |
| Design Data | | |
| fb/FB + fa/Fa | = | 0.000 0.616 |
| Total Force @ Section | lbs = | 0.0 4,178.0 |
| Moment....Actual | ft-l = | 0.0 16,195.7 |
| Moment....Allowable | ft-l = | 26,273.2 26,273.2 |
| Shear.....Actual | psi = | 0.0 36.2 |
| Shear.....Allowable | psi = | 75.0 75.0 |
| Wall Weight | psf = | 145.0 145.0 |
| Rebar Depth 'd' | in = | 9.63 9.63 |
| Lap splice if above | in = | 28.08 28.08 |
| Lap splice if below | in = | 28.08 7.56 |
| Hook embed into footing | in = | 28.08 7.56 |
| Concrete Data | | |
| f'c | psi = | 2,500.0 2,500.0 |
| Fy | psi = | 60,000.0 60,000.0 |

Title Block Line 1
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Project Title:
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 Project Descr:

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Cantilevered Retaining Wall

File = C:\Users\cambria\Desktop\08CONC-1.EC6
 ENERCALC, INC. 1983-2016, Build:6.16.6.7, Ver:6.16.6.7
 Licensee : Canyons Structural Inc

Lic. # : KW-06009078

Description : 10' wall

Footing Dimensions & Strengths

| | | |
|--------------------------|-----------|-----------------|
| Toe Width | = | 3.00 ft |
| Heel Width | = | 6.00 |
| Total Footing Width | = | 9.00 |
| Footing Thickness | = | 16.00 in |
| Key Width | = | 0.00 in |
| Key Depth | = | 0.00 in |
| Key Distance from Toe | = | 0.00 ft |
| f'c = | 2,500 psi | Fy = 60,000 psi |
| Footing Concrete Density | = | 145.00 pcf |
| Min. As % | = | 0.0018 |
| Cover @ Top | 2.00 | @ Btm.= 3.00 in |

Footing Design Results

| | Toe | Heel |
|--------------------|-----------------|--------------|
| Factored Pressure | = 1,564 | 1,032 psf |
| Mu' : Upward | = 6,771 | 0 ft-lb |
| Mu' : Downward | = 1,935 | 0 ft-lb |
| Mu : Design | = 4,836 | 16,196 ft-lb |
| Actual 1-Way Shear | = 13.18 | 54.01 psi |
| Allow 1-Way Shear | = 75.00 | 75.00 psi |
| Toe Reinforcing | = # 6 @ 8.00 in | |
| Heel Reinforcing | = # 6 @ 8.00 in | |
| Key Reinforcing | = None Spec'd | |

Other Acceptable Sizes & Spacings

Toe: #4@ 9.00 in, #5@ 14.00 in, #6@ 19.75 in, #7@ 26.75 in, #8@ 35.25 in, #9@ 44
 Heel: #4@ 6.75 in, #5@ 10.25 in, #6@ 14.75 in, #7@ 20.00 in, #8@ 26.25 in, #9@ 33
 Key: No key defined

Summary of Overturning & Resisting Forces & Moments

| Item |OVERTURNING..... | | |RESISTING..... | | | |
|---------------------------------------|-----------------------|-----------------|-----------------|---------------------------|--------------------|---------------|-----------------|
| | Force lbs | Distance ft | Moment ft-lb | Force lbs | Distance ft | Moment ft-lb | |
| Heel Active Pressure | = 3,293.9 | 4.28 | 14,090.5 | Soil Over Heel | = 6,325.0 | 6.50 | 41,112.5 |
| Surcharge over Heel | = | | | Sloped Soil Over Heel | = | | |
| Toe Active Pressure | = -120.4 | 0.94 | -113.7 | Surcharge Over Heel | = | | |
| Surcharge Over Toe | = | | | Adjacent Footing Load | = | | |
| Adjacent Footing Load | = | | | Axial Dead Load on Stem | = | | |
| Added Lateral Load | = | | | * Axial Live Load on Stem | = | | |
| Load @ Stem Above Soil | = | | | Soil Over Toe | = | 1.50 | |
| | | | | Surcharge Over Toe | = | | |
| | | | | Stem Weight(s) | = 1,667.5 | 3.50 | 5,836.3 |
| | | | | Earth @ Stem Transitions | = | | |
| | | | | Footing Weight | = 1,740.0 | 4.50 | 7,830.0 |
| | | | | Key Weight | = | | |
| | | | | Vert. Component | = | | |
| Total | = 3,173.5 | O.T.M. = | 13,976.8 | Total = | 9,732.5 lbs | R.M. = | 54,778.8 |
| Resisting/Overturning Ratio | | = | 3.92 | | | | |
| Vertical Loads used for Soil Pressure | = | 9,732.5 lbs | | | | | |

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

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 ENERCALC, INC. 1983-2016, Build:6.16.6.7, Ver:6.16.6.7

Cantilevered Retaining Wall

Lic. # : KW-06009078

Description : 12' wall

Licensee : Canyons Structural Inc

Criteria

| | | |
|--|---|----------|
| Retained Height | = | 13.50 ft |
| Wall height above soil | = | 0.00 ft |
| Slope Behind Wall | = | 0.00 : 1 |
| Height of Soil over Toe | = | 18.00 in |
| Water height over heel | = | 0.0 ft |
| Vertical component of active Lateral soil pressure options: | | |
| NOT USED for Soil Pressure. | | |
| USED for Sliding Resistance. | | |
| NOT USED for Overturning Resistance. | | |

Soil Data

| | | |
|---|---|--------------|
| Allow Soil Bearing | = | 1,500.0 psf |
| Equivalent Fluid Pressure Method | | |
| Heel Active Pressure | = | 40.0 psf/ft |
| Toe Active Pressure | = | 30.0 psf/ft |
| Passive Pressure | = | 320.0 psf/ft |
| Soil Density, Heel | = | 110.00 pcf |
| Soil Density, Toe | = | 0.00 pcf |
| Friction Coeff btwn Ftg & Soil | = | 0.450 |
| Soil height to ignore for passive pressure | = | 0.00 in |

Calculations per ACI 318-14, ACI 530-11, IBC 2015,
 CBC 2016, ASCE 7-10

Design Summary

| | | |
|--|-----|--------------|
| Wall Stability Ratios | | |
| Overturning | = | 3.97 OK |
| Sliding | = | 1.65 OK |
| | | |
| Total Bearing Load | = | 12,783 lbs |
| ...resultant ecc. | = | 1.52 in |
| | | |
| Soil Pressure @ Toe | = | 1,242 psf OK |
| Soil Pressure @ Heel | = | 1,082 psf OK |
| Allowable | = | 1,500 psf |
| Soil Pressure Less Than Allowable | | |
| ACI Factored @ Toe | = | 1,491 psf |
| ACI Factored @ Heel | = | 1,298 psf |
| Footing Shear @ Toe | = | 14.4 psi OK |
| Footing Shear @ Heel | = | 54.3 psi OK |
| Allowable | = | 75.0 psi |
| Sliding Calcs (Vertical Component Used) | | |
| Lateral Sliding Force | = | 4,450.1 lbs |
| less 100% Passive Force | = - | 1,604.4 lbs |
| less 100% Friction Force | = - | 5,750.8 lbs |
| Added Force Req'd | = | 0.0 lbs OK |
| ...for 1.5 : 1 Stability | = | 0.0 lbs OK |
| Load Factors | | |
| Dead Load | | 1.200 |
| Live Load | | 1.600 |
| Earth, H | | 1.600 |
| Wind, W | | 1.600 |
| Seismic, E | | 1.000 |

Stem Construction

| | Top Stem | 2nd |
|--------------------------------|------------|-------------------|
| Design Height Above Ftg | ft = 14.00 | Stem OK 0.00 |
| Wall Material Above "Ht" | = Concrete | Concrete |
| Thickness | in = 12.00 | 12.00 |
| Rebar Size | = # 8 | # 8 |
| Rebar Spacing | in = 10.00 | 10.00 |
| Rebar Placed at | = Edge | Edge |
| Design Data | | |
| fb/FB + fa/Fa | = | 0.000 0.733 |
| Total Force @ Section | lbs = | 0.0 5,778.0 |
| Moment....Actual | ft-l = | 0.0 26,217.0 |
| Moment....Allowable | ft-l = | 35,754.9 35,754.9 |
| Shear.....Actual | psi = | 0.0 50.7 |
| Shear.....Allowable | psi = | 75.0 75.0 |
| Wall Weight | psf = | 145.0 145.0 |
| Rebar Depth 'd' | in = | 9.50 9.50 |
| Lap splice if above | in = | 47.04 47.04 |
| Lap splice if below | in = | 47.04 10.08 |
| Hook embed into footing | in = | 47.04 10.08 |
| Concrete Data | | |
| f'c | psi = | 2,500.0 2,500.0 |
| Fy | psi = | 60,000.0 60,000.0 |

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 Project Descr:

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Cantilevered Retaining Wall

File = C:\Users\cambria\Desktop\08CONC-1.EC6
 ENERCALC, INC. 1983-2016, Build:6.16.6.7, Ver:6.16.6.7
 Licensee : Canyons Structural Inc

Lic. # : KW-06009078

Description : 12' wall

Footing Dimensions & Strengths

| | | |
|--------------------------|--------------|-----------------|
| Toe Width | = | 4.50 ft |
| Heel Width | = | 6.50 |
| Total Footing Width | = | 11.00 |
| Footing Thickness | = | 20.00 in |
| Key Width | = | 0.00 in |
| Key Depth | = | 0.00 in |
| Key Distance from Toe | = | 0.00 ft |
| f'c = | 2,500 psi | Fy = 60,000 psi |
| Footing Concrete Density | = 145.00 pcf | |
| Min. As % | = 0.0018 | |
| Cover @ Top | 2.00 | @ Btm.= 3.00 in |

Footing Design Results

| | | <u>Toe</u> | <u>Heel</u> |
|--------------------|---|----------------|--------------|
| Factored Pressure | = | 1,491 | 1,298 psf |
| Mu' : Upward | = | 14,829 | 0 ft-lb |
| Mu' : Downward | = | 4,941 | 0 ft-lb |
| Mu: Design | = | 9,888 | 26,217 ft-lb |
| Actual 1-Way Shear | = | 14.35 | 54.27 psi |
| Allow 1-Way Shear | = | 75.00 | 75.00 psi |
| Toe Reinforcing | = | # 8 @ 10.00 in | |
| Heel Reinforcing | = | # 8 @ 10.00 in | |
| Key Reinforcing | = | None Spec'd | |

Other Acceptable Sizes & Spacings

Toe: #4@ 6.75 in, #5@ 10.50 in, #6@ 15.00 in, #7@ 20.25 in, #8@ 26.75 in, #9@ 33
 Heel: #4@ 5.50 in, #5@ 8.25 in, #6@ 11.75 in, #7@ 16.00 in, #8@ 21.00 in, #9@ 26.
 Key: No key defined

Summary of Overturning & Resisting Forces & Moments

| Item |OVERTURNING..... | | |RESISTING..... | | |
|---------------------------------------|-----------------------|----------------|-----------------|---------------------|----------------|-----------------|
| | Force lbs | Distance ft | Moment ft-lb | Force lbs | Distance ft | Moment ft-lb |
| Heel Active Pressure | = | 4,600.6 | 5.06 | 23,258.4 | | |
| Surcharge over Heel | = | | | | | |
| Toe Active Pressure | = | -150.4 | 1.06 | -158.8 | | |
| Surcharge Over Toe | = | | | | | |
| Adjacent Footing Load | = | | | | | |
| Added Lateral Load | = | | | | | |
| Load @ Stem Above Soil | = | | | | | |
| Total | = | 4,450.1 | O.T.M. = | 23,099.6 | | |
| Resisting/Overturning Ratio | | | = | 3.97 | | |
| Vertical Loads used for Soil Pressure | = | | | 12,783.3 lbs | | |
| Soil Over Heel | = | | | 8,167.5 | 8.25 | 67,381.9 |
| Sloped Soil Over Heel | = | | | | | |
| Surcharge Over Heel | = | | | | | |
| Adjacent Footing Load | = | | | | | |
| Axial Dead Load on Stem | = | | | | | |
| * Axial Live Load on Stem | = | | | | | |
| Soil Over Toe | = | | | | 2.25 | |
| Surcharge Over Toe | = | | | | | |
| Stem Weight(s) | = | | | 1,957.5 | 5.00 | 9,787.5 |
| Earth @ Stem Transitions | = | | | | | |
| Footing Weight | = | | | 2,658.3 | 5.50 | 14,620.8 |
| Key Weight | = | | | | | |
| Vert. Component | = | | | | | |
| Total | = | | | 12,783.3 lbs | R.M. = | 91,790.2 |

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

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 Project Descr:

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 Project ID:

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 ENERCALC, INC. 1983-2016, Build:6.16.6.7, Ver:6.16.6.7

Cantilevered Retaining Wall

Lic. # : KW-06009078

Description : 14' wall

Licensee : Canyons Structural Inc

Criteria

| | | |
|--|---|----------|
| Retained Height | = | 15.50 ft |
| Wall height above soil | = | 0.00 ft |
| Slope Behind Wall | = | 0.00 : 1 |
| Height of Soil over Toe | = | 18.00 in |
| Water height over heel | = | 0.0 ft |
| Vertical component of active Lateral soil pressure options: | | |
| NOT USED for Soil Pressure. | | |
| USED for Sliding Resistance. | | |
| NOT USED for Overturning Resistance. | | |

Soil Data

| | | |
|---|---|--------------|
| Allow Soil Bearing | = | 1,500.0 psf |
| Equivalent Fluid Pressure Method | | |
| Heel Active Pressure | = | 40.0 psf/ft |
| Toe Active Pressure | = | 30.0 psf/ft |
| Passive Pressure | = | 320.0 psf/ft |
| Soil Density, Heel | = | 110.00 pcf |
| Soil Density, Toe | = | 0.00 pcf |
| Friction Coeff btwn Ftg & Soil | = | 0.450 |
| Soil height to ignore for passive pressure | = | 0.00 in |

Calculations per ACI 318-14, ACI 530-11, IBC 2015,
 CBC 2016, ASCE 7-10

Design Summary

| | | |
|--|-----|--------------|
| Wall Stability Ratios | | |
| Overturning | = | 4.88 OK |
| Sliding | = | 1.78 OK |
| | | |
| Total Bearing Load | = | 19,140 lbs |
| ...resultant ecc. | = | 2.37 in |
| | | |
| Soil Pressure @ Toe | = | 1,252 psf OK |
| Soil Pressure @ Heel | = | 1,483 psf OK |
| Allowable | = | 1,500 psf |
| Soil Pressure Less Than Allowable | | |
| ACI Factored @ Toe | = | 1,502 psf |
| ACI Factored @ Heel | = | 1,779 psf |
| Footing Shear @ Toe | = | 14.3 psi OK |
| Footing Shear @ Heel | = | 68.8 psi OK |
| Allowable | = | 75.0 psi |
| Sliding Calcs (Vertical Component Used) | | |
| Lateral Sliding Force | = | 5,941.3 lbs |
| less 100% Passive Force | = - | 1,960.0 lbs |
| less 100% Friction Force | = - | 8,610.0 lbs |
| Added Force Req'd | = | 0.0 lbs OK |
| ...for 1.5 : 1 Stability | = | 0.0 lbs OK |
| Load Factors | | |
| Dead Load | | 1.200 |
| Live Load | | 1.600 |
| Earth, H | | 1.600 |
| Wind, W | | 1.600 |
| Seismic, E | | 1.000 |

Stem Construction

| | Top Stem | 2nd |
|--------------------------------|------------|-------------------|
| Design Height Above Ftg | ft = 16.00 | Stem OK 0.00 |
| Wall Material Above "Ht" | = Concrete | Concrete |
| Thickness | in = 13.00 | 13.00 |
| Rebar Size | = # 8 | # 8 |
| Rebar Spacing | in = 6.00 | 6.00 |
| Rebar Placed at | = Edge | Edge |
| Design Data | | |
| fb/FB + fa/Fa | = | 0.000 0.646 |
| Total Force @ Section | lbs = | 0.0 7,634.0 |
| Moment....Actual | ft-l = | 0.0 39,694.3 |
| Moment....Allowable | ft-l = | 61,399.1 61,399.1 |
| Shear.....Actual | psi = | 0.0 60.6 |
| Shear.....Allowable | psi = | 75.0 75.0 |
| Wall Weight | psf = | 157.1 157.1 |
| Rebar Depth 'd' | in = | 10.50 10.50 |
| Lap splice if above | in = | 47.04 47.04 |
| Lap splice if below | in = | 47.04 10.08 |
| Hook embed into footing | in = | 47.04 10.08 |
| Concrete Data | | |
| f'c | psi = | 2,500.0 2,500.0 |
| Fy | psi = | 60,000.0 60,000.0 |

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Cantilevered Retaining Wall

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 ENERCALC, INC. 1983-2016, Build:6.16.6.7, Ver:6.16.6.7
 Licensee : Canyons Structural Inc

Lic. # : KW-06009078

Description : 14' wall

Footing Dimensions & Strengths

| | | |
|--------------------------|-----------|-----------------|
| Toe Width | = | 5.50 ft |
| Heel Width | = | 8.50 |
| Total Footing Width | = | 14.00 |
| Footing Thickness | = | 24.00 in |
| Key Width | = | 0.00 in |
| Key Depth | = | 0.00 in |
| Key Distance from Toe | = | 0.00 ft |
| f'c = | 2,500 psi | Fy = 60,000 psi |
| Footing Concrete Density | = | 145.00 pcf |
| Min. As % | = | 0.0018 |
| Cover @ Top | 2.00 | @ Btm.= 3.00 in |

Footing Design Results

| | <u>Toe</u> | <u>Heel</u> |
|--------------------|-----------------|--------------|
| Factored Pressure | = 1,502 | 1,779 psf |
| Mu' : Upward | = 23,265 | 0 ft-lb |
| Mu' : Downward | = 8,258 | 0 ft-lb |
| Mu : Design | = 15,007 | 39,694 ft-lb |
| Actual 1-Way Shear | = 14.29 | 68.82 psi |
| Allow 1-Way Shear | = 75.00 | 75.00 psi |
| Toe Reinforcing | = # 8 @ 6.00 in | |
| Heel Reinforcing | = # 8 @ 6.00 in | |
| Key Reinforcing | = None Spec'd | |

Other Acceptable Sizes & Spacings

Toe: #4@ 5.50 in, #5@ 8.50 in, #6@ 12.00 in, #7@ 16.50 in, #8@ 21.50 in, #9@ 27.
 Heel: #4@ 4.50 in, #5@ 6.75 in, #6@ 9.50 in, #7@ 13.00 in, #8@ 17.00 in, #9@ 21.5
 Key: No key defined

Summary of Overturning & Resisting Forces & Moments

| Item |OVERTURNING..... | | | |RESISTING..... | | |
|---|-----------------------|-----------------|-----------------|---|---------------------|----------------|------------------|
| | Force lbs | Distance ft | Moment ft-lb | | Force lbs | Distance ft | Moment ft-lb |
| Heel Active Pressure | = 6,125.0 | 5.83 | 35,729.2 | Soil Over Heel | = 12,645.4 | 10.29 | 130,142.4 |
| Surcharge over Heel | = | | | Sloped Soil Over Heel | = | | |
| Toe Active Pressure | = -183.8 | 1.17 | -214.4 | Surcharge Over Heel | = | | |
| Surcharge Over Toe | = | | | Adjacent Footing Load | = | | |
| Adjacent Footing Load | = | | | Axial Dead Load on Stem | = | | |
| Added Lateral Load | = | | | * Axial Live Load on Stem | = | | |
| Load @ Stem Above Soil | = | | | Soil Over Toe | = | 2.75 | |
| | | | | Surcharge Over Toe | = | | |
| | | | | Stem Weight(s) | = 2,434.8 | 6.04 | 14,710.2 |
| | | | | Earth @ Stem Transitions | = | | |
| | | | | Footing Weight | = 4,060.0 | 7.00 | 28,420.0 |
| | | | | Key Weight | = | | |
| | | | | Vert. Component | = | | |
| Total | = 5,941.3 | O.T.M. = | 35,514.8 | Total = | 19,140.2 lbs | R.M. = | 173,272.6 |
| Resisting/Overturning Ratio | | = | 4.88 | * Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation. | | | |
| Vertical Loads used for Soil Pressure = | | | 19,140.2 lbs | | | | |

ROCK PROTECTED SLOPE

Rise := 4·ft

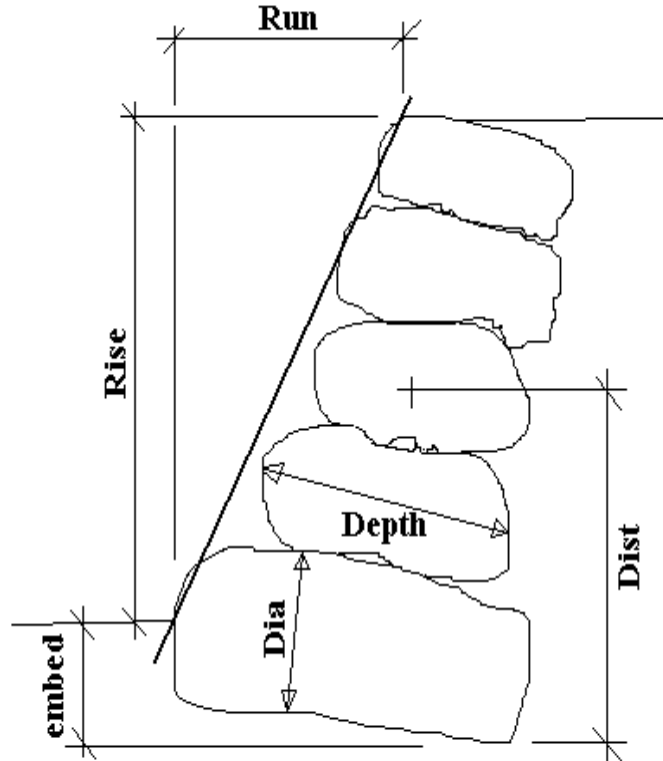
Run := 2·ft

Wall Properties

embed := 12·in

no_rocks := 4

| i = | dia _i := |
|-----|---------------------|
| 1 | 20·in |
| 2 | 16·in |
| 3 | 16·in |
| 4 | 8·in |



Total exposed wall height = 4 ft

Summary of Required Rock Dimensions (inches)

| i = | dia _i = in | depth _i = in |
|-----|--------------------------|----------------------------|
| 1 | 20 | 30 |
| 2 | 16 | 24 |
| 3 | 16 | 24 |
| 4 | 8 | 12 |

STABILITY OF ROCK PROTECTED SLOPE

rock data

$$wt := 150 \cdot \text{pcf}$$

$$\text{rock_weight}_i := wt \cdot (\text{dia}_i \cdot \text{depth}_i \cdot 0.85)$$

check sliding

$$\text{angle}_{\text{repose}} := 30 \cdot \text{deg}$$

The repose angle is based on the type of soil being retained

$$\text{active_pressure} := 45 \cdot \text{pcf}$$

$$\text{passive_pressure} := 280 \cdot \text{pcf}$$

$$\text{angle}_{\text{incline}} := \text{atan}(\text{Slope}^{-1})$$

$$\text{angle}_{\text{incline}} = 63.435 \text{ deg}$$

$$\text{reduction} := \frac{\text{angle}_{\text{incline}} - \text{angle}_{\text{repose}}}{90 \cdot \text{deg} - \text{angle}_{\text{repose}}}$$

$$\text{reduction} = 0.557$$

$$P := \text{active_pressure} \cdot \frac{\text{height}^2}{2} \cdot \text{reduction}$$

$$\text{active lateral soil pressure on each foot length of wall} \quad P = 0.31 \frac{\text{kip}}{\text{ft}}$$

$$\text{wall_weight} := \sum_i \text{rock_weight}_i$$

$$\text{wall_weight} = 1.3 \frac{\text{kip}}{\text{ft}}$$

$$\text{friction} := 0.5$$

$$\frac{\text{wall_weight} \cdot \text{friction} + \frac{\text{passive_pressure} \cdot \text{embed}^2}{2}}{P} = 2.51 \quad > 1.5 \text{ .. OK}$$

check overturning

$$\text{OTM} := P \cdot \frac{\text{height}}{3}$$

$$\text{OTM} = 0.5 \frac{\text{kip} \cdot \text{ft}}{\text{ft}}$$

$$\text{RM} := \sum_i \text{rock_weight}_i \cdot \text{Dist}_i$$

$$\text{RM} = 2.9 \frac{\text{kip} \cdot \text{ft}}{\text{ft}}$$

$$\frac{\text{RM}}{\text{OTM}} = 5.51$$

$$> 1.5 \text{ .. OK}$$

ROCK PROTECTED SLOPE

Rise := 6·ft

Run := 3·ft

Wall Properties

embed := 12·in

no_rocks := 5

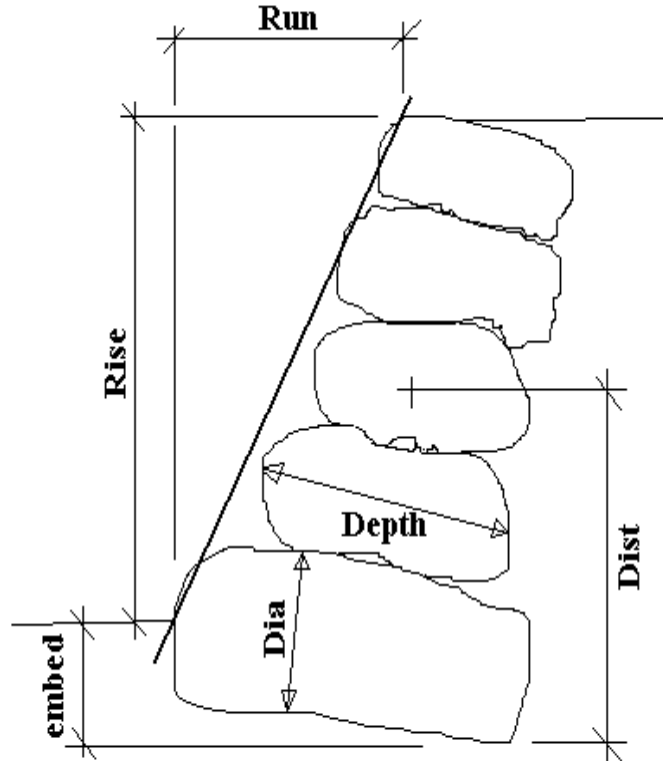
i =

| |
|---|
| 1 |
| 2 |
| 3 |
| 4 |
| 5 |

dia_i :=

| |
|-------|
| 24·in |
| 20·in |
| 18·in |
| 16·in |
| 6·in |

Total exposed wall height = 6 ft



Summary of Required Rock Dimensions (inches)

| i = | dia _i in = | depth _i in = |
|-----|--------------------------|----------------------------|
| 1 | 24 | 36 |
| 2 | 20 | 30 |
| 3 | 18 | 27 |
| 4 | 16 | 24 |
| 5 | 6 | 9 |

STABILITY OF ROCK PROTECTED SLOPE

rock data

$$wt := 150 \cdot \text{pcf}$$

$$\text{rock_weight}_i := wt \cdot (\text{dia}_i \cdot \text{depth}_i \cdot 0.85)$$

check sliding

$$\text{angle}_{\text{repose}} := 30 \cdot \text{deg}$$

The repose angle is based on the type of soil being retained

$$\text{active_pressure} := 45 \cdot \text{pcf}$$

$$\text{passive_pressure} := 280 \cdot \text{pcf}$$

$$\text{angle}_{\text{incline}} := \text{atan}(\text{Slope}^{-1})$$

$$\text{angle}_{\text{incline}} = 63.435 \text{ deg}$$

$$\text{reduction} := \frac{\text{angle}_{\text{incline}} - \text{angle}_{\text{repose}}}{90 \cdot \text{deg} - \text{angle}_{\text{repose}}}$$

$$\text{reduction} = 0.557$$

$$P := \text{active_pressure} \cdot \frac{\text{height}^2}{2} \cdot \text{reduction}$$

$$\text{active lateral soil pressure on each foot length of wall} \quad P = 0.61 \frac{\text{kip}}{\text{ft}}$$

$$\text{wall_weight} := \sum_i \text{rock_weight}_i$$

$$\text{wall_weight} = 2.11 \frac{\text{kip}}{\text{ft}}$$

$$\text{friction} := 0.50$$

$$\frac{\text{wall_weight} \cdot \text{friction} + \frac{\text{passive_pressure} \cdot \text{embed}^2}{2}}{P} = 1.95 \quad > 1.5 \text{ .. OK}$$

check overturning

$$\text{OTM} := P \cdot \frac{\text{height}}{3}$$

$$\text{OTM} = 1.4 \frac{\text{kip} \cdot \text{ft}}{\text{ft}}$$

$$\text{RM} := \sum_i \text{rock_weight}_i \cdot \text{Dist}_i$$

$$\text{RM} = 6.5 \frac{\text{kip} \cdot \text{ft}}{\text{ft}}$$

$$\frac{\text{RM}}{\text{OTM}} = 4.52$$

$$> 1.5 \text{ .. OK}$$

ROCK PROTECTED SLOPE

Rise := 8·ft

Run := 3.5·ft

Wall Properties

embed := 16·in

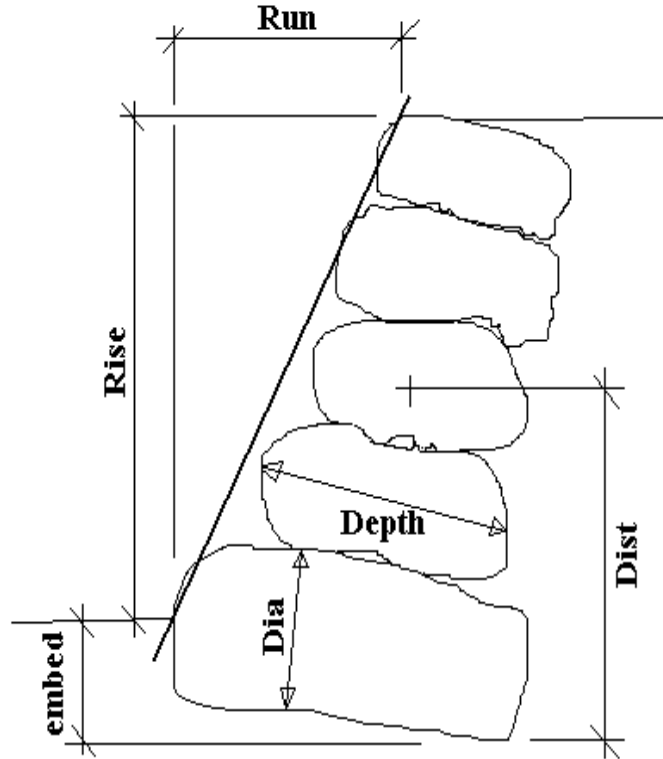
no_rocks := 5

i =

| |
|---|
| 1 |
| 2 |
| 3 |
| 4 |
| 5 |

dia_i :=

| |
|-------|
| 30·in |
| 24·in |
| 22·in |
| 18·in |
| 18·in |



Total exposed wall height = 8 ft

Summary of Required Rock Dimensions (inches)

| i = | dia _i in = | depth _i in = |
|-----|--------------------------|----------------------------|
| 1 | 30 | 45 |
| 2 | 24 | 36 |
| 3 | 22 | 33 |
| 4 | 18 | 27 |
| 5 | 18 | 27 |

STABILITY OF ROCK PROTECTED SLOPE

rock data

$$wt := 150 \cdot \text{pcf}$$

$$\text{rock_weight}_i := wt \cdot (\text{dia}_i \cdot \text{depth}_i \cdot 0.85)$$

check sliding

$$\text{angle}_{\text{repose}} := 30 \cdot \text{deg}$$

The repose angle is based on the type of soil being retained

$$\text{active_pressure} := 45 \cdot \text{pcf}$$

$$\text{passive_pressure} := 280 \cdot \text{pcf}$$

$$\text{angle}_{\text{incline}} := \text{atan}(\text{Slope}^{-1})$$

$$\text{angle}_{\text{incline}} = 66.371 \text{ deg}$$

$$\text{reduction} := \frac{\text{angle}_{\text{incline}} - \text{angle}_{\text{repose}}}{90 \cdot \text{deg} - \text{angle}_{\text{repose}}}$$

$$\text{reduction} = 0.606$$

$$P := \text{active_pressure} \cdot \frac{\text{height}^2}{2} \cdot \text{reduction}$$

$$\text{active lateral soil pressure on each foot length of wall} \quad P = 1.19 \frac{\text{kip}}{\text{ft}}$$

$$\text{wall_weight} := \sum_i \text{rock_weight}_i$$

$$\text{wall_weight} = 3.46 \frac{\text{kip}}{\text{ft}}$$

$$\text{friction} := 0.50$$

$$\frac{\text{wall_weight} \cdot \text{friction} + \frac{\text{passive_pressure} \cdot \text{embed}^2}{2}}{P} = 1.67 > 1.5 \text{ .. OK}$$

check overturning

$$\text{OTM} := P \cdot \frac{\text{height}}{3}$$

$$\text{OTM} = 3.7 \frac{\text{kip} \cdot \text{ft}}{\text{ft}}$$

$$\text{RM} := \sum_i \text{rock_weight}_i \cdot \text{Dist}_i$$

$$\text{RM} = 14.4 \frac{\text{kip} \cdot \text{ft}}{\text{ft}}$$

$$\frac{\text{RM}}{\text{OTM}} = 3.89$$

$$> 1.5 \text{ .. OK}$$

ROCK PROTECTED SLOPE

Rise := 10-ft

Run := 4.5-ft

Wall Properties

embed := 22-in

no_rocks := 6

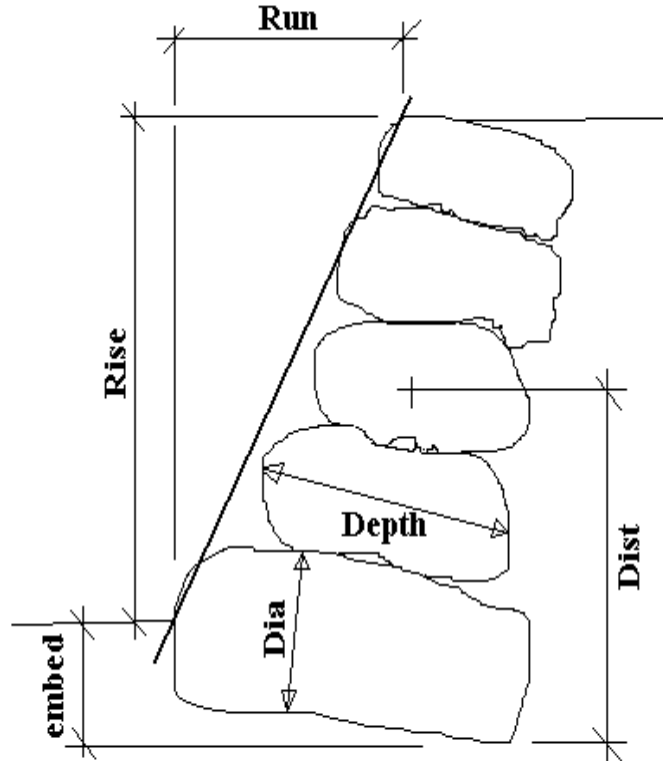
i =

| |
|---|
| 1 |
| 2 |
| 3 |
| 4 |
| 5 |
| 6 |

dia_i :=

| |
|-------|
| 36-in |
| 32-in |
| 26-in |
| 18-in |
| 18-in |
| 12-in |

Total exposed wall
height = 10 ft



Summary of Required Rock Dimensions (inches)

| i = | dia _i in = | depth _i in = |
|-----|--------------------------|----------------------------|
| 1 | 36 | 54 |
| 2 | 32 | 48 |
| 3 | 26 | 39 |
| 4 | 18 | 27 |
| 5 | 18 | 27 |
| 6 | 12 | 18 |

STABILITY OF ROCK PROTECTED SLOPE

rock data

$$wt := 150 \cdot \text{pcf}$$

$$\text{rock_weight}_i := wt \cdot (\text{dia}_i \cdot \text{depth}_i \cdot 0.85)$$

check sliding

$$\text{angle}_{\text{repose}} := 30 \cdot \text{deg}$$

The repose angle is based on the type of soil being retained

$$\text{active_pressure} := 45 \cdot \text{pcf}$$

$$\text{passive_pressure} := 280 \cdot \text{pcf}$$

$$\text{angle}_{\text{incline}} := \text{atan}(\text{Slope}^{-1})$$

$$\text{angle}_{\text{incline}} = 65.772 \text{ deg}$$

$$\text{reduction} := \frac{\text{angle}_{\text{incline}} - \text{angle}_{\text{repose}}}{90 \cdot \text{deg} - \text{angle}_{\text{repose}}}$$

$$\text{reduction} = 0.596$$

$$P := \text{active_pressure} \cdot \frac{\text{height}^2}{2} \cdot \text{reduction}$$

$$\text{active lateral soil pressure on each foot length of wall} \quad P = 1.88 \frac{\text{kip}}{\text{ft}}$$

$$\text{wall_weight} := \sum_i \text{rock_weight}_i$$

$$\text{wall_weight} = 5.03 \frac{\text{kip}}{\text{ft}}$$

$$\text{friction} := 0.50$$

$$\frac{\text{wall_weight} \cdot \text{friction} + \frac{\text{passive_pressure} \cdot \text{embed}^2}{2}}{P} = 1.59 \quad > 1.5 \text{ .. OK}$$

check overturning

$$\text{OTM} := P \cdot \frac{\text{height}}{3}$$

$$\text{OTM} = 7.4 \frac{\text{kip} \cdot \text{ft}}{\text{ft}}$$

$$\text{RM} := \sum_i \text{rock_weight}_i \cdot \text{Dist}_i$$

$$\text{RM} = 24.7 \frac{\text{kip} \cdot \text{ft}}{\text{ft}}$$

$$\frac{\text{RM}}{\text{OTM}} = 3.34$$

$$> 1.5 \text{ .. OK}$$

ROCK PROTECTED SLOPE

Rise := 12-ft

Run := 5.5-ft

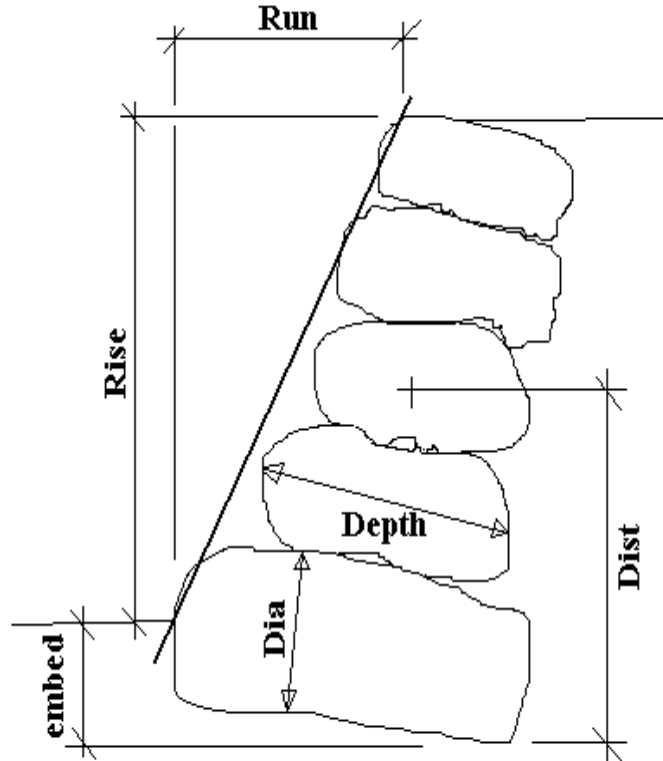
Wall Properties

embed := 30-in

no_rocks := 7

| i = | dia _i := |
|-----|---------------------|
| 1 | 42-in |
| 2 | 34-in |
| 3 | 28-in |
| 4 | 24-in |
| 5 | 18-in |
| 6 | 16-in |
| 7 | 12-in |

Total exposed wall
height = 12 ft



Summary of Required Rock Dimensions (inches)

| i = | dia _i = in | depth _i = in |
|-----|--------------------------|----------------------------|
| 1 | 42 | 63 |
| 2 | 34 | 51 |
| 3 | 28 | 42 |
| 4 | 24 | 36 |
| 5 | 18 | 27 |
| 6 | 16 | 24 |
| 7 | 12 | 18 |

STABILITY OF ROCK PROTECTED SLOPE

rock data

$$wt := 150 \cdot \text{pcf}$$

$$\text{rock_weight}_i := wt \cdot (\text{dia}_i \cdot \text{depth}_i \cdot 0.85)$$

check sliding

$$\text{angle}_{\text{repose}} := 30 \cdot \text{deg}$$

The repose angle is based on the type of soil being retained

$$\text{active_pressure} := 45 \cdot \text{pcf}$$

$$\text{passive_pressure} := 280 \cdot \text{pcf}$$

$$\text{angle}_{\text{incline}} := \text{atan}(\text{Slope}^{-1})$$

$$\text{angle}_{\text{incline}} = 65.376 \text{ deg}$$

$$\text{reduction} := \frac{\text{angle}_{\text{incline}} - \text{angle}_{\text{repose}}}{90 \cdot \text{deg} - \text{angle}_{\text{repose}}}$$

$$\text{reduction} = 0.59$$

$$P := \text{active_pressure} \cdot \frac{\text{height}^2}{2} \cdot \text{reduction}$$

$$\text{active lateral soil pressure on each foot length of wall} \quad P = 2.79 \frac{\text{kip}}{\text{ft}}$$

$$\text{wall_weight} := \sum_i \text{rock_weight}_i$$

$$\text{wall_weight} = 6.65 \frac{\text{kip}}{\text{ft}}$$

$$\text{friction} := 0.50$$

$$\frac{\text{wall_weight} \cdot \text{friction} + \frac{\text{passive_pressure} \cdot \text{embed}^2}{2}}{P} = 1.51 \quad > 1.5 \text{ .. OK}$$

check overturning

$$\text{OTM} := P \cdot \frac{\text{height}}{3}$$

$$\text{OTM} = 13.5 \frac{\text{kip} \cdot \text{ft}}{\text{ft}}$$

$$\text{RM} := \sum_i \text{rock_weight}_i \cdot \text{Dist}_i$$

$$\text{RM} = 38.8 \frac{\text{kip} \cdot \text{ft}}{\text{ft}}$$

$$\frac{\text{RM}}{\text{OTM}} = 2.88$$

$$> 1.5 \text{ .. OK}$$

ROCK PROTECTED SLOPE

Rise := 14-ft

Run := 6.5-ft

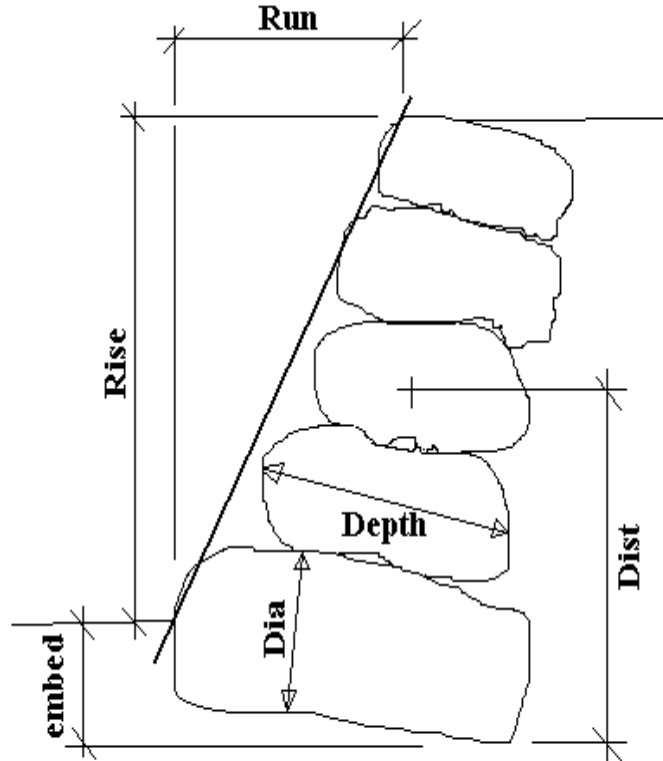
Wall Properties

embed := 32-in

no_rocks := 7

| i = | dia _i := |
|-----|---------------------|
| 1 | 48-in |
| 2 | 40-in |
| 3 | 36-in |
| 4 | 24-in |
| 5 | 22-in |
| 6 | 18-in |
| 7 | 12-in |

Total exposed wall
height = 14 ft



Summary of Required Rock Dimensions (inches)

| i = | dia _i = in | depth _i = in |
|-----|--------------------------|----------------------------|
| 1 | 48 | 72 |
| 2 | 40 | 60 |
| 3 | 36 | 54 |
| 4 | 24 | 36 |
| 5 | 22 | 33 |
| 6 | 18 | 27 |
| 7 | 12 | 18 |

STABILITY OF ROCK PROTECTED SLOPE

rock data

$$wt := 150 \cdot \text{pcf}$$

$$\text{rock_weight}_i := wt \cdot (\text{dia}_i \cdot \text{depth}_i \cdot 0.85)$$

check sliding

$$\text{angle}_{\text{repose}} := 30 \cdot \text{deg}$$

The repose angle is based on the type of soil being retained

$$\text{active_pressure} := 45 \cdot \text{pcf}$$

$$\text{passive_pressure} := 280 \cdot \text{pcf}$$

$$\text{angle}_{\text{incline}} := \text{atan}(\text{Slope}^{-1})$$

$$\text{angle}_{\text{incline}} = 65.095 \text{ deg}$$

$$\text{reduction} := \frac{\text{angle}_{\text{incline}} - \text{angle}_{\text{repose}}}{90 \cdot \text{deg} - \text{angle}_{\text{repose}}}$$

$$\text{reduction} = 0.585$$

$$P := \text{active_pressure} \cdot \frac{\text{height}^2}{2} \cdot \text{reduction}$$

$$\text{active lateral soil pressure on each foot length of wall} \quad P = 3.66 \frac{\text{kip}}{\text{ft}}$$

$$\text{wall_weight} := \sum_i \text{rock_weight}_i$$

$$\text{wall_weight} = 8.94 \frac{\text{kip}}{\text{ft}}$$

$$\text{friction} := 0.50$$

$$\frac{\text{wall_weight} \cdot \text{friction} + \frac{\text{passive_pressure} \cdot \text{embed}^2}{2}}{P} = 1.49 \quad > 1.5 \text{ .. OK}$$

check overturning

$$\text{OTM} := P \cdot \frac{\text{height}}{3}$$

$$\text{OTM} = 20.3 \frac{\text{kip} \cdot \text{ft}}{\text{ft}}$$

$$\text{RM} := \sum_i \text{rock_weight}_i \cdot \text{Dist}_i$$

$$\text{RM} = 60.1 \frac{\text{kip} \cdot \text{ft}}{\text{ft}}$$

$$\frac{\text{RM}}{\text{OTM}} = 2.96$$

$$> 1.5 \text{ .. OK}$$

Strip Footing - FC1.3-(Interior)

Design properties

Roof

roof_{trib} := 0·ft
 Roof_{DL} := 15·psf
 Roof_{LL} := 70psf

Floor

floor_{trib} := 14·ft
 Floor_{DL} := 25·psf
 Floor_{LL} := 40·psf
 Wall_{DL} := 45·psf
 wall_height := 15·ft
 no_st := 2 Number of stories
 no_fl := 1 Number of suspended floors

Foundation

fndn_height := 3·ft
 Fndn_thick := 10·in
 ftng_width := 16·in
 Soil_bearing := 3000·psf

Roof Loads

Roof = 0 plf

p = 2623 plf

w = 10.5 in

ftng_width = 16 in

Floor Loads

Floors = 2260 plf

Total pressure applied to soil @ underside of footing

Required footing width

Footing width provided ADEQUATE

Foundation Loads

Fndn = 363 plf

Strip Footing - FC2.0 (front of house)

Design properties

Roof

roof_{trib} := 16·ft
 Roof_{DL} := 15·psf
 Roof_{LL} := 125psf

Floor

floor_{trib} := 8·ft
 Floor_{DL} := 25·psf
 Floor_{LL} := 40·psf
 Wall_{DL} := 10·psf
 wall_height := 12·ft
 no_st := 2 Number of stories
 no_fl := 1 Number of suspended floors

Foundation

fndn_height := 10·ft
 Fndn_thick := 10·in
 ftng_width := 24·in
 Soil_bearing := 3000·psf

Roof Loads

Roof = 2240 plf

p = 4208 plf

w = 16.8 in

ftng_width = 24 in

Floor Loads

Floors = 760 plf

Total pressure applied to soil @ underside of footing

Required footing width

Footing width provided ADEQUATE

Foundation Loads

Fndn = 1208 plf

SQUARE FOOTING FS2.0 SQUARE SIZE DEPTH

$$L := 24 \cdot \text{in}$$

$$h := 10 \cdot \text{in}$$

Design criteria

| | |
|--------------------------------|-----------------------|
| $f_c := 2500 \cdot \text{psi}$ | concrete strength |
| $f_y := 60 \cdot \text{ksi}$ | steel yield strength |
| $\phi := 0.85$ | concrete factor |
| $q_a := 3000 \cdot \text{psf}$ | soil bearing capacity |

Column load

| | | |
|------------|-----------------------|------------------------|
| total load | $TL := L^2 \cdot q_a$ | $TL = 12 \text{ kip}$ |
| dead load | $DL := TL \cdot 0.20$ | $DL = 2.4 \text{ kip}$ |
| live load | $LL := TL \cdot 0.80$ | $LL = 9.6 \text{ kip}$ |

Bearing pressure for strength design

| | | |
|--|--------------------------|--|
| $A := L^2$ | $A = 4 \text{ ft}^2$ | |
| $q_u := \frac{(1.4 \cdot DL) + (1.7 \cdot LL)}{A}$ | $q_u = 4920 \text{ psf}$ | |

Depth required for two-way or punching shear:

| | | | |
|--|--|--|----|
| $b_{pl} := 8 \cdot \text{in}$ | base plate or column square dimension | | |
| $d := h - 3.5 \cdot \text{in}$ | depth of reinforcing | | |
| $b_o := 4 \cdot (b_{pl} + d)$ | $b_o = 58 \text{ in}$ | | |
| $l_{pl} := b_{pl} + d$ | $l_{pl} = 14.5 \text{ in}$ | | |
| $V_{u2} := (A - l_{pl}^2) \cdot q_u$ | $V_{u2} = 12.5 \text{ kip}$ | | |
| $d_2 := \frac{V_{u2}}{\phi \cdot 4 \cdot \sqrt{f_c} \cdot \text{psi} \cdot b_o}$ | $d_2 = 1.27 \text{ in} < d = 6.5 \text{ in}$ | | OK |

Depth required for one-way shear:

| | | |
|---|----------------------------|--|
| $a := \frac{L}{2} - \frac{b_{pl}}{2} - d$ | $a = 1.5 \text{ in}$ | |
| $V_{u1} := L \cdot a \cdot q_u$ | $V_{u1} = 1.2 \text{ kip}$ | |

SQUARE CONCRETE COLUMN FOOTING cont'd

| | | | |
|--|---|--|----|
| $d_1 := \frac{V_{u1}}{\phi \cdot 2 \cdot \sqrt{f_c} \cdot \text{psi} \cdot L}$ | $d_1 = 0.6 \text{ in} < d = 6.5 \text{ in}$ | | OK |
|--|---|--|----|

Determine the required steel for the footing:

$$b := \frac{L}{2} - \frac{bpl}{2}$$

$$b = 8 \text{ in}$$

$$\Phi := 0.9$$

steel factor

$$m := \frac{f_y}{.85 \cdot f_c}$$

$$m = 28.2$$

$$M_u := b \cdot L \cdot q_u \cdot \frac{b}{2}$$

$$M_u = 2.2 \text{ kft}$$

$$R_u := \frac{M_u \cdot \text{in}^2}{\Phi \cdot L \cdot d^2}$$

$$R_u = 0.029 \text{ kip}$$

$$\rho_{\min} := \frac{200 \cdot \text{psi}}{f_y}$$

$$\rho_{\min} = 0.0033$$

$$A_{s\min} := \rho_{\min} \cdot L \cdot d$$

$$A_{s\min} = 0.52 \text{ in}^2$$

$$\rho := \frac{1}{m} \cdot \left(1 - \sqrt{1 - \frac{2 \cdot R_u \cdot m \cdot \text{in}^{-2}}{f_y}} \right)$$

$$\rho = 0.00048$$

$$A_s := \rho \cdot L \cdot d$$

$$A_s = 0.075 \text{ in}^2$$

$$A_{s\min} := \text{if}(A_{s\min} > A_s \cdot 1.33, A_s \cdot 1.33, A_{s\min}) \quad A_{s\min} = 0.1 \text{ in}^2$$

$$A_s := \text{if}(A_{s\min} > A_s, A_{s\min}, A_s)$$

$$A_s = 0.1 \text{ in}^2$$

$$s_4 := \text{ceil}\left(\frac{A_s}{0.20 \cdot \text{in}^2}\right)$$

$$s_5 := \text{ceil}\left(\frac{A_s}{0.31 \cdot \text{in}^2}\right)$$

$$s_6 := \text{ceil}\left(\frac{A_s}{0.44 \cdot \text{in}^2}\right)$$

Rebar req'd

use $s_4 = 1$ #4 E.W.

use $s_5 = 1$ #5 E.W.

use $s_6 = 1$ #6 E.W.

SQUARE FOOTING FS2.5

SQUARE SIZE

DEPTH

$$L := 30 \cdot \text{in}$$

$$h := 10 \cdot \text{in}$$

Design criteria

| | |
|--------------------------------|-----------------------|
| $f_c := 2500 \cdot \text{psi}$ | concrete strength |
| $f_y := 60 \cdot \text{ksi}$ | steel yield strength |
| $\phi := 0.85$ | concrete factor |
| $q_a := 3000 \cdot \text{psf}$ | soil bearing capacity |

Column load

| | | |
|------------|-----------------------|-------------------------|
| total load | $TL := L^2 \cdot q_a$ | $TL = 18.7 \text{ kip}$ |
| dead load | $DL := TL \cdot 0.20$ | $DL = 3.75 \text{ kip}$ |
| live load | $LL := TL \cdot 0.80$ | $LL = 15 \text{ kip}$ |

Bearing pressure for strength design

| | |
|--|--------------------------|
| $A := L^2$ | $A = 6.25 \text{ ft}^2$ |
| $q_u := \frac{(1.4 \cdot DL) + (1.7 \cdot LL)}{A}$ | $q_u = 4920 \text{ psf}$ |

Depth required for two-way or punching shear:

| | | |
|--|--|-----------|
| $b_{pl} := 8 \cdot \text{in}$ | base plate or column square dimension | |
| $d := h - 3.5 \cdot \text{in}$ | depth of reinforcing | |
| $b_o := 4 \cdot (b_{pl} + d)$ | $b_o = 58 \text{ in}$ | |
| $l_{pl} := b_{pl} + d$ | $l_{pl} = 14.5 \text{ in}$ | |
| $V_{u2} := (A - l_{pl}^2) \cdot q_u$ | $V_{u2} = 23.6 \text{ kip}$ | |
| $d_2 := \frac{V_{u2}}{\phi \cdot 4 \cdot \sqrt{f_c} \cdot \text{psi} \cdot b_o}$ | $d_2 = 2.39 \text{ in} < d = 6.5 \text{ in}$ | OK |

Depth required for one-way shear:

| | |
|---|----------------------------|
| $a := \frac{L}{2} - \frac{b_{pl}}{2} - d$ | $a = 4.5 \text{ in}$ |
| $V_{u1} := L \cdot a \cdot q_u$ | $V_{u1} = 4.6 \text{ kip}$ |

SQUARE CONCRETE COLUMN FOOTING cont'd

| | | |
|--|--|-----------|
| $d_1 := \frac{V_{u1}}{\phi \cdot 2 \cdot \sqrt{f_c} \cdot \text{psi} \cdot L}$ | $d_1 = 1.81 \text{ in} < d = 6.5 \text{ in}$ | OK |
|--|--|-----------|

Determine the required steel for the footing:

$$b := \frac{L}{2} - \frac{bpl}{2}$$

$$b = 11 \text{ in}$$

$$\Phi := 0.9$$

steel factor

$$m := \frac{f_y}{.85 \cdot f_c}$$

$$m = 28.2$$

$$M_u := b \cdot L \cdot q_u \cdot \frac{b}{2}$$

$$M_u = 5.2 \text{ kft}$$

$$R_u := \frac{M_u \cdot \text{in}^2}{\Phi \cdot L \cdot d^2}$$

$$R_u = 0.054 \text{ kip}$$

$$\rho_{\min} := \frac{200 \cdot \text{psi}}{f_y}$$

$$\rho_{\min} = 0.0033$$

$$A_{s\min} := \rho_{\min} \cdot L \cdot d$$

$$A_{s\min} = 0.65 \text{ in}^2$$

$$\rho := \frac{1}{m} \cdot \left(1 - \sqrt{1 - \frac{2 \cdot R_u \cdot m \cdot \text{in}^{-2}}{f_y}} \right)$$

$$\rho = 0.00092$$

$$A_s := \rho \cdot L \cdot d$$

$$A_s = 0.179 \text{ in}^2$$

$$A_{s\min} := \text{if}(A_{s\min} > A_s \cdot 1.33, A_s \cdot 1.33, A_{s\min}) \quad A_{s\min} = 0.238 \text{ in}^2$$

$$A_s := \text{if}(A_{s\min} > A_s, A_{s\min}, A_s)$$

$$A_s = 0.238 \text{ in}^2$$

$$s_4 := \text{ceil}\left(\frac{A_s}{0.20 \cdot \text{in}^2}\right)$$

$$s_5 := \text{ceil}\left(\frac{A_s}{0.31 \cdot \text{in}^2}\right)$$

$$s_6 := \text{ceil}\left(\frac{A_s}{0.44 \cdot \text{in}^2}\right)$$

Rebar req'd

use $s_4 = 2$ #4 E.W.

use $s_5 = 1$ #5 E.W.

use $s_6 = 1$ #6 E.W.

SQUARE FOOTING FS3.0

SQUARE SIZE

DEPTH

$$L := 36 \cdot \text{in}$$

$$h := 10 \cdot \text{in}$$

Design criteria

| | |
|--------------------------------|-----------------------|
| $f_c := 2500 \cdot \text{psi}$ | concrete strength |
| $f_y := 60 \cdot \text{ksi}$ | steel yield strength |
| $\phi := 0.85$ | concrete factor |
| $q_a := 3000 \cdot \text{psf}$ | soil bearing capacity |

Column load

| | | |
|------------|-----------------------|-------------------------|
| total load | $TL := L^2 \cdot q_a$ | $TL = 27 \text{ kip}$ |
| dead load | $DL := TL \cdot 0.20$ | $DL = 5.4 \text{ kip}$ |
| live load | $LL := TL \cdot 0.80$ | $LL = 21.6 \text{ kip}$ |

Bearing pressure for strength design

| | |
|--|--------------------------|
| $A := L^2$ | $A = 9 \text{ ft}^2$ |
| $q_u := \frac{(1.4 \cdot DL) + (1.7 \cdot LL)}{A}$ | $q_u = 4920 \text{ psf}$ |

Depth required for two-way or punching shear:

| | | |
|--|--|-----------|
| $b_{pl} := 8 \cdot \text{in}$ | base plate or column square dimension | |
| $d := h - 3.5 \cdot \text{in}$ | depth of reinforcing | |
| $b_o := 4 \cdot (b_{pl} + d)$ | $b_o = 58 \text{ in}$ | |
| $l_{pl} := b_{pl} + d$ | $l_{pl} = 14.5 \text{ in}$ | |
| $V_{u2} := (A - l_{pl}^2) \cdot q_u$ | $V_{u2} = 37.1 \text{ kip}$ | |
| $d_2 := \frac{V_{u2}}{\phi \cdot 4 \cdot \sqrt{f_c} \cdot \text{psi} \cdot b_o}$ | $d_2 = 3.76 \text{ in} < d = 6.5 \text{ in}$ | OK |

Depth required for one-way shear:

| | |
|---|----------------------------|
| $a := \frac{L}{2} - \frac{b_{pl}}{2} - d$ | $a = 7.5 \text{ in}$ |
| $V_{u1} := L \cdot a \cdot q_u$ | $V_{u1} = 9.2 \text{ kip}$ |

SQUARE CONCRETE COLUMN FOOTING cont'd

| | | |
|--|--|-----------|
| $d_1 := \frac{V_{u1}}{\phi \cdot 2 \cdot \sqrt{f_c} \cdot \text{psi} \cdot L}$ | $d_1 = 3.01 \text{ in} < d = 6.5 \text{ in}$ | OK |
|--|--|-----------|

Determine the required steel for the footing:

$$b := \frac{L}{2} - \frac{bpl}{2}$$

$$b = 14 \text{ in}$$

$$\Phi := 0.9$$

steel factor

$$m := \frac{f_y}{.85 \cdot f_c}$$

$$m = 28.2$$

$$M_u := b \cdot L \cdot q_u \cdot \frac{b}{2}$$

$$M_u = 10 \text{ kft}$$

$$R_u := \frac{M_u \cdot \text{in}^2}{\Phi \cdot L \cdot d^2}$$

$$R_u = 0.088 \text{ kip}$$

$$\rho_{\min} := \frac{200 \cdot \text{psi}}{f_y}$$

$$\rho_{\min} = 0.0033$$

$$A_{s\min} := \rho_{\min} \cdot L \cdot d$$

$$A_{s\min} = 0.78 \text{ in}^2$$

$$\rho := \frac{1}{m} \cdot \left(1 - \sqrt{1 - \frac{2 \cdot R_u \cdot m \cdot \text{in}^{-2}}{f_y}} \right)$$

$$\rho = 0.0015$$

$$A_s := \rho \cdot L \cdot d$$

$$A_s = 0.351 \text{ in}^2$$

$$A_{s\min} := \text{if}(A_{s\min} > A_s \cdot 1.33, A_s \cdot 1.33, A_{s\min}) \quad A_{s\min} = 0.467 \text{ in}^2$$

$$A_s := \text{if}(A_{s\min} > A_s, A_{s\min}, A_s)$$

$$A_s = 0.467 \text{ in}^2$$

$$s_4 := \text{ceil}\left(\frac{A_s}{0.20 \cdot \text{in}^2}\right)$$

$$s_5 := \text{ceil}\left(\frac{A_s}{0.31 \cdot \text{in}^2}\right)$$

$$s_6 := \text{ceil}\left(\frac{A_s}{0.44 \cdot \text{in}^2}\right)$$

Rebar req'd

use $s_4 = 3$ #4 E.W.

use $s_5 = 2$ #5 E.W.

use $s_6 = 2$ #6 E.W.

SQUARE FOOTING FS3.5

SQUARE SIZE

DEPTH

$$L := 42 \cdot \text{in}$$

$$h := 10 \cdot \text{in}$$

Design criteria

| | |
|--------------------------------|-----------------------|
| $f_c := 2500 \cdot \text{psi}$ | concrete strength |
| $f_y := 60 \cdot \text{ksi}$ | steel yield strength |
| $\phi := 0.85$ | concrete factor |
| $q_a := 3000 \cdot \text{psf}$ | soil bearing capacity |

Column load

| | | |
|------------|-----------------------|-------------------------|
| total load | $TL := L^2 \cdot q_a$ | $TL = 36.7 \text{ kip}$ |
| dead load | $DL := TL \cdot 0.20$ | $DL = 7.35 \text{ kip}$ |
| live load | $LL := TL \cdot 0.80$ | $LL = 29.4 \text{ kip}$ |

Bearing pressure for strength design

| | |
|--|--------------------------|
| $A := L^2$ | $A = 12.25 \text{ ft}^2$ |
| $q_u := \frac{(1.4 \cdot DL) + (1.7 \cdot LL)}{A}$ | $q_u = 4920 \text{ psf}$ |

Depth required for two-way or punching shear:

| | | |
|--|--|-----------|
| $b_{pl} := 8 \cdot \text{in}$ | base plate or column square dimension | |
| $d := h - 3.5 \cdot \text{in}$ | depth of reinforcing | |
| $b_o := 4 \cdot (b_{pl} + d)$ | $b_o = 58 \text{ in}$ | |
| $l_{pl} := b_{pl} + d$ | $l_{pl} = 14.5 \text{ in}$ | |
| $V_{u2} := (A - l_{pl}^2) \cdot q_u$ | $V_{u2} = 53.1 \text{ kip}$ | |
| $d_2 := \frac{V_{u2}}{\phi \cdot 4 \cdot \sqrt{f_c} \cdot \text{psi} \cdot b_o}$ | $d_2 = 5.38 \text{ in} < d = 6.5 \text{ in}$ | OK |

Depth required for one-way shear:

| | |
|---|-----------------------------|
| $a := \frac{L}{2} - \frac{b_{pl}}{2} - d$ | $a = 10.5 \text{ in}$ |
| $V_{u1} := L \cdot a \cdot q_u$ | $V_{u1} = 15.1 \text{ kip}$ |

SQUARE CONCRETE COLUMN FOOTING cont'd

| | | |
|--|--|-----------|
| $d_1 := \frac{V_{u1}}{\phi \cdot 2 \cdot \sqrt{f_c} \cdot \text{psi} \cdot L}$ | $d_1 = 4.22 \text{ in} < d = 6.5 \text{ in}$ | OK |
|--|--|-----------|

Determine the required steel for the footing:

$$b := \frac{L}{2} - \frac{bpl}{2}$$

$$b = 17 \text{ in}$$

$$\Phi := 0.9$$

steel factor

$$m := \frac{f_y}{.85 \cdot f_c}$$

$$m = 28.2$$

$$M_u := b \cdot L \cdot q_u \cdot \frac{b}{2}$$

$$M_u = 17.3 \text{ kft}$$

$$R_u := \frac{M_u \cdot \text{in}^2}{\Phi \cdot L \cdot d^2}$$

$$R_u = 0.13 \text{ kip}$$

$$\rho_{\min} := \frac{200 \cdot \text{psi}}{f_y}$$

$$\rho_{\min} = 0.0033$$

$$A_{s\min} := \rho_{\min} \cdot L \cdot d$$

$$A_{s\min} = 0.91 \text{ in}^2$$

$$\rho := \frac{1}{m} \cdot \left(1 - \sqrt{1 - \frac{2 \cdot R_u \cdot m \cdot \text{in}^{-2}}{f_y}} \right)$$

$$\rho = 0.00223$$

$$A_s := \rho \cdot L \cdot d$$

$$A_s = 0.61 \text{ in}^2$$

$$A_{s\min} := \text{if}(A_{s\min} > A_s \cdot 1.33, A_s \cdot 1.33, A_{s\min}) \quad A_{s\min} = 0.811 \text{ in}^2$$

$$A_s := \text{if}(A_{s\min} > A_s, A_{s\min}, A_s)$$

$$A_s = 0.811 \text{ in}^2$$

$$s_4 := \text{ceil}\left(\frac{A_s}{0.20 \cdot \text{in}^2}\right)$$

$$s_5 := \text{ceil}\left(\frac{A_s}{0.31 \cdot \text{in}^2}\right)$$

$$s_6 := \text{ceil}\left(\frac{A_s}{0.44 \cdot \text{in}^2}\right)$$

Rebar req'd

use $s_4 = 5$ #4 E.W.

use $s_5 = 3$ #5 E.W.

use $s_6 = 2$ #6 E.W.

SQUARE FOOTING FS4.0

SQUARE SIZE

DEPTH

$$L := 48 \cdot \text{in}$$

$$h := 12 \cdot \text{in}$$

Design criteria

| | | |
|--------------------------------|-----------------------|--|
| $f_c := 2500 \cdot \text{psi}$ | concrete strength | |
| $f_y := 60 \cdot \text{ksi}$ | steel yield strength | |
| $\phi := 0.85$ | concrete factor | |
| $q_a := 3000 \cdot \text{psf}$ | soil bearing capacity | |

Column load

| | | |
|------------|-----------------------|-------------------------|
| total load | $TL := L^2 \cdot q_a$ | $TL = 48 \text{ kip}$ |
| dead load | $DL := TL \cdot 0.20$ | $DL = 9.6 \text{ kip}$ |
| live load | $LL := TL \cdot 0.80$ | $LL = 38.4 \text{ kip}$ |

Bearing pressure for strength design

| | |
|--|--------------------------|
| $A := L^2$ | $A = 16 \text{ ft}^2$ |
| $q_u := \frac{(1.4 \cdot DL) + (1.7 \cdot LL)}{A}$ | $q_u = 4920 \text{ psf}$ |

Depth required for two-way or punching shear:

| | | |
|--|--|-----------|
| $b_{pl} := 8 \cdot \text{in}$ | base plate or column square dimension | |
| $d := h - 3.5 \cdot \text{in}$ | depth of reinforcing | |
| $b_o := 4 \cdot (b_{pl} + d)$ | $b_o = 66 \text{ in}$ | |
| $l_{pl} := b_{pl} + d$ | $l_{pl} = 16.5 \text{ in}$ | |
| $V_{u2} := (A - l_{pl}^2) \cdot q_u$ | $V_{u2} = 69.4 \text{ kip}$ | |
| $d_2 := \frac{V_{u2}}{\phi \cdot 4 \cdot \sqrt{f_c} \cdot \text{psi} \cdot b_o}$ | $d_2 = 6.19 \text{ in} < d = 8.5 \text{ in}$ | OK |

Depth required for one-way shear:

| | |
|---|-----------------------------|
| $a := \frac{L}{2} - \frac{b_{pl}}{2} - d$ | $a = 11.5 \text{ in}$ |
| $V_{u1} := L \cdot a \cdot q_u$ | $V_{u1} = 18.9 \text{ kip}$ |

SQUARE CONCRETE COLUMN FOOTING cont'd

| | | |
|--|--|-----------|
| $d_1 := \frac{V_{u1}}{\phi \cdot 2 \cdot \sqrt{f_c} \cdot \text{psi} \cdot L}$ | $d_1 = 4.62 \text{ in} < d = 8.5 \text{ in}$ | OK |
|--|--|-----------|

Determine the required steel for the footing:

$$b := \frac{L}{2} - \frac{bpl}{2}$$

$$b = 20 \text{ in}$$

$$\Phi := 0.9$$

steel factor

$$m := \frac{f_y}{.85 \cdot f_c}$$

$$m = 28.2$$

$$M_u := b \cdot L \cdot q_u \cdot \frac{b}{2}$$

$$M_u = 27.3 \text{ kft}$$

$$R_u := \frac{M_u \cdot \text{in}^2}{\Phi \cdot L \cdot d^2}$$

$$R_u = 0.105 \text{ kip}$$

$$\rho_{\min} := \frac{200 \cdot \text{psi}}{f_y}$$

$$\rho_{\min} = 0.0033$$

$$A_{s\min} := \rho_{\min} \cdot L \cdot d$$

$$A_{s\min} = 1.36 \text{ in}^2$$

$$\rho := \frac{1}{m} \cdot \left(1 - \sqrt{1 - \frac{2 \cdot R_u \cdot m \cdot \text{in}^{-2}}{f_y}} \right)$$

$$\rho = 0.0018$$

$$A_s := \rho \cdot L \cdot d$$

$$A_s = 0.733 \text{ in}^2$$

$$A_{s\min} := \text{if}(A_{s\min} > A_s \cdot 1.33, A_s \cdot 1.33, A_{s\min}) \quad A_{s\min} = 0.975 \text{ in}^2$$

$$A_s := \text{if}(A_{s\min} > A_s, A_{s\min}, A_s)$$

$$A_s = 0.975 \text{ in}^2$$

$$s_4 := \text{ceil}\left(\frac{A_s}{0.20 \cdot \text{in}^2}\right)$$

$$s_5 := \text{ceil}\left(\frac{A_s}{0.31 \cdot \text{in}^2}\right)$$

$$s_6 := \text{ceil}\left(\frac{A_s}{0.44 \cdot \text{in}^2}\right)$$

Rebar req'd

use $s_4 = 5$ #4 E.W.

use $s_5 = 4$ #5 E.W.

use $s_6 = 3$ #6 E.W.

SQUARE FOOTING FS4.5

SQUARE SIZE

DEPTH

$$L := 54 \cdot \text{in}$$

$$h := 12 \cdot \text{in}$$

Design criteria

| | |
|--------------------------------|-----------------------|
| $f_c := 2500 \cdot \text{psi}$ | concrete strength |
| $f_y := 60 \cdot \text{ksi}$ | steel yield strength |
| $\phi := 0.85$ | concrete factor |
| $q_a := 3000 \cdot \text{psf}$ | soil bearing capacity |

Column load

| | | |
|------------|-----------------------|--------------------------|
| total load | $TL := L^2 \cdot q_a$ | $TL = 60.7 \text{ kip}$ |
| dead load | $DL := TL \cdot 0.20$ | $DL = 12.15 \text{ kip}$ |
| live load | $LL := TL \cdot 0.80$ | $LL = 48.6 \text{ kip}$ |

Bearing pressure for strength design

| | |
|--|--------------------------|
| $A := L^2$ | $A = 20.25 \text{ ft}^2$ |
| $q_u := \frac{(1.4 \cdot DL) + (1.7 \cdot LL)}{A}$ | $q_u = 4920 \text{ psf}$ |

Depth required for two-way or punching shear:

| | | |
|--|--|-----------|
| $b_{pl} := 8 \cdot \text{in}$ | base plate or column square dimension | |
| $d := h - 3.5 \cdot \text{in}$ | depth of reinforcing | |
| $b_o := 4 \cdot (b_{pl} + d)$ | $b_o = 66 \text{ in}$ | |
| $l_{pl} := b_{pl} + d$ | $l_{pl} = 16.5 \text{ in}$ | |
| $V_{u2} := (A - l_{pl}^2) \cdot q_u$ | $V_{u2} = 90.3 \text{ kip}$ | |
| $d_2 := \frac{V_{u2}}{\phi \cdot 4 \cdot \sqrt{f_c} \cdot \text{psi} \cdot b_o}$ | $d_2 = 8.05 \text{ in} < d = 8.5 \text{ in}$ | OK |

Depth required for one-way shear:

| | |
|---|-----------------------------|
| $a := \frac{L}{2} - \frac{b_{pl}}{2} - d$ | $a = 14.5 \text{ in}$ |
| $V_{u1} := L \cdot a \cdot q_u$ | $V_{u1} = 26.8 \text{ kip}$ |

SQUARE CONCRETE COLUMN FOOTING cont'd

| | | |
|--|--|-----------|
| $d_1 := \frac{V_{u1}}{\phi \cdot 2 \cdot \sqrt{f_c} \cdot \text{psi} \cdot L}$ | $d_1 = 5.83 \text{ in} < d = 8.5 \text{ in}$ | OK |
|--|--|-----------|

Determine the required steel for the footing:

$$b := \frac{L}{2} - \frac{bpl}{2}$$

$$b = 23 \text{ in}$$

$$\Phi := 0.9$$

steel factor

$$m := \frac{f_y}{.85 \cdot f_c}$$

$$m = 28.2$$

$$M_u := b \cdot L \cdot q_u \cdot \frac{b}{2}$$

$$M_u = 40.7 \text{ kft}$$

$$R_u := \frac{M_u \cdot \text{in}^2}{\Phi \cdot L \cdot d^2}$$

$$R_u = 0.139 \text{ kip}$$

$$\rho_{\min} := \frac{200 \cdot \text{psi}}{f_y}$$

$$\rho_{\min} = 0.0033$$

$$A_{s\min} := \rho_{\min} \cdot L \cdot d$$

$$A_{s\min} = 1.53 \text{ in}^2$$

$$\rho := \frac{1}{m} \cdot \left(1 - \sqrt{1 - \frac{2 \cdot R_u \cdot m \cdot \text{in}^{-2}}{f_y}} \right)$$

$$\rho = 0.0024$$

$$A_s := \rho \cdot L \cdot d$$

$$A_s = 1.1 \text{ in}^2$$

$$A_{s\min} := \text{if}(A_{s\min} > A_s \cdot 1.33, A_s \cdot 1.33, A_{s\min}) \quad A_{s\min} = 1.464 \text{ in}^2$$

$$A_s := \text{if}(A_{s\min} > A_s, A_{s\min}, A_s)$$

$$A_s = 1.464 \text{ in}^2$$

$$s_4 := \text{ceil}\left(\frac{A_s}{0.20 \cdot \text{in}^2}\right)$$

$$s_5 := \text{ceil}\left(\frac{A_s}{0.31 \cdot \text{in}^2}\right)$$

$$s_6 := \text{ceil}\left(\frac{A_s}{0.44 \cdot \text{in}^2}\right)$$

Rebar req'd

use $s_4 = 8$ #4 E.W.

use $s_5 = 5$ #5 E.W.

use $s_6 = 4$ #6 E.W.

SQUARE FOOTING FS5.0

SQUARE SIZE

DEPTH

$$L := 60 \cdot \text{in}$$

$$h := 15 \cdot \text{in}$$

Design criteria

| | |
|--------------------------------|-----------------------|
| $f_c := 2500 \cdot \text{psi}$ | concrete strength |
| $f_y := 60 \cdot \text{ksi}$ | steel yield strength |
| $\phi := 0.85$ | concrete factor |
| $q_a := 3000 \cdot \text{psf}$ | soil bearing capacity |

Column load

| | | |
|------------|-----------------------|-----------------------|
| total load | $TL := L^2 \cdot q_a$ | $TL = 75 \text{ kip}$ |
| dead load | $DL := TL \cdot 0.20$ | $DL = 15 \text{ kip}$ |
| live load | $LL := TL \cdot 0.80$ | $LL = 60 \text{ kip}$ |

Bearing pressure for strength design

| | |
|--|--------------------------|
| $A := L^2$ | $A = 25 \text{ ft}^2$ |
| $q_u := \frac{(1.4 \cdot DL) + (1.7 \cdot LL)}{A}$ | $q_u = 4920 \text{ psf}$ |

Depth required for two-way or punching shear:

| | | |
|--|--|-----------|
| $b_{pl} := 8 \cdot \text{in}$ | base plate or column square dimension | |
| $d := h - 3.5 \cdot \text{in}$ | depth of reinforcing | |
| $b_o := 4 \cdot (b_{pl} + d)$ | $b_o = 78 \text{ in}$ | |
| $l_{pl} := b_{pl} + d$ | $l_{pl} = 19.5 \text{ in}$ | |
| $V_{u2} := (A - l_{pl}^2) \cdot q_u$ | $V_{u2} = 110 \text{ kip}$ | |
| $d_2 := \frac{V_{u2}}{\phi \cdot 4 \cdot \sqrt{f_c} \cdot \text{psi} \cdot b_o}$ | $d_2 = 8.3 \text{ in} < d = 11.5 \text{ in}$ | OK |

Depth required for one-way shear:

| | |
|---|-----------------------------|
| $a := \frac{L}{2} - \frac{b_{pl}}{2} - d$ | $a = 14.5 \text{ in}$ |
| $V_{u1} := L \cdot a \cdot q_u$ | $V_{u1} = 29.7 \text{ kip}$ |

SQUARE CONCRETE COLUMN FOOTING cont'd

| | | |
|--|---|-----------|
| $d_1 := \frac{V_{u1}}{\phi \cdot 2 \cdot \sqrt{f_c} \cdot \text{psi} \cdot L}$ | $d_1 = 5.83 \text{ in} < d = 11.5 \text{ in}$ | OK |
|--|---|-----------|

Determine the required steel for the footing:

$$b := \frac{L}{2} - \frac{bpl}{2}$$

$$b = 26 \text{ in}$$

$$\Phi := 0.9$$

steel factor

$$m := \frac{f_y}{.85 \cdot f_c}$$

$$m = 28.2$$

$$M_u := b \cdot L \cdot q_u \cdot \frac{b}{2}$$

$$M_u = 57.7 \text{ kft}$$

$$R_u := \frac{M_u \cdot \text{in}^2}{\Phi \cdot L \cdot d^2}$$

$$R_u = 0.097 \text{ kip}$$

$$\rho_{\min} := \frac{200 \cdot \text{psi}}{f_y}$$

$$\rho_{\min} = 0.0033$$

$$A_{s\min} := \rho_{\min} \cdot L \cdot d$$

$$A_{s\min} = 2.3 \text{ in}^2$$

$$\rho := \frac{1}{m} \cdot \left(1 - \sqrt{1 - \frac{2 \cdot R_u \cdot m \cdot \text{in}^{-2}}{f_y}} \right)$$

$$\rho = 0.00166$$

$$A_s := \rho \cdot L \cdot d$$

$$A_s = 1.142 \text{ in}^2$$

$$A_{s\min} := \text{if}(A_{s\min} > A_s \cdot 1.33, A_s \cdot 1.33, A_{s\min}) \quad A_{s\min} = 1.52 \text{ in}^2$$

$$A_s := \text{if}(A_{s\min} > A_s, A_{s\min}, A_s)$$

$$A_s = 1.52 \text{ in}^2$$

$$s_4 := \text{ceil}\left(\frac{A_s}{0.20 \cdot \text{in}^2}\right)$$

$$s_5 := \text{ceil}\left(\frac{A_s}{0.31 \cdot \text{in}^2}\right)$$

$$s_6 := \text{ceil}\left(\frac{A_s}{0.44 \cdot \text{in}^2}\right)$$

Rebar req'd

use $s_4 = 8$ #4 E.W.

use $s_5 = 5$ #5 E.W.

use $s_6 = 4$ #6 E.W.

SQUARE FOOTING FS5.5

SQUARE SIZE

DEPTH

$$L := 66 \cdot \text{in}$$

$$h := 15 \cdot \text{in}$$

Design criteria

| | |
|--------------------------------|-----------------------|
| $f_c := 2500 \cdot \text{psi}$ | concrete strength |
| $f_y := 60 \cdot \text{ksi}$ | steel yield strength |
| $\phi := 0.85$ | concrete factor |
| $q_a := 3000 \cdot \text{psf}$ | soil bearing capacity |

Column load

| | | |
|------------|-----------------------|--------------------------|
| total load | $TL := L^2 \cdot q_a$ | $TL = 90.7 \text{ kip}$ |
| dead load | $DL := TL \cdot 0.20$ | $DL = 18.15 \text{ kip}$ |
| live load | $LL := TL \cdot 0.80$ | $LL = 72.6 \text{ kip}$ |

Bearing pressure for strength design

| | |
|--|--------------------------|
| $A := L^2$ | $A = 30.25 \text{ ft}^2$ |
| $q_u := \frac{(1.4 \cdot DL) + (1.7 \cdot LL)}{A}$ | $q_u = 4920 \text{ psf}$ |

Depth required for two-way or punching shear:

| | | |
|--|---------------------------------------|---------------------------------------|
| $b_{pl} := 8 \cdot \text{in}$ | base plate or column square dimension | |
| $d := h - 3.5 \cdot \text{in}$ | depth of reinforcing | |
| $b_o := 4 \cdot (b_{pl} + d)$ | $b_o = 78 \text{ in}$ | |
| $l_{pl} := b_{pl} + d$ | $l_{pl} = 19.5 \text{ in}$ | |
| $V_{u2} := (A - l_{pl}^2) \cdot q_u$ | $V_{u2} = 135.8 \text{ kip}$ | |
| $d_2 := \frac{V_{u2}}{\phi \cdot 4 \cdot \sqrt{f_c} \cdot \text{psi} \cdot b_o}$ | $d_2 = 10.24 \text{ in} <$ | $d = 11.5 \text{ in} \quad \text{OK}$ |

Depth required for one-way shear:

| | |
|---|-----------------------------|
| $a := \frac{L}{2} - \frac{b_{pl}}{2} - d$ | $a = 17.5 \text{ in}$ |
| $V_{u1} := L \cdot a \cdot q_u$ | $V_{u1} = 39.5 \text{ kip}$ |

SQUARE CONCRETE COLUMN FOOTING cont'd

| | | |
|--|---------------------------|---------------------------------------|
| $d_1 := \frac{V_{u1}}{\phi \cdot 2 \cdot \sqrt{f_c} \cdot \text{psi} \cdot L}$ | $d_1 = 7.03 \text{ in} <$ | $d = 11.5 \text{ in} \quad \text{OK}$ |
|--|---------------------------|---------------------------------------|

Determine the required steel for the footing:

$$b := \frac{L}{2} - \frac{bpl}{2}$$

$$b = 29 \text{ in}$$

$$\Phi := 0.9$$

steel factor

$$m := \frac{f_y}{.85 \cdot f_c}$$

$$m = 28.2$$

$$M_u := b \cdot L \cdot q_u \cdot \frac{b}{2}$$

$$M_u = 79 \text{ kft}$$

$$R_u := \frac{M_u \cdot \text{in}^2}{\Phi \cdot L \cdot d^2}$$

$$R_u = 0.121 \text{ kip}$$

$$\rho_{\min} := \frac{200 \cdot \text{psi}}{f_y}$$

$$\rho_{\min} = 0.0033$$

$$A_{s\min} := \rho_{\min} \cdot L \cdot d$$

$$A_{s\min} = 2.53 \text{ in}^2$$

$$\rho := \frac{1}{m} \cdot \left(1 - \sqrt{1 - \frac{2 \cdot R_u \cdot m \cdot \text{in}^{-2}}{f_y}} \right)$$

$$\rho = 0.00207$$

$$A_s := \rho \cdot L \cdot d$$

$$A_s = 1.573 \text{ in}^2$$

$$A_{s\min} := \text{if}(A_{s\min} > A_s \cdot 1.33, A_s \cdot 1.33, A_{s\min}) \quad A_{s\min} = 2.092 \text{ in}^2$$

$$A_s := \text{if}(A_{s\min} > A_s, A_{s\min}, A_s)$$

$$A_s = 2.092 \text{ in}^2$$

$$s_4 := \text{ceil}\left(\frac{A_s}{0.20 \cdot \text{in}^2}\right)$$

$$s_5 := \text{ceil}\left(\frac{A_s}{0.31 \cdot \text{in}^2}\right)$$

$$s_6 := \text{ceil}\left(\frac{A_s}{0.44 \cdot \text{in}^2}\right)$$

Rebar req'd

use $s_4 = 11$ #4 E.W.

use $s_5 = 7$ #5 E.W.

use $s_6 = 5$ #6 E.W.

SQUARE FOOTING FS6.0

SQUARE SIZE

DEPTH

$$L := 72 \cdot \text{in}$$

$$h := 18 \cdot \text{in}$$

Design criteria

| | |
|--------------------------------|-----------------------|
| $f_c := 2500 \cdot \text{psi}$ | concrete strength |
| $f_y := 60 \cdot \text{ksi}$ | steel yield strength |
| $\phi := 0.85$ | concrete factor |
| $q_a := 3000 \cdot \text{psf}$ | soil bearing capacity |

Column load

| | | |
|------------|-----------------------|-------------------------|
| total load | $TL := L^2 \cdot q_a$ | $TL = 108 \text{ kip}$ |
| dead load | $DL := TL \cdot 0.20$ | $DL = 21.6 \text{ kip}$ |
| live load | $LL := TL \cdot 0.80$ | $LL = 86.4 \text{ kip}$ |

Bearing pressure for strength design

| | |
|--|--------------------------|
| $A := L^2$ | $A = 36 \text{ ft}^2$ |
| $q_u := \frac{(1.4 \cdot DL) + (1.7 \cdot LL)}{A}$ | $q_u = 4920 \text{ psf}$ |

Depth required for two-way or punching shear:

| | | |
|--|---------------------------------------|---------------------------------------|
| $b_{pl} := 8 \cdot \text{in}$ | base plate or column square dimension | |
| $d := h - 3.5 \cdot \text{in}$ | depth of reinforcing | |
| $b_o := 4 \cdot (b_{pl} + d)$ | $b_o = 90 \text{ in}$ | |
| $l_{pl} := b_{pl} + d$ | $l_{pl} = 22.5 \text{ in}$ | |
| $V_{u2} := (A - l_{pl}^2) \cdot q_u$ | $V_{u2} = 159.8 \text{ kip}$ | |
| $d_2 := \frac{V_{u2}}{\phi \cdot 4 \cdot \sqrt{f_c} \cdot \text{psi} \cdot b_o}$ | $d_2 = 10.45 \text{ in} <$ | $d = 14.5 \text{ in} \quad \text{OK}$ |

Depth required for one-way shear:

| | |
|---|---------------------------|
| $a := \frac{L}{2} - \frac{b_{pl}}{2} - d$ | $a = 17.5 \text{ in}$ |
| $V_{u1} := L \cdot a \cdot q_u$ | $V_{u1} = 43 \text{ kip}$ |

SQUARE CONCRETE COLUMN FOOTING cont'd

| | |
|--|---|
| $d_1 := \frac{V_{u1}}{\phi \cdot 2 \cdot \sqrt{f_c} \cdot \text{psi} \cdot L}$ | $d_1 = 7.03 \text{ in} < \quad d = 14.5 \text{ in} \quad \text{OK}$ |
|--|---|

Determine the required steel for the footing:

$$b := \frac{L}{2} - \frac{bpl}{2}$$

$$b = 32 \text{ in}$$

$$\Phi := 0.9$$

steel factor

$$m := \frac{f_y}{.85 \cdot f_c}$$

$$m = 28.2$$

$$M_u := b \cdot L \cdot q_u \cdot \frac{b}{2}$$

$$M_u = 105 \text{ kft}$$

$$R_u := \frac{M_u \cdot \text{in}^2}{\Phi \cdot L \cdot d^2}$$

$$R_u = 0.092 \text{ kip}$$

$$\rho_{\min} := \frac{200 \cdot \text{psi}}{f_y}$$

$$\rho_{\min} = 0.0033$$

$$A_{s\min} := \rho_{\min} \cdot L \cdot d$$

$$A_{s\min} = 3.48 \text{ in}^2$$

$$\rho := \frac{1}{m} \cdot \left(1 - \sqrt{1 - \frac{2 \cdot R_u \cdot m \cdot \text{in}^{-2}}{f_y}} \right)$$

$$\rho = 0.00158$$

$$A_s := \rho \cdot L \cdot d$$

$$A_s = 1.645 \text{ in}^2$$

$$A_{s\min} := \text{if}(A_{s\min} > A_s \cdot 1.33, A_s \cdot 1.33, A_{s\min}) \quad A_{s\min} = 2.188 \text{ in}^2$$

$$A_s := \text{if}(A_{s\min} > A_s, A_{s\min}, A_s)$$

$$A_s = 2.188 \text{ in}^2$$

$$s_4 := \text{ceil}\left(\frac{A_s}{0.20 \cdot \text{in}^2}\right)$$

$$s_5 := \text{ceil}\left(\frac{A_s}{0.31 \cdot \text{in}^2}\right)$$

$$s_6 := \text{ceil}\left(\frac{A_s}{0.44 \cdot \text{in}^2}\right)$$

Rebar req'd

use $s_4 = 11$ #4 E.W.

use $s_5 = 8$ #5 E.W.

use $s_6 = 5$ #6 E.W.

SQUARE FOOTING FS6.5

SQUARE SIZE

DEPTH

$$L := 78 \cdot \text{in}$$

$$h := 18 \cdot \text{in}$$

Design criteria

| | |
|--------------------------------|-----------------------|
| $f_c := 2500 \cdot \text{psi}$ | concrete strength |
| $f_y := 60 \cdot \text{ksi}$ | steel yield strength |
| $\phi := 0.85$ | concrete factor |
| $q_a := 3000 \cdot \text{psf}$ | soil bearing capacity |

Column load

| | | |
|------------|-----------------------|--------------------------|
| total load | $TL := L^2 \cdot q_a$ | $TL = 126.7 \text{ kip}$ |
| dead load | $DL := TL \cdot 0.20$ | $DL = 25.35 \text{ kip}$ |
| live load | $LL := TL \cdot 0.80$ | $LL = 101.4 \text{ kip}$ |

Bearing pressure for strength design

| | |
|--|--------------------------|
| $A := L^2$ | $A = 42.25 \text{ ft}^2$ |
| $q_u := \frac{(1.4 \cdot DL) + (1.7 \cdot LL)}{A}$ | $q_u = 4920 \text{ psf}$ |

Depth required for two-way or punching shear:

| | | |
|--|---------------------------------------|---------------------------------------|
| $b_{pl} := 8 \cdot \text{in}$ | base plate or column square dimension | |
| $d := h - 3.5 \cdot \text{in}$ | depth of reinforcing | |
| $b_o := 4 \cdot (b_{pl} + d)$ | $b_o = 90 \text{ in}$ | |
| $l_{pl} := b_{pl} + d$ | $l_{pl} = 22.5 \text{ in}$ | |
| $V_{u2} := (A - l_{pl}^2) \cdot q_u$ | $V_{u2} = 190.6 \text{ kip}$ | |
| $d_2 := \frac{V_{u2}}{\phi \cdot 4 \cdot \sqrt{f_c} \cdot \text{psi} \cdot b_o}$ | $d_2 = 12.46 \text{ in} <$ | $d = 14.5 \text{ in} \quad \text{OK}$ |

Depth required for one-way shear:

| | |
|---|-----------------------------|
| $a := \frac{L}{2} - \frac{b_{pl}}{2} - d$ | $a = 20.5 \text{ in}$ |
| $V_{u1} := L \cdot a \cdot q_u$ | $V_{u1} = 54.6 \text{ kip}$ |

SQUARE CONCRETE COLUMN FOOTING cont'd

| | | |
|--|---------------------------|---------------------------------------|
| $d_1 := \frac{V_{u1}}{\phi \cdot 2 \cdot \sqrt{f_c} \cdot \text{psi} \cdot L}$ | $d_1 = 8.24 \text{ in} <$ | $d = 14.5 \text{ in} \quad \text{OK}$ |
|--|---------------------------|---------------------------------------|

Determine the required steel for the footing:

$$b := \frac{L}{2} - \frac{bpl}{2}$$

$$b = 35 \text{ in}$$

$$\Phi := 0.9$$

steel factor

$$m := \frac{f_y}{.85 \cdot f_c}$$

$$m = 28.2$$

$$M_u := b \cdot L \cdot q_u \cdot \frac{b}{2}$$

$$M_u = 136 \text{ kft}$$

$$R_u := \frac{M_u \cdot \text{in}^2}{\Phi \cdot L \cdot d^2}$$

$$R_u = 0.1111 \text{ kip}$$

$$\rho_{\min} := \frac{200 \cdot \text{psi}}{f_y}$$

$$\rho_{\min} = 0.0033$$

$$A_{s\min} := \rho_{\min} \cdot L \cdot d$$

$$A_{s\min} = 3.77 \text{ in}^2$$

$$\rho := \frac{1}{m} \cdot \left(1 - \sqrt{1 - \frac{2 \cdot R_u \cdot m \cdot \text{in}^{-2}}{f_y}} \right)$$

$$\rho = 0.00189$$

$$A_s := \rho \cdot L \cdot d$$

$$A_s = 2.142 \text{ in}^2$$

$$A_{s\min} := \text{if}(A_{s\min} > A_s \cdot 1.33, A_s \cdot 1.33, A_{s\min}) \quad A_{s\min} = 2.849 \text{ in}^2$$

$$A_s := \text{if}(A_{s\min} > A_s, A_{s\min}, A_s)$$

$$A_s = 2.849 \text{ in}^2$$

$$s_4 := \text{ceil}\left(\frac{A_s}{0.20 \cdot \text{in}^2}\right)$$

$$s_5 := \text{ceil}\left(\frac{A_s}{0.31 \cdot \text{in}^2}\right)$$

$$s_6 := \text{ceil}\left(\frac{A_s}{0.44 \cdot \text{in}^2}\right)$$

Rebar req'd

use $s_4 = 15$ #4 E.W.

use $s_5 = 10$ #5 E.W.

use $s_6 = 7$ #6 E.W.

SQUARE FOOTING FS7.0

SQUARE SIZE

DEPTH

$$L := 84 \cdot \text{in}$$

$$h := 21 \cdot \text{in}$$

Design criteria

| | |
|--------------------------------|-----------------------|
| $f_c := 2500 \cdot \text{psi}$ | concrete strength |
| $f_y := 60 \cdot \text{ksi}$ | steel yield strength |
| $\phi := 0.85$ | concrete factor |
| $q_a := 3000 \cdot \text{psf}$ | soil bearing capacity |

Column load

| | | |
|------------|-----------------------|--------------------------|
| total load | $TL := L^2 \cdot q_a$ | $TL = 147 \text{ kip}$ |
| dead load | $DL := TL \cdot 0.20$ | $DL = 29.4 \text{ kip}$ |
| live load | $LL := TL \cdot 0.80$ | $LL = 117.6 \text{ kip}$ |

Bearing pressure for strength design

| | |
|--|--------------------------|
| $A := L^2$ | $A = 49 \text{ ft}^2$ |
| $q_u := \frac{(1.4 \cdot DL) + (1.7 \cdot LL)}{A}$ | $q_u = 4920 \text{ psf}$ |

Depth required for two-way or punching shear:

| | | |
|--|---------------------------------------|---------------------------------------|
| $b_{pl} := 8 \cdot \text{in}$ | base plate or column square dimension | |
| $d := h - 3.5 \cdot \text{in}$ | depth of reinforcing | |
| $b_o := 4 \cdot (b_{pl} + d)$ | $b_o = 102 \text{ in}$ | |
| $l_{pl} := b_{pl} + d$ | $l_{pl} = 25.5 \text{ in}$ | |
| $V_{u2} := (A - l_{pl}^2) \cdot q_u$ | $V_{u2} = 218.9 \text{ kip}$ | |
| $d_2 := \frac{V_{u2}}{\phi \cdot 4 \cdot \sqrt{f_c} \cdot \text{psi} \cdot b_o}$ | $d_2 = 12.62 \text{ in} <$ | $d = 17.5 \text{ in} \quad \text{OK}$ |

Depth required for one-way shear:

| | |
|---|-----------------------------|
| $a := \frac{L}{2} - \frac{b_{pl}}{2} - d$ | $a = 20.5 \text{ in}$ |
| $V_{u1} := L \cdot a \cdot q_u$ | $V_{u1} = 58.8 \text{ kip}$ |

SQUARE CONCRETE COLUMN FOOTING cont'd

| | | |
|--|---------------------------|---------------------------------------|
| $d_1 := \frac{V_{u1}}{\phi \cdot 2 \cdot \sqrt{f_c} \cdot \text{psi} \cdot L}$ | $d_1 = 8.24 \text{ in} <$ | $d = 17.5 \text{ in} \quad \text{OK}$ |
|--|---------------------------|---------------------------------------|

Determine the required steel for the footing:

$$b := \frac{L}{2} - \frac{bpl}{2}$$

$$b = 38 \text{ in}$$

$$\Phi := 0.9$$

steel factor

$$m := \frac{f_y}{.85 \cdot f_c}$$

$$m = 28.2$$

$$M_u := b \cdot L \cdot q_u \cdot \frac{b}{2}$$

$$M_u = 172.7 \text{ kft}$$

$$R_u := \frac{M_u \cdot \text{in}^2}{\Phi \cdot L \cdot d^2}$$

$$R_u = 0.089 \text{ kip}$$

$$\rho_{\min} := \frac{200 \cdot \text{psi}}{f_y}$$

$$\rho_{\min} = 0.0033$$

$$A_{s\min} := \rho_{\min} \cdot L \cdot d$$

$$A_{s\min} = 4.9 \text{ in}^2$$

$$\rho := \frac{1}{m} \cdot \left(1 - \sqrt{1 - \frac{2 \cdot R_u \cdot m \cdot \text{in}^{-2}}{f_y}} \right)$$

$$\rho = 0.00152$$

$$A_s := \rho \cdot L \cdot d$$

$$A_s = 2.241 \text{ in}^2$$

$$A_{s\min} := \text{if}(A_{s\min} > A_s \cdot 1.33, A_s \cdot 1.33, A_{s\min}) \quad A_{s\min} = 2.98 \text{ in}^2$$

$$A_s := \text{if}(A_{s\min} > A_s, A_{s\min}, A_s)$$

$$A_s = 2.98 \text{ in}^2$$

$$s_4 := \text{ceil}\left(\frac{A_s}{0.20 \cdot \text{in}^2}\right)$$

$$s_5 := \text{ceil}\left(\frac{A_s}{0.31 \cdot \text{in}^2}\right)$$

$$s_6 := \text{ceil}\left(\frac{A_s}{0.44 \cdot \text{in}^2}\right)$$

Rebar req'd

use $s_4 = 15$ #4 E.W.

use $s_5 = 10$ #5 E.W.

use $s_6 = 7$ #6 E.W.

SQUARE FOOTING FS7.5

SQUARE SIZE

DEPTH

$$L := 90 \cdot \text{in}$$

$$h := 21 \cdot \text{in}$$

Design criteria

| | |
|--------------------------------|-----------------------|
| $f_c := 2500 \cdot \text{psi}$ | concrete strength |
| $f_y := 60 \cdot \text{ksi}$ | steel yield strength |
| $\phi := 0.85$ | concrete factor |
| $q_a := 3000 \cdot \text{psf}$ | soil bearing capacity |

Column load

| | | |
|------------|-----------------------|--------------------------|
| total load | $TL := L^2 \cdot q_a$ | $TL = 168.7 \text{ kip}$ |
| dead load | $DL := TL \cdot 0.20$ | $DL = 33.75 \text{ kip}$ |
| live load | $LL := TL \cdot 0.80$ | $LL = 135 \text{ kip}$ |

Bearing pressure for strength design

| | |
|--|--------------------------|
| $A := L^2$ | $A = 56.25 \text{ ft}^2$ |
| $q_u := \frac{(1.4 \cdot DL) + (1.7 \cdot LL)}{A}$ | $q_u = 4920 \text{ psf}$ |

Depth required for two-way or punching shear:

| | | |
|--|---------------------------------------|---------------------------------------|
| $b_{pl} := 8 \cdot \text{in}$ | base plate or column square dimension | |
| $d := h - 3.5 \cdot \text{in}$ | depth of reinforcing | |
| $b_o := 4 \cdot (b_{pl} + d)$ | $b_o = 102 \text{ in}$ | |
| $l_{pl} := b_{pl} + d$ | $l_{pl} = 25.5 \text{ in}$ | |
| $V_{u2} := (A - l_{pl}^2) \cdot q_u$ | $V_{u2} = 254.5 \text{ kip}$ | |
| $d_2 := \frac{V_{u2}}{\phi \cdot 4 \cdot \sqrt{f_c} \cdot \text{psi} \cdot b_o}$ | $d_2 = 14.68 \text{ in} <$ | $d = 17.5 \text{ in} \quad \text{OK}$ |

Depth required for one-way shear:

| | |
|---|-----------------------------|
| $a := \frac{L}{2} - \frac{b_{pl}}{2} - d$ | $a = 23.5 \text{ in}$ |
| $V_{u1} := L \cdot a \cdot q_u$ | $V_{u1} = 72.3 \text{ kip}$ |

SQUARE CONCRETE COLUMN FOOTING cont'd

| | | |
|--|---------------------------|---------------------------------------|
| $d_1 := \frac{V_{u1}}{\phi \cdot 2 \cdot \sqrt{f_c} \cdot \text{psi} \cdot L}$ | $d_1 = 9.45 \text{ in} <$ | $d = 17.5 \text{ in} \quad \text{OK}$ |
|--|---------------------------|---------------------------------------|

Determine the required steel for the footing:

$$b := \frac{L}{2} - \frac{bpl}{2}$$

$$b = 41 \text{ in}$$

$$\Phi := 0.9$$

steel factor

$$m := \frac{f_y}{.85 \cdot f_c}$$

$$m = 28.2$$

$$M_u := b \cdot L \cdot q_u \cdot \frac{b}{2}$$

$$M_u = 215.4 \text{ kft}$$

$$R_u := \frac{M_u \cdot \text{in}^2}{\Phi \cdot L \cdot d^2}$$

$$R_u = 0.104 \text{ kip}$$

$$\rho_{\min} := \frac{200 \cdot \text{psi}}{f_y}$$

$$\rho_{\min} = 0.0033$$

$$A_{s\min} := \rho_{\min} \cdot L \cdot d$$

$$A_{s\min} = 5.25 \text{ in}^2$$

$$\rho := \frac{1}{m} \cdot \left(1 - \sqrt{1 - \frac{2 \cdot R_u \cdot m \cdot \text{in}^{-2}}{f_y}} \right)$$

$$\rho = 0.00178$$

$$A_s := \rho \cdot L \cdot d$$

$$A_s = 2.806 \text{ in}^2$$

$$A_{s\min} := \text{if}(A_{s\min} > A_s \cdot 1.33, A_s \cdot 1.33, A_{s\min}) \quad A_{s\min} = 3.731 \text{ in}^2$$

$$A_s := \text{if}(A_{s\min} > A_s, A_{s\min}, A_s)$$

$$A_s = 3.731 \text{ in}^2$$

$$s_4 := \text{ceil}\left(\frac{A_s}{0.20 \cdot \text{in}^2}\right)$$

$$s_5 := \text{ceil}\left(\frac{A_s}{0.31 \cdot \text{in}^2}\right)$$

$$s_6 := \text{ceil}\left(\frac{A_s}{0.44 \cdot \text{in}^2}\right)$$

Rebar req'd

use $s_4 = 19$ #4 E.W.

use $s_5 = 13$ #5 E.W.

use $s_6 = 9$ #6 E.W.

SQUARE FOOTING FS8.0

SQUARE SIZE

DEPTH

$$L := 96 \cdot \text{in}$$

$$h := 21 \cdot \text{in}$$

Design criteria

| | |
|--------------------------------|-----------------------|
| $f_c := 2500 \cdot \text{psi}$ | concrete strength |
| $f_y := 60 \cdot \text{ksi}$ | steel yield strength |
| $\phi := 0.85$ | concrete factor |
| $q_a := 3000 \cdot \text{psf}$ | soil bearing capacity |

Column load

| | | |
|------------|-----------------------|--------------------------|
| total load | $TL := L^2 \cdot q_a$ | $TL = 192 \text{ kip}$ |
| dead load | $DL := TL \cdot 0.20$ | $DL = 38.4 \text{ kip}$ |
| live load | $LL := TL \cdot 0.80$ | $LL = 153.6 \text{ kip}$ |

Bearing pressure for strength design

| | |
|--|--------------------------|
| $A := L^2$ | $A = 64 \text{ ft}^2$ |
| $q_u := \frac{(1.4 \cdot DL) + (1.7 \cdot LL)}{A}$ | $q_u = 4920 \text{ psf}$ |

Depth required for two-way or punching shear:

| | | |
|--|---------------------------------------|---------------------------------------|
| $b_{pl} := 8 \cdot \text{in}$ | base plate or column square dimension | |
| $d := h - 3.5 \cdot \text{in}$ | depth of reinforcing | |
| $b_o := 4 \cdot (b_{pl} + d)$ | $b_o = 102 \text{ in}$ | |
| $l_{pl} := b_{pl} + d$ | $l_{pl} = 25.5 \text{ in}$ | |
| $V_{u2} := (A - l_{pl}^2) \cdot q_u$ | $V_{u2} = 292.7 \text{ kip}$ | |
| $d_2 := \frac{V_{u2}}{\phi \cdot 4 \cdot \sqrt{f_c} \cdot \text{psi} \cdot b_o}$ | $d_2 = 16.88 \text{ in} <$ | $d = 17.5 \text{ in} \quad \text{OK}$ |

Depth required for one-way shear:

| | |
|---|-----------------------------|
| $a := \frac{L}{2} - \frac{b_{pl}}{2} - d$ | $a = 26.5 \text{ in}$ |
| $V_{u1} := L \cdot a \cdot q_u$ | $V_{u1} = 86.9 \text{ kip}$ |

SQUARE CONCRETE COLUMN FOOTING cont'd

| | | |
|--|----------------------------|---------------------------------------|
| $d_1 := \frac{V_{u1}}{\phi \cdot 2 \cdot \sqrt{f_c} \cdot \text{psi} \cdot L}$ | $d_1 = 10.65 \text{ in} <$ | $d = 17.5 \text{ in} \quad \text{OK}$ |
|--|----------------------------|---------------------------------------|

Determine the required steel for the footing:

$$b := \frac{L}{2} - \frac{bpl}{2}$$

$$b = 44 \text{ in}$$

$$\Phi := 0.9$$

steel factor

$$m := \frac{f_y}{.85 \cdot f_c}$$

$$m = 28.2$$

$$M_u := b \cdot L \cdot q_u \cdot \frac{b}{2}$$

$$M_u = 264.6 \text{ kft}$$

$$R_u := \frac{M_u \cdot \text{in}^2}{\Phi \cdot L \cdot d^2}$$

$$R_u = 0.12 \text{ kip}$$

$$\rho_{\min} := \frac{200 \cdot \text{psi}}{f_y}$$

$$\rho_{\min} = 0.0033$$

$$A_{s\min} := \rho_{\min} \cdot L \cdot d$$

$$A_{s\min} = 5.6 \text{ in}^2$$

$$\rho := \frac{1}{m} \cdot \left(1 - \sqrt{1 - \frac{2 \cdot R_u \cdot m \cdot \text{in}^{-2}}{f_y}} \right)$$

$$\rho = 0.00206$$

$$A_s := \rho \cdot L \cdot d$$

$$A_s = 3.46 \text{ in}^2$$

$$A_{s\min} := \text{if}(A_{s\min} > A_s \cdot 1.33, A_s \cdot 1.33, A_{s\min}) \quad A_{s\min} = 4.602 \text{ in}^2$$

$$A_s := \text{if}(A_{s\min} > A_s, A_{s\min}, A_s)$$

$$A_s = 4.602 \text{ in}^2$$

$$s_4 := \text{ceil}\left(\frac{A_s}{0.20 \cdot \text{in}^2}\right)$$

$$s_5 := \text{ceil}\left(\frac{A_s}{0.31 \cdot \text{in}^2}\right)$$

$$s_6 := \text{ceil}\left(\frac{A_s}{0.44 \cdot \text{in}^2}\right)$$

Rebar req'd

use $s_4 = 24$ #4 E.W.

use $s_5 = 15$ #5 E.W.

use $s_6 = 11$ #6 E.W.

SQUARE FOOTING FS8.5

SQUARE SIZE

DEPTH

$$L := 102 \cdot \text{in}$$

$$h := 24 \cdot \text{in}$$

Design criteria

| | |
|--------------------------------|-----------------------|
| $f_c := 2500 \cdot \text{psi}$ | concrete strength |
| $f_y := 60 \cdot \text{ksi}$ | steel yield strength |
| $\phi := 0.85$ | concrete factor |
| $q_a := 3000 \cdot \text{psf}$ | soil bearing capacity |

Column load

| | | |
|------------|-----------------------|--------------------------|
| total load | $TL := L^2 \cdot q_a$ | $TL = 216.7 \text{ kip}$ |
| dead load | $DL := TL \cdot 0.20$ | $DL = 43.35 \text{ kip}$ |
| live load | $LL := TL \cdot 0.80$ | $LL = 173.4 \text{ kip}$ |

Bearing pressure for strength design

| | |
|--|--------------------------|
| $A := L^2$ | $A = 72.25 \text{ ft}^2$ |
| $q_u := \frac{(1.4 \cdot DL) + (1.7 \cdot LL)}{A}$ | $q_u = 4920 \text{ psf}$ |

Depth required for two-way or punching shear:

| | | |
|--|---------------------------------------|---------------------------------------|
| $b_{pl} := 8 \cdot \text{in}$ | base plate or column square dimension | |
| $d := h - 3.5 \cdot \text{in}$ | depth of reinforcing | |
| $b_o := 4 \cdot (b_{pl} + d)$ | $b_o = 114 \text{ in}$ | |
| $l_{pl} := b_{pl} + d$ | $l_{pl} = 28.5 \text{ in}$ | |
| $V_{u2} := (A - l_{pl}^2) \cdot q_u$ | $V_{u2} = 327.7 \text{ kip}$ | |
| $d_2 := \frac{V_{u2}}{\phi \cdot 4 \cdot \sqrt{f_c} \cdot \text{psi} \cdot b_o}$ | $d_2 = 16.91 \text{ in} <$ | $d = 20.5 \text{ in} \quad \text{OK}$ |

Depth required for one-way shear:

| | |
|---|-----------------------------|
| $a := \frac{L}{2} - \frac{b_{pl}}{2} - d$ | $a = 26.5 \text{ in}$ |
| $V_{u1} := L \cdot a \cdot q_u$ | $V_{u1} = 92.4 \text{ kip}$ |

SQUARE CONCRETE COLUMN FOOTING cont'd

| | | |
|--|----------------------------|---------------------------------------|
| $d_1 := \frac{V_{u1}}{\phi \cdot 2 \cdot \sqrt{f_c} \cdot \text{psi} \cdot L}$ | $d_1 = 10.65 \text{ in} <$ | $d = 20.5 \text{ in} \quad \text{OK}$ |
|--|----------------------------|---------------------------------------|

Determine the required steel for the footing:

$$b := \frac{L}{2} - \frac{bpl}{2}$$

$$b = 47 \text{ in}$$

$$\Phi := 0.9$$

steel factor

$$m := \frac{f_y}{.85 \cdot f_c}$$

$$m = 28.2$$

$$M_u := b \cdot L \cdot q_u \cdot \frac{b}{2}$$

$$M_u = 320.8 \text{ kft}$$

$$R_u := \frac{M_u \cdot \text{in}^2}{\Phi \cdot L \cdot d^2}$$

$$R_u = 0.1 \text{ kip}$$

$$\rho_{\min} := \frac{200 \cdot \text{psi}}{f_y}$$

$$\rho_{\min} = 0.0033$$

$$A_{s\min} := \rho_{\min} \cdot L \cdot d$$

$$A_{s\min} = 6.97 \text{ in}^2$$

$$\rho := \frac{1}{m} \cdot \left(1 - \sqrt{1 - \frac{2 \cdot R_u \cdot m \cdot \text{in}^{-2}}{f_y}} \right)$$

$$\rho = 0.0017$$

$$A_s := \rho \cdot L \cdot d$$

$$A_s = 3.563 \text{ in}^2$$

$$A_{s\min} := \text{if}(A_{s\min} > A_s \cdot 1.33, A_s \cdot 1.33, A_{s\min}) \quad A_{s\min} = 4.739 \text{ in}^2$$

$$A_s := \text{if}(A_{s\min} > A_s, A_{s\min}, A_s)$$

$$A_s = 4.739 \text{ in}^2$$

$$s_4 := \text{ceil}\left(\frac{A_s}{0.20 \cdot \text{in}^2}\right)$$

$$s_5 := \text{ceil}\left(\frac{A_s}{0.31 \cdot \text{in}^2}\right)$$

$$s_6 := \text{ceil}\left(\frac{A_s}{0.44 \cdot \text{in}^2}\right)$$

Rebar req'd

use $s_4 = 24$ #4 E.W.

use $s_5 = 16$ #5 E.W.

use $s_6 = 11$ #6 E.W.

User-Specified Input

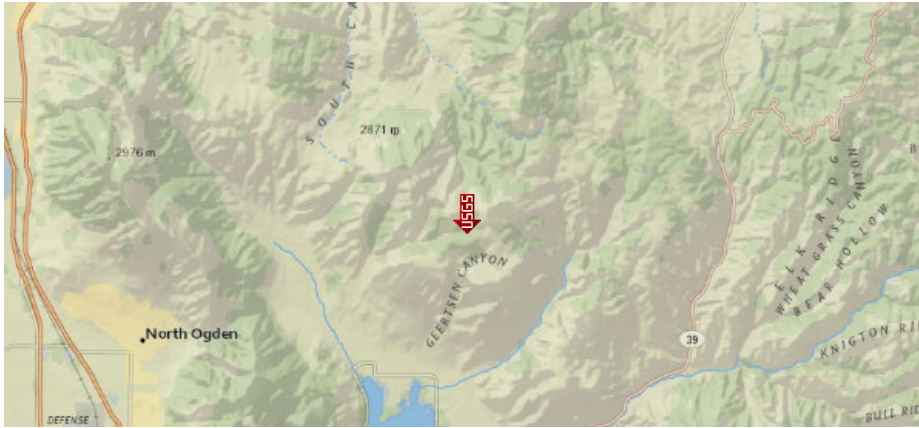
Report Title Browning Ski Lodge
Tue August 1, 2017 20:15:37 UTC

Building Code Reference Document 2012/2015 International Building Code
(which utilizes USGS hazard data available in 2008)

Site Coordinates 41.3688°N, 111.7579°W

Site Soil Classification Site Class B – “Rock”

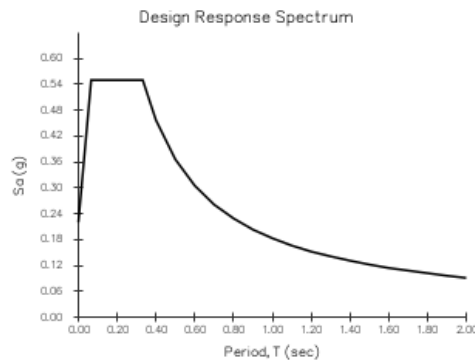
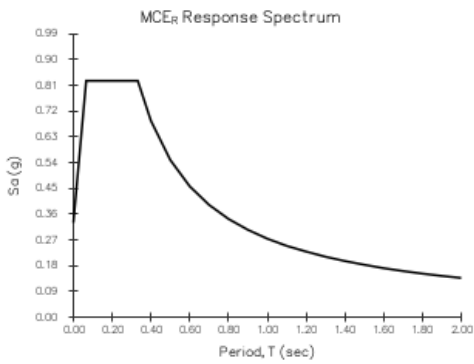
Risk Category I/II/III



USGS-Provided Output

$S_s = 0.826 \text{ g}$ $S_{MS} = 0.826 \text{ g}$ $S_{DS} = 0.550 \text{ g}$
 $S_1 = 0.274 \text{ g}$ $S_{M1} = 0.274 \text{ g}$ $S_{D1} = 0.183 \text{ g}$

For information on how the S_s and S_1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the “2009 NEHRP” building code reference document.



Although this information is a product of the U.S. Geological Survey, we provide no warranty, expressed or implied, as to the accuracy of the data contained therein. This tool is not a substitute for technical subject-matter knowledge.

Canyons Structural Inc.

940 East Elm Ave.
Salt Lake City, UT 84109
801.486.6848

JOB TITLE Browning Ski Lodge

08/2017

JOB NO.
CALCULATED BY CRF
CHECKED BY

SHEET NO.
DATE 8/14/17
DATE

Seismic Loads:

ASCE 7- 10

Strength Level Forces

Risk Category : II
Importance Factor (I) : 1.00
Site Class : B

S_s (0.2 sec) = 82.60 %g
S₁ (1.0 sec) = 27.40 %g

| | | | |
|------------------------|-------------------------|-------------------------|---------------------|
| F _a = 1.000 | S _{ms} = 0.826 | S _{DS} = 0.551 | Design Category = D |
| F _v = 1.000 | S _{m1} = 0.274 | S _{D1} = 0.183 | Design Category = C |

Seismic Design Category = **D**

Number of Stories: 2

Structure Type: Light Frame

Horizontal Struct Irregularities: No plan Irregularity

Vertical Structural Irregularities: No vertical Irregularity

Flexible Diaphragms: Yes

Building System: **Bearing Wall Systems**Seismic resisting system: **Light frame (wood) walls with structural wood shear panels**System Structural Height Limit: **65 ft**Actual Structural Height (h_n) = 26.0 ft

See ASCE7 Section 12.2.5 for exceptions and other system limitations

DESIGN COEFFICIENTS AND FACTORS

Response Modification Coefficient (R) = 6.5
Over-Strength Factor (Ω_o) = 2.5
Deflection Amplification Factor (C_d) : 4
S_{DS} = 0.551
S_{D1} = 0.183

Seismic Load Effect (E) = ρ Q_E +/- 0.2S_{DS} D = ρ Q_E +/- 0.110D
Special Seismic Load Effect (E_m) : Ω_o Q_E +/- 0.2S_{DS} D = 2.5 Q_E +/- 0.110D

ρ = redundancy coefficient
Q_E = horizontal seismic force
D = dead load

PERMITTED ANALYTICAL PROCEDURES**Simplified Analysis** - Use Equivalent Lateral Force Analysis**Equivalent Lateral-Force Analysis** - Permitted

| | | |
|---|----------|---------------------|
| Building period coef. (C _T) = 0.020 | | Cu = 1.53 |
| Approx fundamental period (T _a) : C _T h _n ^{0.75} = 0.230 sec | x = 0.75 | Tmax = CuTa = 0.353 |
| User calculated fundamental period (T) = 0 sec | | Use T = 0.230 |
| Long Period Transition Period (TL) = ASCE7 map = 10 | | |
| Seismic response coef. (C _s) = S _{DS} /R = 0.085 | | |
| need not exceed C _s = S _{d1} I / RT = 0.122 | | |
| but not less than C _s = 0.044S _{dsl} = 0.024 | | |
| USE C _s = 0.085 | | |
| Design Base Shear V = 0.085W | | |

Model & Seismic Response Analysis - Permitted (see code for procedure)**ALLOWABLE STORY DRIFT**

Structure Type: Non- masonry, 4 story or less designed to accommodate the story drift

Allowable story drift = 0.025hs_x where h_{sx} is the story height below level x

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JOB TITLE Browning Ski Lodge

08/2017

JOB NO.
CALCULATED BY CRF
CHECKED BY

SHEET NO.
DATE 8/14/17
DATE

Seismic Loads:

ASCE 7- 10

Strength Level Forces

Risk Category : II
Importance Factor (I) : 1.00
Site Class : B

Ss (0.2 sec) = 82.60 %g
S1 (1.0 sec) = 27.40 %g

| | | | |
|------------|-------------|-------------------------|---------------------|
| Fa = 1.000 | Sms = 0.826 | S _{DS} = 0.551 | Design Category = D |
| Fv = 1.000 | Sm1 = 0.274 | S _{D1} = 0.183 | Design Category = C |

Seismic Design Category = **D**

Number of Stories: 2

Structure Type: Light Frame

Horizontal Struct Irregularities: No plan Irregularity

Vertical Structural Irregularities: No vertical Irregularity

Flexible Diaphragms: Yes

Building System: **Moment-resisting Frame Systems**Seismic resisting system: **Steel ordinary moment frames**System Structural Height Limit: **System not permitted for this seismic design category (see code footnote for exception)**

Actual Structural Height (hn) = 26.0 ft

See ASCE7 Section 12.2.5 for exceptions and other system limitations

DESIGN COEFFICIENTS AND FACTORS

Response Modification Coefficient (R) = 3.5
Over-Strength Factor (Ω_0) = 2.5
Deflection Amplification Factor (Cd) : 3
S_{DS} = 0.551
S_{D1} = 0.183

Seismic Load Effect (E) = $\rho Q_E \pm 0.2S_{DS} D$ = $\rho Q_E \pm 0.110D$
Special Seismic Load Effect (Em) : $\Omega_0 Q_E \pm 0.2S_{DS} D$ = $2.5 Q_E \pm 0.110D$

ρ = redundancy coefficient
Q_E = horizontal seismic force
D = dead load

PERMITTED ANALYTICAL PROCEDURES**Simplified Analysis** - Use Equivalent Lateral Force Analysis**Equivalent Lateral-Force Analysis** - Permitted

| | | |
|--|----------|---------------------|
| Building period coef. (C_T) = 0.020 | | Cu = 1.53 |
| Approx fundamental period (Ta) : $C_T h_n^x$ = 0.230 sec | x = 0.75 | Tmax = CuTa = 0.353 |
| User calculated fundamental period (T) = 0 sec | | Use T = 0.230 |
| Long Period Transition Period (TL) = ASCE7 map = 10 | | |
| Seismic response coef. (Cs) = S _{DS} /R = 0.157 | | |
| need not exceed Cs = S _{d1} / RT = 0.227 | | |
| but not less than Cs = 0.044S _{d1} = 0.024 | | |
| USE Cs = 0.157 | | |
| Design Base Shear V = 0.157W | | |

Model & Seismic Response Analysis - Permitted (see code for procedure)**ALLOWABLE STORY DRIFT**

Structure Type: Non- masonry, 4 story or less designed to accommodate the story drift

Allowable story drift = 0.025hsx where hsx is the story height below level x

DESIGNER: CMF

SEISMIC SNOW LOAD flat, warm

Snow Load to include in lateral design (Utah Snow Study Amendment to the Code)

elevation := 8800

Roof_{snowL} := 125·psf Roof_{LL} := if [Roof_{snowL} > 30·psf , [Roof_{snowL} · [0.20 + 0.025 · $\left(\frac{\text{elevation} - 5000}{1000} \right)]]] , 0·\text{psf}]$ Roof_{LL} = 37 psf

Roof_{LL} = 37 psf

| Browning Ski Lodge (Part A) Horizontal Seismic Force Distribution by Courtney R. Fleming | | | | | | | V= 0.157 *W (Shearwall ASD) | | | | | | | 08/2017 |
|--|-----------|--------|------------|----------------|-----------------------------|------------|------------------------------------|----------------|----------------|---------|--------------------------|----------------------------|-----------------------------|---------|
| Location | Area | DL | Seismic SL | Seismic Wt., W | Level Force, V _t | # of walls | Eave length | Wall Length, L | Wall Height, H | Wall DL | Wall Wt., W _w | Wall Force, V _w | Total Force, V _s | |
| 1 | 1600 ft^2 | 15 psf | 37 psf | 83.2 kips | 13.1 kips | 2 | 0.00 ft | 80.0 ft | 10.0 ft | 8 psf | 6.4 kips | 1.0 kips | 14.1 kips | |
| 2 | 1600 ft^2 | 25 psf | 0 psf | 40.0 kips | 6.3 kips | 3 | 0.00 ft | 120.0 ft | 10.0 ft | 8 psf | 9.6 kips | 1.5 kips | 7.8 kips | |

Browning Ski Lodge (Part B)
Horizontal Seismic Force Distribution
 by Courtney R. Fleming

08/2017

V= **0.085 *W (Shearwall ASD)**

| Location | Area | DL | Seismic SL | Seismic Wt., W _s | Level Force, V _i | # of walls | Eave length | Wall Length, L | Wall Height, H | Wall DL | Wall Wt., W _w | Wall Force, V _w | Total Force, V _s |
|----------|---------------------|--------|------------|-----------------------------|-----------------------------|------------|-------------|----------------|----------------|---------|--------------------------|----------------------------|-----------------------------|
| 1 | 400 ft ² | 15 psf | 37 psf | 20.8 kips | 1.8 kips | 4 | 0.00 ft | 80.0 ft | 10.0 ft | 8 psf | 6.4 kips | 0.5 kips | 2.3 kips |
| 2 | 400 ft ² | 25 psf | 0 psf | 10.0 kips | 0.9 kips | 4 | 0.00 ft | 80.0 ft | 10.0 ft | 8 psf | 6.4 kips | 0.5 kips | 1.4 kips |
| 3 | 400 ft ² | 25 psf | 0 psf | 10.0 kips | 0.9 kips | 4 | 0.00 ft | 80.0 ft | 10.0 ft | 8 psf | 6.4 kips | 0.5 kips | 1.4 kips |

| | |
|-----------|---------------------------------------|
| Project: | Browning Ski Lodge (Part A) |
| Engineer: | Courtney R. Fleming, Project Engineer |
| Date: | 8/15/2017 |

Equivalent Lateral Force Procedure per latest version of ASCE 7

Seismic Forces Equivalent Lateral Force Procedure

V = **0.157W** Base Shear ASCE 7-10 Equation 12.8-1 pg. 89
 Cs = **0.157** Seismic Response Coefficient (input from Code Search Spreadsheet: 'EQ!F61')
 T = **0.230** Building Period (input from Code Search Spreadsheet: 'EQ!K56')

Total Seismic loads:

| | Diaphragm | Wall |
|--|-----------|---------|
| | 123 kips | 16 kips |

Total Building wt. = **139 kips**

Total Base Shear, V:

V, Seismic: 22 kips **Seismic Controls**

Seismic Controls for all wall designs

Vertical Distribution of Forces:

1
 k = 1.0 ASCE 7-10 Equation 12.8-12, pg. 91

| Level | wi | hi | wi*hi*k | wi*hi*k/Σwi*hi*k | Cs | Fx | Vx (kips) | ASD REDUCTION |
|-------------|-------------------|----------|-------------|------------------|-------|------------------|------------------|---------------|
| Roof | 86 kips | 24.0 ft. | 2074 | 0.8 | 0.157 | 17.7 kips | 17.7 kips | 12.7 kips |
| Upper Floor | 48 kips | 10.0 ft. | 480 | 0.2 | 0.157 | 4.1 kips | 21.9 kips | 15.6 kips |
| Main | 5 kips | 0.0 ft. | 0 | 0.0 | 0.157 | 0.0 kips | 0.0 kips | 0.0 kips |
| | 0 kips | 0.0 ft. | 0 | 0.0 | 0.157 | 0.0 kips | 0.0 kips | 0.0 kips |
| | | 0.0 ft. | 0 | 0.0 | 0.157 | 0.0 kips | 0.0 kips | 0.0 kips |
| | | 0.0 ft. | 0 | 0.0 | 0.157 | 0.0 kips | 0.0 kips | 0.0 kips |
| Σ | 139.2 kips | -- | 2554 | | | 21.9 kips | | |

| | |
|-----------|---------------------------------------|
| Project: | Browning Ski Lodge (Part B) |
| Engineer: | Courtney R. Fleming, Project Engineer |
| Date: | 8/15/2017 |

Equivalent Lateral Force Procedure per latest version of ASCE 7

Seismic Forces Equivalent Lateral Force Procedure

V = **0.085W** Base Shear ASCE 7-10 Equation 12.8-1 pg. 89
 Cs = **0.085** Seismic Response Coefficient (input from Code Search Spreadsheet: 'EQ!F61')
 T = **0.230** Building Period (input from Code Search Spreadsheet: 'EQ!K56')

| | | |
|----------------------|-----------|---------|
| Total Seismic loads: | Diaphragm | Wall |
| | 48 kips | 19 kips |

Total Building wt. = **68 kips**

Total Base Shear, V:

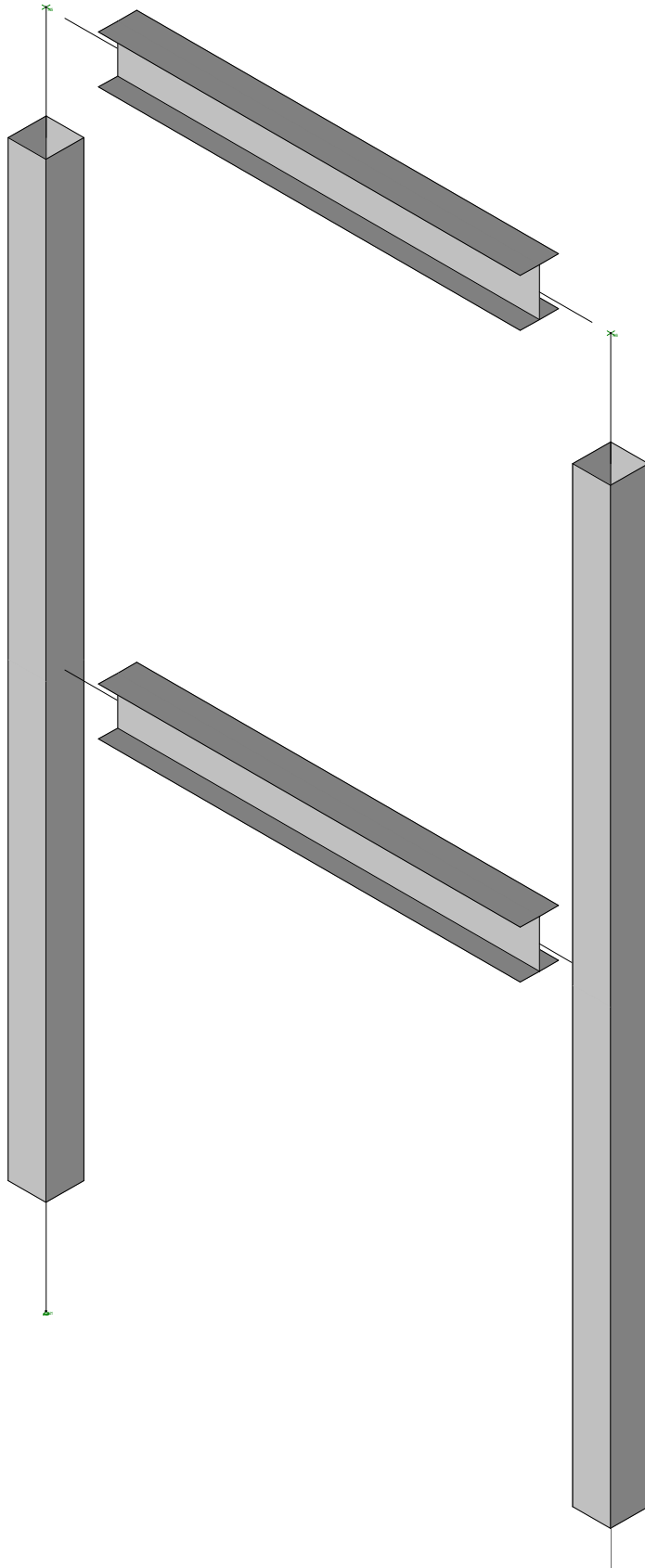
V, Seismic: 6 kips **Seismic Controls**

Seismic Controls for all wall designs

Vertical Distribution of Forces:

1
 k = 1.0 ASCE 7-10 Equation 12.8-12, pg. 91

| Level | wi | hi | wi*hi*k | wi*hi*k/Σwi*hi*k | Cs | Fx | Vx (kips) | ASD REDUCTION |
|-------------|------------------|----------|-------------|------------------|-------|-----------------|-----------------|---------------|
| Roof | 32 kips | 30.0 ft. | 948 | 0.7 | 0.085 | 3.8 kips | 3.8 kips | 2.7 kips |
| Upper Floor | 16 kips | 20.0 ft. | 328 | 0.2 | 0.085 | 1.3 kips | 5.1 kips | 3.6 kips |
| Main | 16 kips | 10.0 ft. | 164 | 0.1 | 0.085 | 0.7 kips | 5.7 kips | 4.1 kips |
| | 3 kips | 0.0 ft. | 0 | 0.0 | 0.085 | 0.0 kips | 0.0 kips | 0.0 kips |
| | | 0.0 ft. | 0 | 0.0 | 0.085 | 0.0 kips | 0.0 kips | 0.0 kips |
| | | 0.0 ft. | 0 | 0.0 | 0.085 | 0.0 kips | 0.0 kips | 0.0 kips |
| Σ | 67.6 kips | -- | 1440 | | | 5.7 kips | | |



| | | |
|--------------------|---------------------------------|-------------------------|
| | | SK - 1 |
| Courtney Fleming | Ordinary Moment Frame - 2-Story | Aug 15, 2017 at 8:36 AM |
| Browning Ski Lodge | | MF1 - 2 Story.r3d |



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^i ÖNR=OMT
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| N | j P | v | JQO | JQO | M |

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| O | k S | i | v | JNV |

ççáííç-Çè-áÇbãÑççÉÇçã æéã-ÁÉã Éáíé-E i` P-wèççÑ-áÇÑççéa F

| | ççáíí~ÁÉã | i la lj | a æÁíçã | j ~Çãí ÇÉáUÑççí-ðí çÁ-íçãÑB z |
|---|-----------|---------|---------|-------------------------------|
| N | k R | i | v | J |
| O | k S | i | v | J |

bãíÉççÉÉççáí íáÉ-Áíçãä

| | ççáí | u=áz | i` | v=áz | i` | w=áz | i` | j u=áÑiz | i` | j v=áÑiz | i` | j w=áÑiz | i` |
|----|--------|------|-------|------|-------|------|----|----------|----|----------|----|----------|----|
| N | k N | ã ~ñ | KQR | O | QKMPN | P | M | N | M | N | M | N | N |
| O | | ã á | M | NS | M | NS | M | N | M | N | M | N | N |
| P | k O | ã ~ñ | M | NS | QKMPN | P | M | N | M | N | M | N | N |
| Q | | ã á | JQR | O | M | NS | M | N | M | N | M | N | N |
| R | k R | ã ~ñ | QKQ | NN | M | N | M | N | M | N | M | N | N |
| S | | ã á | JKIOS | U | M | N | M | N | M | N | M | N | N |
| T | k S | ã ~ñ | PKIOS | V | M | N | M | N | M | N | M | N | N |
| U | | ã á | JKS | NS | M | N | M | N | M | N | M | N | N |
| V | k P | ã ~ñ | PKQP | V | M | N | M | N | M | N | M | N | N |
| NM | | ã á | JKNP | NS | M | N | M | N | M | N | M | N | N |
| NN | k Q | ã ~ñ | QK/PN | NN | M | N | M | N | M | N | M | N | N |
| NO | | ã á | JKQP | U | M | N | M | N | M | N | M | N | N |
| NP | ççí~æW | ã ~ñ | NNRQR | V | UQMSO | P | M | N | | | | | |
| NQ | | ã á | JNRQR | U | M | NS | M | N | | | | | |

bãíÉççÉÉççáí íá æéã-ÁÉã Éáíé

| | ççáí | u=áz | i` | v=áz | i` | w=áz | i` | u=çí~íKk` | v=çí~íçã~Kk` | w=çí~íçã~Kk` |
|----|------|------|----|------|------|------|----|-----------|--------------|--------------|
| N | k N | ã ~ñ | M | NS | M | NS | M | N | M | N |
| O | | ã á | M | O | M | P | M | N | M | N |
| P | k O | ã ~ñ | M | O | M | NS | M | N | M | N |
| Q | | ã á | M | NS | M | P | M | N | M | N |
| R | k P | ã ~ñ | M | NS | M | NS | M | N | M | N |
| S | | ã á | M | V | JKNS | P | M | N | M | N |
| T | k Q | ã ~ñ | M | U | M | NS | M | N | M | N |
| U | | ã á | M | NN | JKNS | P | M | N | M | N |
| V | k R | ã ~ñ | M | U | M | NS | M | N | M | N |
| NM | | ã á | M | NN | JKPN | P | M | N | M | N |

o fp^ JPa = Éãçã-NRMQ = xKkKkKkMh = ÉãÇÉéy_ ççí ááÖpáá çÇÖÉy ~áéj cN=JOpíçéóKÇç= m-Çè=O



` çā é-áó W
 a ĘāĀĔĔ W` çī āáÉó=āā āÖ
 ççĀk i ā ĀĔĔ W Ęçī āāÖp āā ççÖĔ
 j ççĀk ~ā Ĕ WI āā-óój çā Ĕāī=é-ā Ĕ=UOp ióéó

^i ÖNR=OMNT
 URG= j
 ` ÜĔĔĔÉç_öM|||

bāiĔĕçéĔ-j çāĕĕ ĩā āēā ĀĔĔ Ĕā Ĕ=Ĕ çāiāiĔçĔ

| | | | | | | | | | | | | | | |
|----|------|-----|-------|----|-------|----|-------|----|-------------|----------------|----------------|---|----------|----|
| | ççāī | | u=āāz | i` | v=āāz | i` | w=āāz | i` | u=ççī-īKki` | v=ççī-īçā=Kki` | w=ççī-īçā=Kki` | | | |
| NN | kS | ā~ñ | M | NS | M | NS | M | N | M | N | M | N | ORPOEJMQ | Q |
| NO | | ā ā | M | V | JKPN | P | M | N | M | N | M | N | M | NS |

bāiĔĕçéĔ-j Ĕā ĀĔĔpĔĀiāçā=ççĀĔĔ

| | | | | | | | | | | | | | | | |
|----|----------|-----|-------|-------|----------|------|----------|----|----------------|--------------|----------------|----|---|-------|----|
| | j Ĕā ĀĔĔ | pĔĀ | ñ=āāz | i` | ó=ÜĔ-ēāz | i` | ò=ÜĔ-ēāz | i` | ççēēī Ĕāiāz i` | óbj çā ĔĔKi` | óbj çā Ĕāiāiāz | i` | | | |
| N | j N | N | ā~ñ | PSKVO | P | KSN | O | M | N | M | N | M | N | OKNO | P |
| O | | | ā ā | M | NS | M | NS | M | N | M | N | M | N | M | NS |
| P | | O | ā~ñ | QMSVS | P | KSN | O | M | N | M | N | M | N | M | NS |
| Q | | | ā ā | M | NS | M | NS | M | N | M | N | M | N | JKSPV | O |
| R | | P | ā~ñ | QKPN | P | KQR | O | M | N | M | N | M | N | M | N |
| S | | | ā ā | M | NS | M | NS | M | N | M | N | M | N | M | N |
| T | j O | N | ā~ñ | PSKVO | P | M | NS | M | N | M | N | M | N | M | NS |
| U | | | ā ā | M | NS | JKN | O | M | N | M | N | M | N | JOKNO | P |
| V | | O | ā~ñ | QMSVS | P | M | NS | M | N | M | N | M | N | PKSPV | O |
| NM | | | ā ā | M | NS | JKN | O | M | N | M | N | M | N | M | NS |
| NN | | P | ā~ñ | QKPN | P | M | NS | M | N | M | N | M | N | M | N |
| NO | | | ā ā | M | NS | JKQR | O | M | N | M | N | M | N | M | N |
| NP | j P | N | ā~ñ | PKPN | V | RQR | O | M | N | M | N | M | N | QOPV | O |
| NQ | | | ā ā | JKPN | U | M | NS | M | N | M | N | M | N | M | NS |
| NR | | O | ā~ñ | M | N | M | P | M | N | M | N | M | N | M | NS |
| NS | | | ā ā | M | N | M | NS | M | N | M | N | M | N | JKT | O |
| NT | | P | ā~ñ | PKPN | U | M | NS | M | N | M | N | M | N | QOPV | O |
| NU | | | ā ā | JKPN | V | RQR | O | M | N | M | N | M | N | M | NS |
| NV | j T | N | ā~ñ | OKS | V | OKVO | P | M | N | M | N | M | N | NKMR | O |
| OM | | | ā ā | JKSS | U | M | NS | M | N | M | N | M | N | M | NS |
| ON | | O | ā~ñ | M | N | M | P | M | N | M | N | M | N | M | NS |
| OO | | | ā ā | M | N | M | NS | M | N | M | N | M | N | JKMP | Q |
| OP | | P | ā~ñ | OKS | U | M | NS | M | N | M | N | M | N | NKMR | O |
| OQ | | | ā ā | JKSS | V | OKVO | Q | M | N | M | N | M | N | M | NS |

bāiĔĕçéĔ-j Ĕā ĀĔĔpĔĀiāçā=ĔĔĔĔĔāē

| | | | | | | | | | | | | | | | |
|----|----------|-----|-------|-----|-------|-----|-------|----|---------------|---------------|---------------|--------|---|----|---|
| | j Ĕā ĀĔĔ | pĔĀ | ñ=āāz | i` | ó=āāz | i` | ò=āāz | i` | ñ=ççī-ĔĔ=Kki` | ĔāĔĔ Ló=Ĕç i` | ĔāĔĔ Ló=Ĕç i` | | | | |
| N | j N | N | ā~ñ | KPN | P | M | N | M | N | M | N | k` | N | k` | N |
| O | | | ā ā | M | NS | M | N | M | N | M | N | k` | N | k` | N |
| P | | O | ā~ñ | KNS | P | M | N | M | N | M | N | k` | N | k` | N |
| Q | | | ā ā | M | NS | M | N | M | N | M | N | k` | N | k` | N |
| R | | P | ā~ñ | M | N | M | N | M | N | M | N | k` | N | k` | N |
| S | | | ā ā | M | N | M | N | M | N | M | N | k` | N | k` | N |
| T | j O | N | ā~ñ | KPN | P | M | N | M | N | M | N | k` | N | k` | N |
| U | | | ā ā | M | NS | M | N | M | N | M | N | k` | N | k` | N |
| V | | O | ā~ñ | KNS | P | M | N | M | N | M | N | k` | N | k` | N |
| NM | | | ā ā | M | NS | M | N | M | N | M | N | k` | N | k` | N |
| NN | | P | ā~ñ | M | N | M | N | M | N | M | N | k` | N | k` | N |
| NO | | | ā ā | M | N | M | N | M | N | M | N | k` | N | k` | N |
| NP | j P | N | ā~ñ | M | N | M | NS | M | N | M | N | k` | N | k` | N |
| NQ | | | ā ā | M | N | JMT | P | M | N | M | N | k` | N | k` | N |
| NR | | O | ā~ñ | M | N | M | NS | M | N | M | N | k` | N | k` | N |
| NS | | | ā ā | M | N | JMT | O | M | N | M | N | SRQPPV | O | k` | N |
| NT | | P | ā~ñ | M | N | M | NS | M | N | M | N | k` | N | k` | N |



` çã é-áó W
 a ÉããÉé W` çí ááÉó=ãã ãÖ
 gçÄk i ä ÄÉé W_ ççí áãÖp áã çÇÉÉ
 j çÇÉk ~ã É WI çã-óó çã Éáí=é-ã É=Opíçéó

^i ÖNR=OMNT
 URG^ j
 ` ÜÉÁÉÇ_ óM || |

bãíÉäçéÉ=j Éã ÄÉé pÉÁíçã=áÉñÉÁíç äé=É çáíáíÉÇF

| | j Éã ÄÉé | pÉÁ | ñ=ãz | i` | ó=ãz | i` | ò=ãz | i` | ñ=çí-íÉ=çKk i` | ÉãFí Lóç ~íç i` | ÉãFí Lóç ~íç i` | | | | |
|----|----------|-----|------|----|------|------|------|----|----------------|-----------------|-----------------|----|---|----|---|
| NU | | | ã ã | M | N | JMNT | P | M | N | M | N | k` | N | k` | N |
| NV | j T | N | ã ~ñ | M | N | M | NS | M | N | M | N | k` | N | k` | N |
| OM | | | ã ã | M | N | JMPO | P | M | N | M | N | k` | N | k` | N |
| ON | | O | ã ~ñ | M | N | M | NS | M | N | M | N | k` | N | k` | N |
| OO | | | ã ã | M | N | JMOO | Q | M | N | M | N | k` | N | k` | N |
| OP | | P | ã ~ñ | M | N | M | NS | M | N | M | N | k` | N | k` | N |
| OQ | | | ã ã | M | N | JMPO | P | M | N | M | N | k` | N | k` | N |

bãíÉäçéÉ= fp` =ÓãÇWíoca p íÉÉä` çÇÉ= ÜÉÁäé

| | j Éã ÄÉé | pÜ-éÉ | ` çÇÉ= Kk çÄñz i` | pÜ-éKk i çÄñz a ä i` | éÜáíá=áz éÜáíá=áz éÜáí á=óKkÜá á=óKk Ä | beá | | | | | |
|---|----------|----------|-------------------|----------------------|--|-------|---------|------|-------|---------|-------------------------|
| N | j N | eppUíUíS | K/MR | NM P | K/MQ | M ó O | OURKOPQ | QSU | NNMCR | NNMCR | Nkk e pp=TKK |
| O | j O | eppUíUíS | K/MR | NM P | K/MQ | M ó O | OURKOPQ | QSU | NNMCR | NNMCR | Nkk e pp=TKK |
| P | j P | t NMíQR | K/MQ | QSST O | K/RU | M ó O | QQ/KNP | RVUR | TQKMS | OMRKUTR | Nkk e NUNÄ |
| Q | j T | t NMíQR | K/MQ | QSST Q | K/UV | M ó P | QQ/KNP | RVUR | TQKMS | OMRKUTR | Nkk e NUNÄ |

| | | | <i>Elliot Group - Browning Ski Lodge (Part A)</i> | | | | | | | | | | | | | 8/21/2017 | | | |
|-------|---------|------|---|---------------|--------------|-------------|---------|------------|-------------|-------|------------|---------|-------------|-----------|----------|-----------|-------------|-------------|-------------|
| | | | SUMMARY OF LATERAL FORCES-PERFORATED | | | | | | | | | | | | | | | | |
| Level | Line No | Mark | Force V(k) | Wood/Conc. | Wind/Seismic | Length (ft) | Li (ft) | % full-ht. | Opening ht. | Co | Net L (ft) | v (plf) | Height (ft) | Reduction | SW Type | Uplift | Uplift LEFT | Jplift RIGH | Holddowns |
| 1 | 1 | 1.1 | 2.00 | wood/concrete | Seismic | 7 | 5.5 | 79% | 2 | 1.094 | 6.0 | 332 | 10 | 1.00 | B | 3325 | 2834 | 2834 | HDU2 |
| 2 | 2 | 2.2 | 2.30 | wood/concrete | Seismic | 7 | 5.5 | 79% | 2 | 1.094 | 6.0 | 382 | 10 | 1.00 | C | 3823 | 3333 | 3333 | HTT4 |
| 9 | 3 | 9.3 | 0.60 | wood/concrete | Seismic | 16 | 12 | 75% | 6 | 0.889 | 10.7 | 56 | 12 | 1.00 | A | 675 | n/a | n/a | - |
| 9 | 4 | 9.4 | 0.60 | wood/concrete | Seismic | 14 | 10 | 71% | 6 | 0.875 | 8.8 | 69 | 12 | 1.00 | A | 823 | n/a | n/a | - |
| 8 | 2 | 8.2 | 5.40 | wood/concrete | Seismic | 22 | 18 | 82% | 6 | 0.917 | 16.5 | 327 | 18 | 1.00 | B | 5891 | 2545 | 2545 | HDU2 |

| | | | | CRF | | | | | | | | 8/21/2017 | | |
|--------|----------|----------|-------|--|--------------------------|-------------|---------|-------------|-----------|---------|--------|-------------|--------------|-----------|
| | | | | Elliot Group - Browning Ski Lodge (Part B) | | | | | | | | | | |
| | | | | SUMMARY OF LATERAL FORCES (SEGMENTED DESIGN) | | | | | | | | | | |
| Level | Line No. | Wall No. | Mark | Force V(k) | Wind/Seismic | Length (ft) | v (plf) | Height (ft) | Reduction | SW Type | Uplift | Uplift LEFT | Jplift RIGHT | Holddowns |
| R | 1 | 1 | R.1.1 | | | 20 | 43 | 9 | 1.00 | A | 384 | n/a | n/a | - |
| R | 1 | 2 | R.1.2 | | | 14 | 43 | 9 | 1.00 | A | 384 | n/a | n/a | - |
| R | 1 | 3 | R.1.3 | | | 0 | 43 | 0 | #DIV/0! | #DIV/0! | 0 | n/a | n/a | - |
| R | 1 | 4 | R.1.4 | | | 0 | 43 | 0 | #DIV/0! | #DIV/0! | 0 | n/a | n/a | - |
| R | 1 | 5 | R.1.5 | | | 0 | 43 | 0 | #DIV/0! | #DIV/0! | 0 | n/a | n/a | - |
| R | 1 | 6 | R.1.6 | | | 0 | 43 | 0 | #DIV/0! | #DIV/0! | 0 | n/a | n/a | - |
| R | 1 | 7 | R.1.7 | | | 0 | 43 | 0 | #DIV/0! | #DIV/0! | 0 | n/a | n/a | - |
| Totals | | | | 1.5 | Seismic wood/wood | 34 | | | | | | | | |
| 3 | 1 | 1 | 3.1.1 | | | 20 | 97 | 9 | 1.00 | A | 874 | n/a | n/a | - |
| 3 | 1 | 2 | 3.1.2 | | | 14 | 97 | 9 | 1.00 | A | 874 | n/a | n/a | - |
| 3 | 1 | 3 | 3.1.3 | | | 0 | 97 | 0 | #DIV/0! | #DIV/0! | 0 | n/a | n/a | - |
| 3 | 1 | 4 | 3.1.4 | | | 0 | 97 | 0 | #DIV/0! | #DIV/0! | 0 | n/a | n/a | - |
| 3 | 1 | 5 | 3.1.5 | | | 0 | 97 | 0 | #DIV/0! | #DIV/0! | 0 | n/a | n/a | - |
| 3 | 1 | 6 | 3.1.6 | | | 0 | 97 | 0 | #DIV/0! | #DIV/0! | 0 | n/a | n/a | - |
| 3 | 1 | 7 | 3.1.7 | | | 0 | 97 | 0 | #DIV/0! | #DIV/0! | 0 | n/a | n/a | - |
| Totals | | | | 3.3 | Seismic wood/wood | 34 | | | | | | | | |
| 2 | 1 | 1 | 2.1.1 | | | 20 | 125 | 9 | 1.00 | A | 1125 | n/a | n/a | - |
| 2 | 1 | 2 | 2.1.2 | | | 14 | 125 | 9 | 1.00 | A | 1125 | n/a | n/a | - |
| 2 | 1 | 3 | 2.1.3 | | | 0 | 125 | 0 | #DIV/0! | #DIV/0! | 0 | n/a | n/a | - |
| 2 | 1 | 4 | 2.1.4 | | | 0 | 125 | 0 | #DIV/0! | #DIV/0! | 0 | n/a | n/a | - |
| 2 | 1 | 5 | 2.1.5 | | | 0 | 125 | 0 | #DIV/0! | #DIV/0! | 0 | n/a | n/a | - |
| 2 | 1 | 6 | 2.1.6 | | | 0 | 125 | 0 | #DIV/0! | #DIV/0! | 0 | n/a | n/a | - |
| 2 | 1 | 7 | 2.1.7 | | | 0 | 125 | 0 | #DIV/0! | #DIV/0! | 0 | n/a | n/a | - |
| Totals | | | | 4.3 | Seismic wood/concrete | 34 | | | | | | | | |

Project: Typ. Residential
 Designer: Courtney Fleming
 Date: 1/4/2017

Anchor Bolts for Shearwalls, use 5/8" diameter bolts
 Assume embedment depth in concrete > 6" so wood strength will control
 Shear strength for 5/8" anchor bolt bearing against 1-1/2" douglas fir-larch

| Wall Type | Strength (lb/ft) | Plate Thickness (i | Plate Capacity at Bolt(lb) | Required Spacing (in) | Bolt Spacing |
|-----------|------------------|--------------------|----------------------------|-----------------------|--------------|
| A | 340 | 1.5 | 930 | 32.8 | 32 |
| B | 510 | 3 | 1190 | 28.0 | 28 |
| C | 665 | 3 | 1190 | 21.5 | 20 |
| D | 870 | 3 | 1190 | 16.4 | 16 |
| 2B | 1020 | 3 | 1190 | 14.0 | 14 |
| 2C | 1330 | 3 | 1190 | 10.7 | 10 |
| 2D | 1740 | 3 | 1190 | 8.2 | 8 |

Reference NDS 2015 Table 11E, pg. 93



| | | | |
|-----------|--------------------|-------|-----------|
| Company: | Canyons Structural | Date: | 7/21/2015 |
| Engineer: | Courtney Fleming | Page: | 1/4 |
| Project: | HTT4 w/10d nails | | |
| Address: | | | |
| Phone: | | | |
| E-mail: | | | |

1. Project information

Customer company:
 Customer contact name:
 Customer e-mail:
 Comment:

Project description:
 Location:
 Fastening description:

2. Input Data & Anchor Parameters

General

Design method: ACI 318-11
 Units: Imperial units

Anchor Information:

Anchor type: Cast-in-place
 Material: F1554 Grade 36
 Diameter (inch): 0.625
 Effective Embedment depth, h_{ef} (inch): 10.000
 Anchor category: -
 Anchor ductility: Yes
 h_{min} (inch): 11.38
 C_{min} (inch): 1.11
 S_{min} (inch): 2.50

Base Material

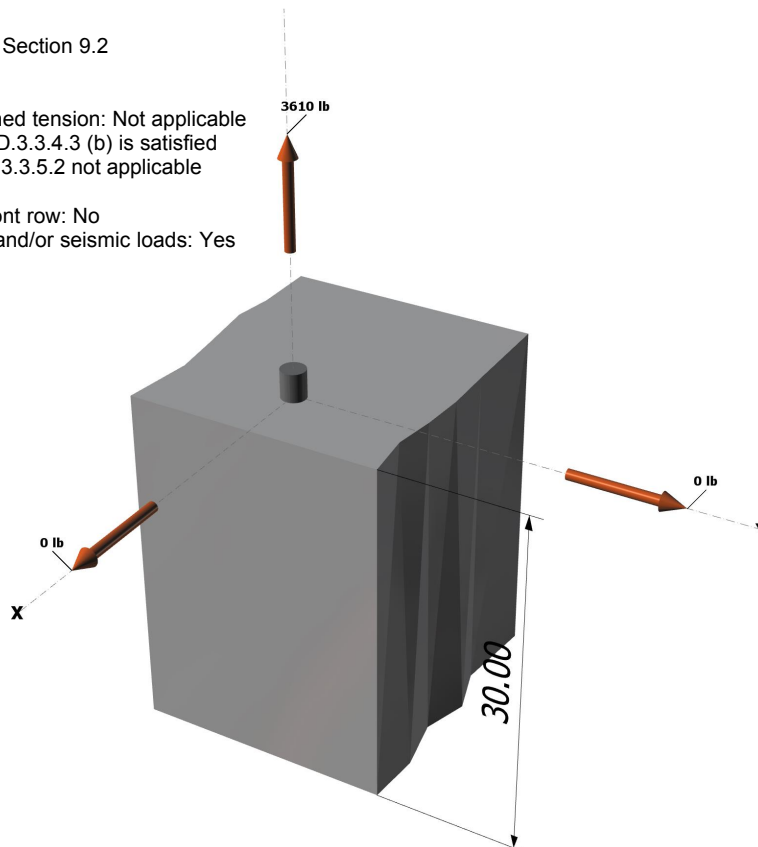
Concrete: Normal-weight
 Concrete thickness, h (inch): 30.00
 State: Cracked
 Compressive strength, f'_c (psi): 2500
 $\Psi_{e,v}$: 1.0
 Reinforcement condition: B tension, B shear
 Supplemental reinforcement: Not applicable
 Do not evaluate concrete breakout in tension: No
 Do not evaluate concrete breakout in shear: No
 Ignore 6do requirement: Yes
 Build-up grout pad: No

Base Plate

Load and Geometry

Load factor source: ACI 318 Section 9.2
 Load combination: not set
 Seismic design: Yes
 Anchors subjected to sustained tension: Not applicable
 Ductility section for tension: D.3.3.4.3 (b) is satisfied
 Ductility section for shear: D.3.3.5.2 not applicable
 Ω_0 factor: not set
 Apply entire shear load at front row: No
 Anchors only resisting wind and/or seismic loads: Yes

<Figure 1>

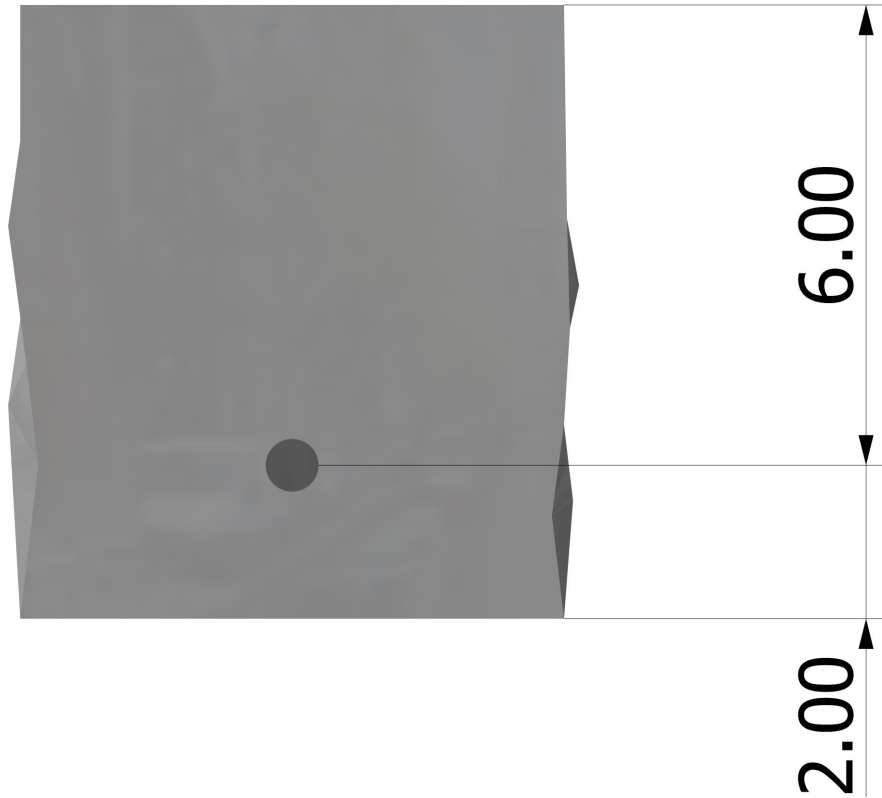


Input data and results must be checked for agreement with the existing circumstances, the standards and guidelines must be checked for plausibility.

Simpson Strong-Tie Company Inc. 5956 W. Las Positas Boulevard Pleasanton, CA 94588 Phone: 925.560.9000 Fax: 925.847.3871 www.strongtie.com

| | | | |
|-----------|--------------------|-------|-----------|
| Company: | Canyons Structural | Date: | 7/21/2015 |
| Engineer: | Courtney Fleming | Page: | 2/4 |
| Project: | HTT4 w/10d nails | | |
| Address: | | | |
| Phone: | | | |
| E-mail: | | | |

<Figure 2>

**Recommended Anchor**

Anchor Name: Heavy Hex Bolt - 5/8"Ø Heavy Hex Bolt, F1554 Gr. 36





Anchor Designer™
Software
Version 2.0.5154.2

| | | | |
|-----------|--------------------|-------|-----------|
| Company: | Canyons Structural | Date: | 7/21/2015 |
| Engineer: | Courtney Fleming | Page: | 3/4 |
| Project: | HTT4 w/10d nails | | |
| Address: | | | |
| Phone: | | | |
| E-mail: | | | |

3. Resulting Anchor Forces

| Anchor | Tension load, N_{ua} (lb) | Shear load x, V_{uax} (lb) | Shear load y, V_{uay} (lb) | Shear load combined, $\sqrt{(V_{uax})^2 + (V_{uay})^2}$ (lb) |
|--------|--------------------------------|---------------------------------|---------------------------------|---|
| 1 | 3610.0 | 0.0 | 0.0 | 0.0 |
| Sum | 3610.0 | 0.0 | 0.0 | 0.0 |

Maximum concrete compression strain (%): 0.00

Maximum concrete compression stress (psi): 0

Resultant tension force (lb): 3610

Resultant compression force (lb): 0

Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 0.00

Eccentricity of resultant tension forces in y-axis, e'_{Ny} (inch): 0.00

4. Steel Strength of Anchor in Tension (Sec. D.5.1)

| N_{sa} (lb) | ϕ | ϕN_{sa} (lb) |
|---------------|--------|--------------------|
| 13100 | 0.75 | 9825 |

5. Concrete Breakout Strength of Anchor in Tension (Sec. D.5.2)

$$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5} \text{ (Eq. D-6)}$$

| k_c | λ_a | f'_c (psi) | h_{ef} (in) | N_b (lb) |
|-------|-------------|--------------|---------------|------------|
| 24.0 | 1.00 | 2500 | 10.000 | 37947 |

$$0.75 \phi N_{cb} = 0.75 \phi (A_{Nc} / A_{Nco}) \Psi_{ed,N} \Psi_{c,N} \Psi_{cp,N} N_b \text{ (Sec. D.4.1 \& Eq. D-3)}$$

| A_{Nc} (in ²) | A_{Nco} (in ²) | $\Psi_{ed,N}$ | $\Psi_{c,N}$ | $\Psi_{cp,N}$ | N_b (lb) | ϕ | $0.75 \phi N_{cb}$ (lb) |
|-----------------------------|------------------------------|---------------|--------------|---------------|------------|--------|-------------------------|
| 240.00 | 900.00 | 0.740 | 1.00 | 1.000 | 37947 | 0.70 | 3931 |

6. Pullout Strength of Anchor in Tension (Sec. D.5.3)

$$0.75 \phi N_{pn} = 0.75 \phi \Psi_{c,P} N_p = 0.75 \phi \Psi_{c,P} 8 A_{brg} f'_c \text{ (Sec. D.4.1, Eq. D-13 \& D-14)}$$

| $\Psi_{c,P}$ | A_{brg} (in ²) | f'_c (psi) | ϕ | $0.75 \phi N_{pn}$ (lb) |
|--------------|------------------------------|--------------|--------|-------------------------|
| 1.0 | 0.67 | 2500 | 0.70 | 7046 |

Input data and results must be checked for agreement with the existing circumstances, the standards and guidelines must be checked for plausibility.

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| | | | |
|-----------|--------------------|-------|-----------|
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| Engineer: | Courtney Fleming | Page: | 4/4 |
| Project: | HTT4 w/10d nails | | |
| Address: | | | |
| Phone: | | | |
| E-mail: | | | |

7. Side-Face Blowout Strength of Anchor in Tension (Sec. D.5.3)

$$0.75\phi N_{sb} = 0.75\phi \left\{ (1 + c_{a2}/c_{a1})/4 \right\} (160c_{a1}\sqrt{A_{brg}})\lambda\sqrt{f'_c} \quad (\text{Sec. D.4.1 \& Eq. D-16})$$

| c_{a1} (in) | c_{a2} (in) | A_{brg} (in ²) | λ_a | f'_c (psi) | ϕ | $0.75\phi N_{sbg}$ (lb) |
|---------------|---------------|------------------------------|-------------|--------------|--------|-------------------------|
| 2.00 | 99999.00 | 0.67 | 1.00 | 2500 | 0.70 | 6881 |

11. Interaction of Tensile and Shear Forces (Sec. D.7)

| Tension | Factored Load, N_{ua} (lb) | Design Strength, ϕN_n (lb) | Ratio | Status |
|--------------------------|------------------------------|----------------------------------|-------------|-----------------------|
| Steel | 3610 | 9825 | 0.37 | Pass |
| Concrete breakout | 3610 | 3931 | 0.92 | Pass (Governs) |
| Pullout | 3610 | 7046 | 0.51 | Pass |
| Side-face blowout | 3610 | 6881 | 0.52 | Pass |

5/8"Ø Heavy Hex Bolt, F1554 Gr. 36 with hef = 10.000 inch meets the selected design criteria.

12. Warnings

- Minimum spacing and edge distance requirement of 6da per ACI 318 Sections D.8.1 and D.8.2 for torqued cast-in-place anchor is waived per designer option.
- Per designer input, ductility requirements for tension have been determined to be satisfied – designer to verify.
- Per designer input, the shear component of the strength-level earthquake force applied to anchors does not exceed 20 percent of the total factored anchor shear force associated with the same load combination. Therefore the ductility requirements of D.3.3.5.3 for shear need not be satisfied – designer to verify.
- Designer must exercise own judgement to determine if this design is suitable.

Input data and results must be checked for agreement with the existing circumstances, the standards and guidelines must be checked for plausibility.

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| | | | |
|-----------|--------------------|-------|-----------|
| Company: | Canyons Structural | Date: | 7/21/2015 |
| Engineer: | Courtney Fleming | Page: | 1/4 |
| Project: | HTT5 w/10d nails | | |
| Address: | | | |
| Phone: | | | |
| E-mail: | | | |

1. Project information

Customer company:
 Customer contact name:
 Customer e-mail:
 Comment:

Project description:
 Location:
 Fastening description:

2. Input Data & Anchor Parameters

General

Design method: ACI 318-11
 Units: Imperial units

Anchor Information:

Anchor type: Cast-in-place
 Material: F1554 Grade 36
 Diameter (inch): 0.625
 Effective Embedment depth, h_{ef} (inch): 14.000
 Anchor category: -
 Anchor ductility: Yes
 h_{min} (inch): 15.38
 C_{min} (inch): 1.11
 S_{min} (inch): 2.50

Base Material

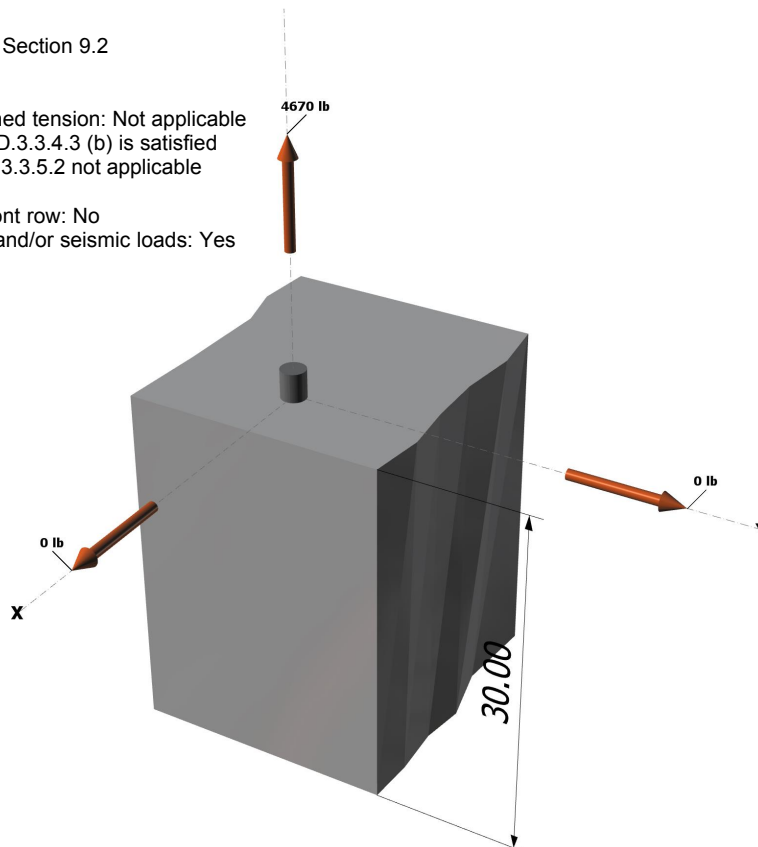
Concrete: Normal-weight
 Concrete thickness, h (inch): 30.00
 State: Cracked
 Compressive strength, f'_c (psi): 2500
 $\Psi_{e,v}$: 1.0
 Reinforcement condition: B tension, B shear
 Supplemental reinforcement: Not applicable
 Do not evaluate concrete breakout in tension: No
 Do not evaluate concrete breakout in shear: No
 Ignore 6do requirement: Yes
 Build-up grout pad: No

Base Plate

Load and Geometry

Load factor source: ACI 318 Section 9.2
 Load combination: not set
 Seismic design: Yes
 Anchors subjected to sustained tension: Not applicable
 Ductility section for tension: D.3.3.4.3 (b) is satisfied
 Ductility section for shear: D.3.3.5.2 not applicable
 Ω_0 factor: not set
 Apply entire shear load at front row: No
 Anchors only resisting wind and/or seismic loads: Yes

<Figure 1>



Input data and results must be checked for agreement with the existing circumstances, the standards and guidelines must be checked for plausibility.

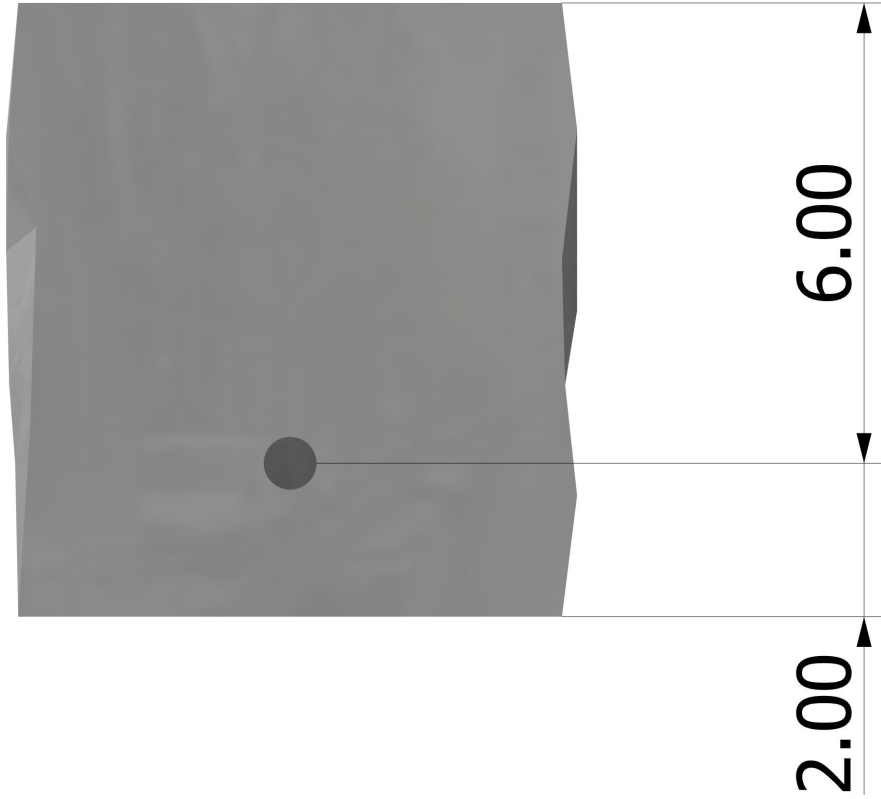
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| Project: | HTT5 w/10d nails | | |
| Address: | | | |
| Phone: | | | |
| E-mail: | | | |

<Figure 2>



Recommended Anchor

Anchor Name: Heavy Hex Bolt - 5/8"Ø Heavy Hex Bolt, F1554 Gr. 36





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| Engineer: | Courtney Fleming | Page: | 3/4 |
| Project: | HTT5 w/10d nails | | |
| Address: | | | |
| Phone: | | | |
| E-mail: | | | |

3. Resulting Anchor Forces

| Anchor | Tension load, N_{ua} (lb) | Shear load x, V_{uax} (lb) | Shear load y, V_{uay} (lb) | Shear load combined, $\sqrt{(V_{uax})^2 + (V_{uay})^2}$ (lb) |
|--------|--------------------------------|---------------------------------|---------------------------------|---|
| 1 | 4670.0 | 0.0 | 0.0 | 0.0 |
| Sum | 4670.0 | 0.0 | 0.0 | 0.0 |

Maximum concrete compression strain (%): 0.00

Maximum concrete compression stress (psi): 0

Resultant tension force (lb): 4670

Resultant compression force (lb): 0

Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 0.00

Eccentricity of resultant tension forces in y-axis, e'_{Ny} (inch): 0.00

4. Steel Strength of Anchor in Tension (Sec. D.5.1)

| N_{sa} (lb) | ϕ | ϕN_{sa} (lb) |
|---------------|--------|--------------------|
| 13100 | 0.75 | 9825 |

5. Concrete Breakout Strength of Anchor in Tension (Sec. D.5.2)

$$N_b = 16\lambda_a \sqrt{f_c} h_{ef}^{5/3} \text{ (Eq. D-7)}$$

| λ_a | f_c (psi) | h_{ef} (in) | N_b (lb) |
|-------------|-------------|---------------|------------|
| 1.00 | 2500 | 14.000 | 65058 |

$$0.75\phi N_{cb} = 0.75\phi (A_{Nc} / A_{Nco}) \Psi_{ed,N} \Psi_{c,N} \Psi_{cp,N} N_b \text{ (Sec. D.4.1 \& Eq. D-3)}$$

| A_{Nc} (in ²) | A_{Nco} (in ²) | $\Psi_{ed,N}$ | $\Psi_{c,N}$ | $\Psi_{cp,N}$ | N_b (lb) | ϕ | $0.75\phi N_{cb}$ (lb) |
|-----------------------------|------------------------------|---------------|--------------|---------------|------------|--------|------------------------|
| 336.00 | 1764.00 | 0.729 | 1.00 | 1.000 | 65058 | 0.70 | 4740 |

6. Pullout Strength of Anchor in Tension (Sec. D.5.3)

$$0.75\phi N_{pn} = 0.75\phi \Psi_{c,P} N_p = 0.75\phi \Psi_{c,P} 8A_{brg} f_c \text{ (Sec. D.4.1, Eq. D-13 \& D-14)}$$

| $\Psi_{c,P}$ | A_{brg} (in ²) | f_c (psi) | ϕ | $0.75\phi N_{pn}$ (lb) |
|--------------|------------------------------|-------------|--------|------------------------|
| 1.0 | 0.67 | 2500 | 0.70 | 7046 |

Input data and results must be checked for agreement with the existing circumstances, the standards and guidelines must be checked for plausibility.

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| Project: | HTT5 w/10d nails | | |
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| Phone: | | | |
| E-mail: | | | |

7. Side-Face Blowout Strength of Anchor in Tension (Sec. D.5.3)

$$0.75\phi N_{sb} = 0.75\phi \left\{ (1 + c_{a2}/c_{a1})/4 \right\} (160c_{a1}\sqrt{A_{brg}})\lambda\sqrt{f'_c} \quad (\text{Sec. D.4.1 \& Eq. D-16})$$

| c_{a1} (in) | c_{a2} (in) | A_{brg} (in ²) | λ_a | f'_c (psi) | ϕ | $0.75\phi N_{sb}$ (lb) |
|---------------|---------------|------------------------------|-------------|--------------|--------|------------------------|
| 2.00 | 99999.00 | 0.67 | 1.00 | 2500 | 0.70 | 6881 |

11. Interaction of Tensile and Shear Forces (Sec. D.7)

| Tension | Factored Load, N_{ua} (lb) | Design Strength, ϕN_n (lb) | Ratio | Status |
|--------------------------|------------------------------|----------------------------------|-------------|-----------------------|
| Steel | 4670 | 9825 | 0.48 | Pass |
| Concrete breakout | 4670 | 4740 | 0.99 | Pass (Governs) |
| Pullout | 4670 | 7046 | 0.66 | Pass |
| Side-face blowout | 4670 | 6881 | 0.68 | Pass |

5/8"Ø Heavy Hex Bolt, F1554 Gr. 36 with hef = 14.000 inch meets the selected design criteria.

12. Warnings

- Minimum spacing and edge distance requirement of 6da per ACI 318 Sections D.8.1 and D.8.2 for torqued cast-in-place anchor is waived per designer option.
- Per designer input, ductility requirements for tension have been determined to be satisfied – designer to verify.
- Per designer input, the shear component of the strength-level earthquake force applied to anchors does not exceed 20 percent of the total factored anchor shear force associated with the same load combination. Therefore the ductility requirements of D.3.3.5.3 for shear need not be satisfied – designer to verify.
- Designer must exercise own judgement to determine if this design is suitable.

Input data and results must be checked for agreement with the existing circumstances, the standards and guidelines must be checked for plausibility.

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