

RB Engineers, Inc.

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JOB: MERLINO
PROJECT #: 20-7888
BY: R.B. / MJT
DATE: 4/21/2021

PAGE G1 OF 36

STUCTURAL PLAN CHECK REPLY FOR

MERLINO RESIDENCE
MERCER ISLAND, WA

BASIS FOR DESIGN:

CODE: INTERNATIONAL BUILDING CODE (2015 EDITION)
WIND: 110 MPH, EXPOSURE "B" $K_{zt} = 1.6$
SEISMIC: $S_s = 1.55$, $S_1 = 0.55$ (SITE CLASS D)
ROOF SNOW: 25 PSF
ALLOWABLE SOIL BEARING PRESSURE: 1500 PSF (ASSUMED)

INDEX TO COMPUTATIONS:

| | | |
|-----------------|-------|----------|
| GENERAL | _____ | G1 – G3 |
| REVISED LATERAL | _____ | L1 – L20 |
| COLUMN | _____ | C1 – C5 |
| BEAM | _____ | B1 – B4 |
| FOOTING | _____ | F1 – F4 |

RB ENGINEERS, INC. IS
NOT RESPONSIBLE FOR THE SITE,
SOILS, WEATHER PROOFING, TRUSSES
AND/OR EXISTING CONDITIONS.



EXPIRES: Feb 20 **22**

RB Engineers, Inc.

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| | | | |
|----------|----------------------|-------|-----------|
| Project: | Merlino Residence | By: | RB/MJT |
| Client: | | Date: | 9/10/2020 |
| Subject: | Lateral Calculations | Page: | G2/ |

LOADING CRITERIA FOR ROOF AND/OR CEILING

- Main Roof Area
- Canopy or Mansard Roof
- Ceiling Only
- Other

| Item | Material | Load PSF |
|----------------------|-------------|----------|
| Roofing | Composition | 2.2 |
| Sheathing or Decking | 15/32 CDX | 1.5 |
| Insulation | | 2.8 |
| Ceiling | 5/8 GWB | 2.6 |
| Fixtures | | 1.0 |
| Framing | Truss | 2.3 |
| Misc. | | 0.6 |

TOTAL DEAD LOAD : 13 PSF

LIVE LOADS

- Snow Load - 25 psf - non reducible
- Ceiling Only - 10 psf
- Increase in F_b and F_v of 15% allowed for duration of load

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| | |
|-------------------------------|-------------------|
| Project: Merlino Residence | By: RB/MJT |
| Client: | Date: 9/10/2020 |
| Subject: Lateral Calculations | Page: G3/3 |

LOADING CRITERIA FOR FLOOR

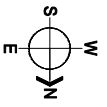
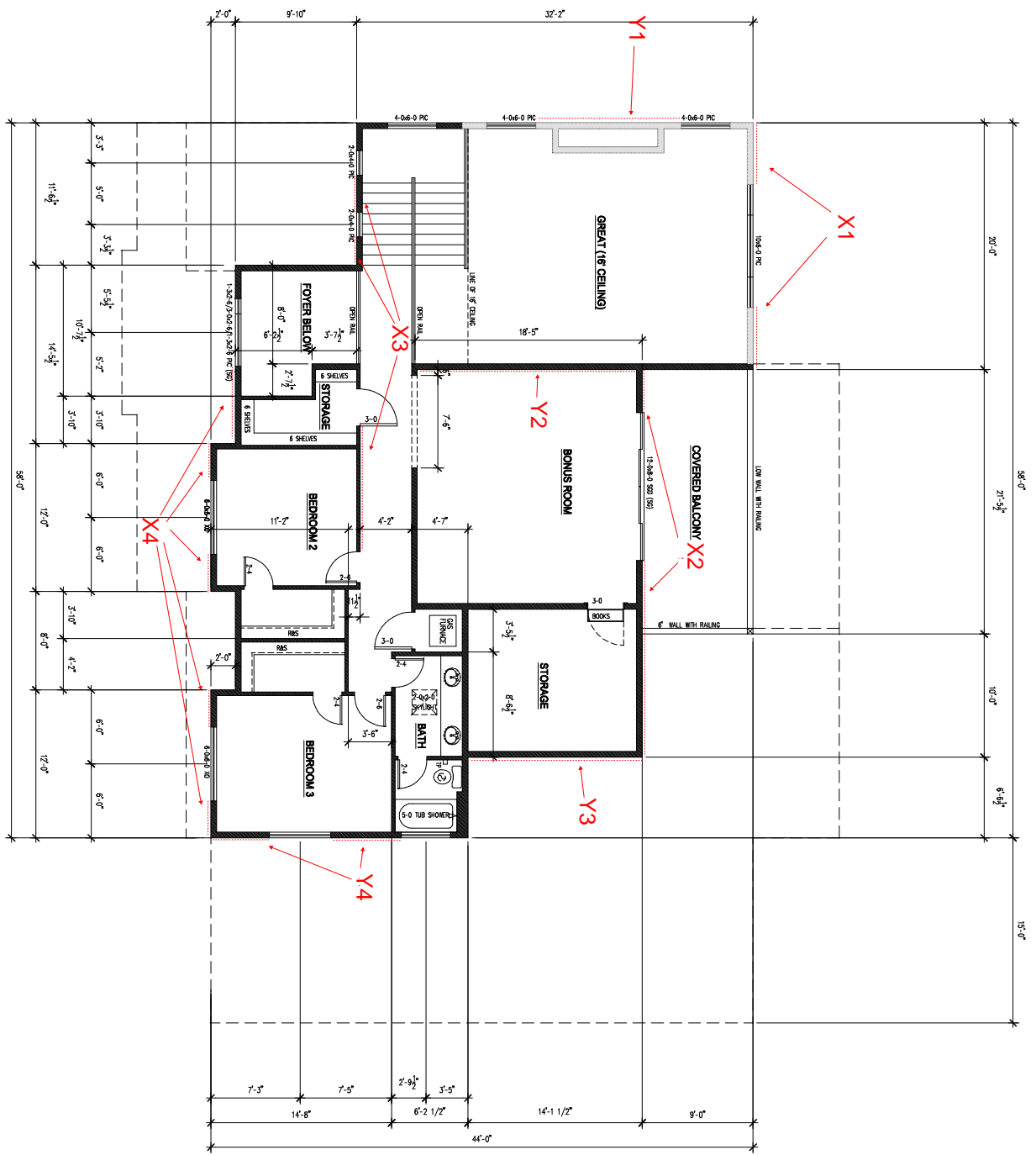
| Item | Material | Load PSF |
|-----------------|----------------|----------|
| Floor Covering | Carpet and Pad | 3.0 |
| Floor Sheathing | 3/4" T&G CDX | 2.3 |
| Ceiling | 1/2" GWB | 2.2 |
| Fixtures | | 1.0 |
| Framing | TJI's | 3.0 |
| Misc | | 1.5 |

TOTAL DEAD LOAD : 13 PSF

LIVE LOADS

- Residential - 40 psf (reducible)
- Office - 50 psf (reducible)
- Assembly - 100 psf (non-reducible)
- Corridors and Exits - 100 psf (reducible)
- Storage - 125 psf (non-reducible)

SW Key Plan

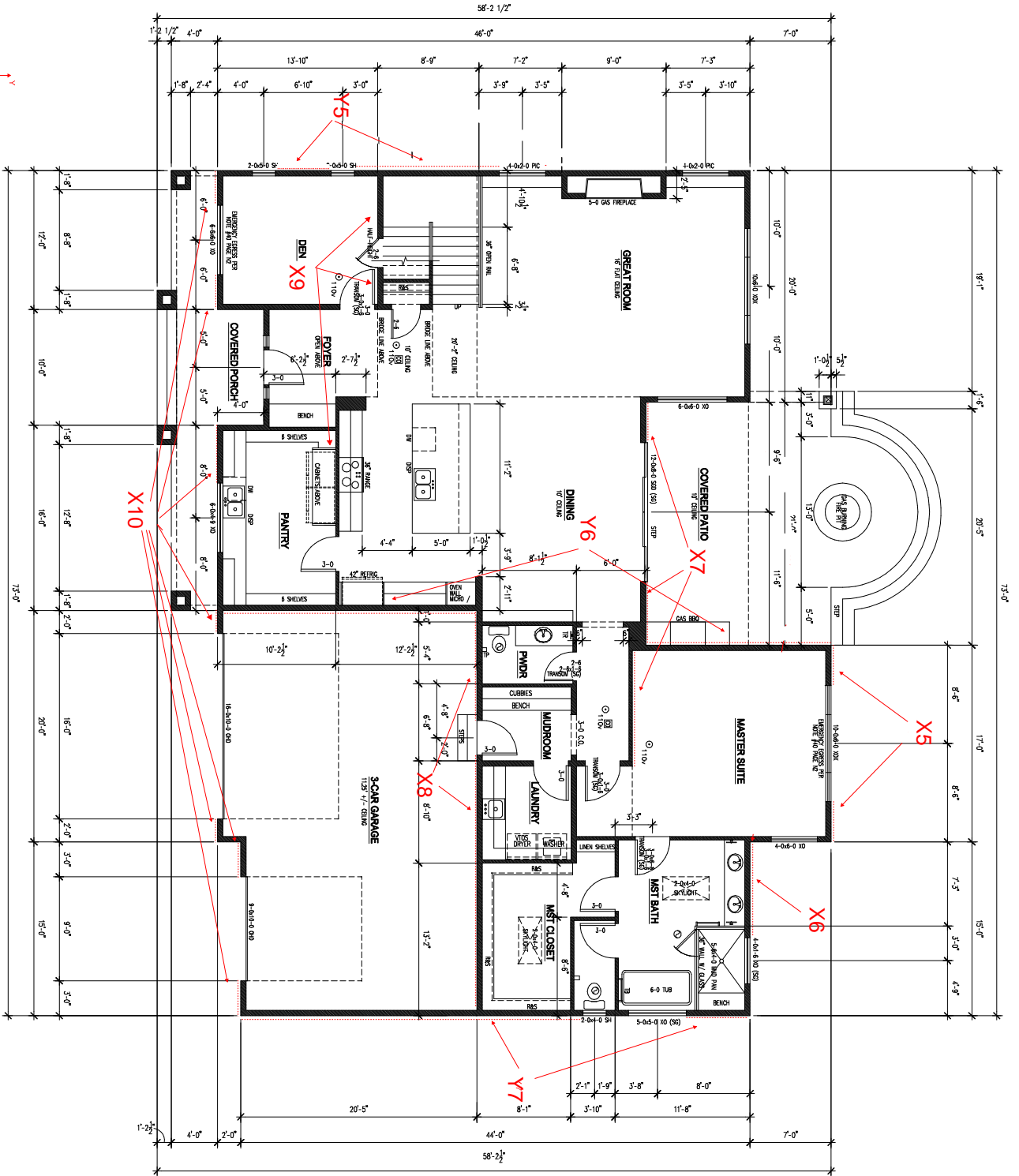


A4
 SHEET NUMBER
 DRAWN BY: [Name]
 DATE: 7.16.2020
 SCALE: 1/4"=1'-0"
 PROJECT: 1747020
 REVISION: [None]

MERLINO RESIDENCE
 MERCER ISLAND, WA

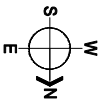
UPPER LEVEL FLOOR PLAN

DR. GRESTI
 ARCHITECTS, PLLC
 206.426.6800



ADD 18 S.F. TO MAIN LEVEL

| | |
|---------------------------------|------------------|
| FLOOR AREA: | 3482 S.F. |
| UNHEATED FLOOR AREA: | 3744 S.F. |
| TOTAL HEATED AREA: | 3744 S.F. |
| GARAGE: | 784 S.F. |
| ENTRY PORCH: | 182 S.F. |
| REAR PATIO: | 380 S.F. |
| COVERED BALCONY: | 208 S.F. |
| FLOOR AREA RATIO: | 594 S.F. |
| MAXIMUM ALLOWED: | 40% |
| TOTAL LIVING: | 3744 S.F. |
| GARAGE: | 784 S.F. |
| GREAT ROOM TALL CEILING: | (480 S.F. x 8') |
| FOYER TALL CEILING: | (70 S.F. x 11') |
| STAIRWELL CEILING: | (103 S.F. x 11') |
| PROPOSED F.A.R. | 4918 S.F. |



A2

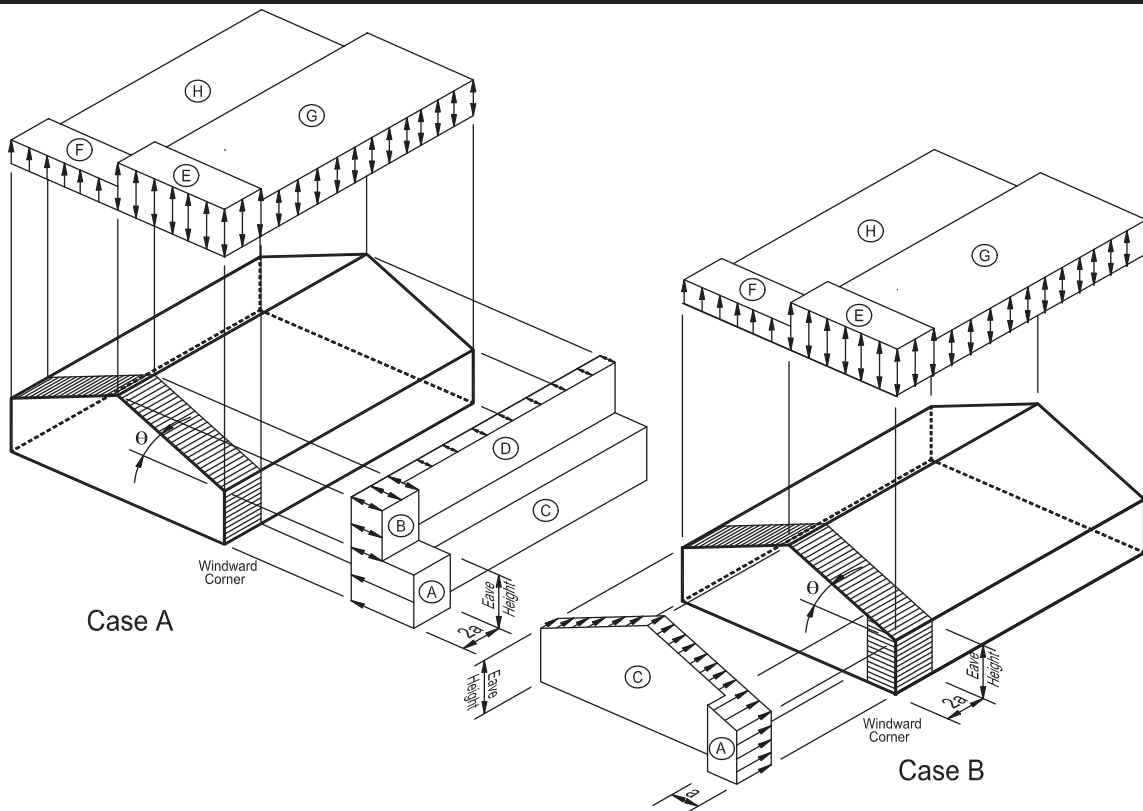
DATE: 7.16.2020
 SCALE: 1/4"=1'-0"
 SHEET NUMBER: 206 OF 200

MERLINO RESIDENCE

MERCER ISLAND, WA

MAIN LEVEL FLOOR PLAN

| | | |
|--|------------------------------|-----------------------------------|
| Main Wind Force Resisting System – Method 2 | | $h \leq 60$ ft. |
| Figure 28.6-1 | Design Wind Pressures | Walls & Roofs |
| Enclosed Buildings | | |



Notes:

1. Pressures shown are applied to the horizontal and vertical projections, for exposure B, at $h=30$ ft (9.1m). Adjust to other exposures and heights with adjustment factor λ .
2. The load patterns shown shall be applied to each corner of the building in turn as the reference corner. (See Figure 28.4-1)
3. For Case B use $\theta = 0^\circ$.
4. Load cases 1 and 2 must be checked for $25^\circ < \theta \leq 45^\circ$. Load case 2 at 25° is provided only for interpolation between 25° and 30° .
5. Plus and minus signs signify pressures acting toward and away from the projected surfaces, respectively.
6. For roof slopes other than those shown, linear interpolation is permitted.
7. The total horizontal load shall not be less than that determined by assuming $p_s = 0$ in zones B & D.
8. Where zone E or G falls on a roof overhang on the windward side of the building, use E_{OH} and G_{OH} for the pressure on the horizontal projection of the overhang. Overhangs on the leeward and side edges shall have the basic zone pressure applied.
9. Notation:
 - a : 10 percent of least horizontal dimension or $0.4h$, whichever is smaller, but not less than either 4% of least horizontal dimension or 3 ft (0.9 m).
 - h : Mean roof height, in feet (meters), except that eave height shall be used for roof angles $< 10^\circ$.
 - θ : Angle of plane of roof from horizontal, in degrees.

| Main Wind Force Resisting System – Method 2 | | | | h ≤ 60 ft. | | | | | | | | |
|--|----------------------|-----------------------|----------------------|---------------|-------|-------|--------------------|-------|-------|-------|-----------------|-----------------|
| Figure 28.6-1 (cont'd) | | Design Wind Pressures | | Walls & Roofs | | | | | | | | |
| Enclosed Buildings | | | | | | | | | | | | |
| Simplified Design Wind Pressure , p _{S30} (psf) (Exposure B at h = 30 ft. with I = 1.0) | | | | | | | | | | | | |
| Basic Wind Speed (mph) | Roof Angle (degrees) | Load Case | Zones | | | | | | | | | |
| | | | Horizontal Pressures | | | | Vertical Pressures | | | | Overhangs | |
| | | | A | B | C | D | E | F | G | H | E _{OH} | G _{OH} |
| 110 | 0 to 5° | 1 | 19.2 | -10.0 | 12.7 | -5.9 | -23.1 | -13.1 | -16.0 | -10.1 | -32.3 | -25.3 |
| | 10° | 1 | 21.6 | -9.0 | 14.4 | -5.2 | -23.1 | -14.1 | -16.0 | -10.8 | -32.3 | -25.3 |
| | 15° | 1 | 24.1 | -8.0 | 16.0 | -4.6 | -23.1 | -15.1 | -16.0 | -11.5 | -32.3 | -25.3 |
| | 20° | 1 | 26.6 | -7.0 | 17.7 | -3.9 | -23.1 | -16.0 | -16.0 | -12.2 | -32.3 | -25.3 |
| | 25° | 1 | 24.1 | 3.9 | 17.4 | 4.0 | -10.7 | -14.6 | -7.7 | -11.7 | -19.9 | -17.0 |
| | | 2 | ----- | ----- | ----- | ----- | -4.1 | -7.9 | -1.1 | -5.1 | ----- | ----- |
| | 30 to 45 | 1 | 21.6 | 14.8 | 17.2 | 11.8 | 1.7 | -13.1 | 0.6 | -11.3 | -7.6 | -8.7 |
| | 2 | 21.6 | 14.8 | 17.2 | 11.8 | 8.3 | -6.5 | 7.2 | -4.6 | -7.6 | -8.7 | |
| 115 | 0 to 5° | 1 | 21.0 | -10.9 | 13.9 | -6.5 | -25.2 | -14.3 | -17.5 | -11.1 | -35.3 | -27.6 |
| | 10° | 1 | 23.7 | -9.8 | 15.7 | -5.7 | -25.2 | -15.4 | -17.5 | -11.8 | -35.3 | -27.6 |
| | 15° | 1 | 26.3 | -8.7 | 17.5 | -5.0 | -25.2 | -16.5 | -17.5 | -12.6 | -35.3 | -27.6 |
| | 20° | 1 | 29.0 | -7.7 | 19.4 | -4.2 | -25.2 | -17.5 | -17.5 | -13.3 | -35.3 | -27.6 |
| | 25° | 1 | 26.3 | 4.2 | 19.1 | 4.3 | -11.7 | -15.9 | -8.5 | -12.8 | -21.8 | -18.5 |
| | | 2 | ----- | ----- | ----- | ----- | -4.4 | -8.7 | -1.2 | -5.5 | ----- | ----- |
| | 30 to 45 | 1 | 23.6 | 16.1 | 18.8 | 12.9 | 1.8 | -14.3 | 0.6 | -12.3 | -8.3 | -9.5 |
| | 2 | 23.6 | 16.1 | 18.8 | 12.9 | 9.1 | -7.1 | 7.9 | -5.0 | -8.3 | -9.5 | |
| 120 | 0 to 5° | 1 | 22.8 | -11.9 | 15.1 | -7.0 | -27.4 | -15.6 | -19.1 | -12.1 | -38.4 | -30.1 |
| | 10° | 1 | 25.8 | -10.7 | 17.1 | -6.2 | -27.4 | -16.8 | -19.1 | -12.9 | -38.4 | -30.1 |
| | 15° | 1 | 28.7 | -9.5 | 19.1 | -5.4 | -27.4 | -17.9 | -19.1 | -13.7 | -38.4 | -30.1 |
| | 20° | 1 | 31.6 | -8.3 | 21.1 | -4.6 | -27.4 | -19.1 | -19.1 | -14.5 | -38.4 | -30.1 |
| | 25° | 1 | 28.6 | 4.6 | 20.7 | 4.7 | -12.7 | -17.3 | -9.2 | -13.9 | -23.7 | -20.2 |
| | | 2 | ----- | ----- | ----- | ----- | -4.8 | -9.4 | -1.3 | -6.0 | ----- | ----- |
| | 30 to 45 | 1 | 25.7 | 17.6 | 20.4 | 14.0 | 2.0 | -15.6 | 0.7 | -13.4 | -9.0 | -10.3 |
| | 2 | 25.7 | 17.6 | 20.4 | 14.0 | 9.9 | -7.7 | 8.6 | -5.5 | -9.0 | -10.3 | |
| 130 | 0 to 5° | 1 | 26.8 | -13.9 | 17.8 | -8.2 | -32.2 | -18.3 | -22.4 | -14.2 | -45.1 | -35.3 |
| | 10° | 1 | 30.2 | -12.5 | 20.1 | -7.3 | -32.2 | -19.7 | -22.4 | -15.1 | -45.1 | -35.3 |
| | 15° | 1 | 33.7 | -11.2 | 22.4 | -6.4 | -32.2 | -21.0 | -22.4 | -16.1 | -45.1 | -35.3 |
| | 20° | 1 | 37.1 | -9.8 | 24.7 | -5.4 | -32.2 | -22.4 | -22.4 | -17.0 | -45.1 | -35.3 |
| | 25° | 1 | 33.6 | 5.4 | 24.3 | 5.5 | -14.9 | -20.4 | -10.8 | -16.4 | -27.8 | -23.7 |
| | | 2 | ----- | ----- | ----- | ----- | -5.7 | -11.1 | -1.5 | -7.1 | ----- | ----- |
| | 30 to 45 | 1 | 30.1 | 20.6 | 24.0 | 16.5 | 2.3 | -18.3 | 0.8 | -15.7 | -10.6 | -12.1 |
| | 2 | 30.1 | 20.6 | 24.0 | 16.5 | 11.6 | -9.0 | 10.0 | -6.4 | -10.6 | -12.1 | |
| 140 | 0 to 5° | 1 | 31.1 | -16.1 | 20.6 | -9.6 | -37.3 | -21.2 | -26.0 | -16.4 | -52.3 | -40.9 |
| | 10° | 1 | 35.1 | -14.5 | 23.3 | -8.5 | -37.3 | -22.8 | -26.0 | -17.5 | -52.3 | -40.9 |
| | 15° | 1 | 39.0 | -12.9 | 26.0 | -7.4 | -37.3 | -24.4 | -26.0 | -18.6 | -52.3 | -40.9 |
| | 20° | 1 | 43.0 | -11.4 | 28.7 | -6.3 | -37.3 | -26.0 | -26.0 | -19.7 | -52.3 | -40.9 |
| | 25° | 1 | 39.0 | 6.3 | 28.2 | 6.4 | -17.3 | -23.6 | -12.5 | -19.0 | -32.3 | -27.5 |
| | | 2 | ----- | ----- | ----- | ----- | -6.6 | -12.8 | -1.8 | -8.2 | ----- | ----- |
| | 30 to 45 | 1 | 35.0 | 23.9 | 27.8 | 19.1 | 2.7 | -21.2 | 0.9 | -18.2 | -12.3 | -14.0 |
| | 2 | 35.0 | 23.9 | 27.8 | 19.1 | 13.4 | -10.5 | 11.7 | -7.5 | -12.3 | -14.0 | |
| 150 | 0 to 5° | 1 | 35.7 | -18.5 | 23.7 | -11.0 | -42.9 | -24.4 | -29.8 | -18.9 | -60.0 | -47.0 |
| | 10° | 1 | 40.2 | -16.7 | 26.8 | -9.7 | -42.9 | -26.2 | -29.8 | -20.1 | -60.0 | -47.0 |
| | 15° | 1 | 44.8 | -14.9 | 29.8 | -8.5 | -42.9 | -28.0 | -29.8 | -21.4 | -60.0 | -47.0 |
| | 20° | 1 | 49.4 | -13.0 | 32.9 | -7.2 | -42.9 | -29.8 | -29.8 | -22.6 | -60.0 | -47.0 |
| | 25° | 1 | 44.8 | 7.2 | 32.4 | 7.4 | -19.9 | -27.1 | -14.4 | -21.8 | -37.0 | -31.6 |
| | | 2 | ----- | ----- | ----- | ----- | -7.5 | -14.7 | -2.1 | -9.4 | ----- | ----- |
| | 30 to 45 | 1 | 40.1 | 27.4 | 31.9 | 22.0 | 3.1 | -24.4 | 1.0 | -20.9 | -14.1 | -16.1 |
| | 2 | 40.1 | 27.4 | 31.9 | 22.0 | 15.4 | -12.0 | 13.4 | -8.6 | -14.1 | -16.1 | |

Unit Conversions – 1.0 ft = 0.3048 m; 1.0 psf = 0.0479 kN/m²

| | | |
|--|------------------------------|--------------------------|
| Main Wind Force Resisting System – Method 2 | | h ≤ 60 ft. |
| Figure 28.6-1 (cont'd) | Design Wind Pressures | Walls & Roofs |
| Enclosed Buildings | | |

Simplified Design Wind Pressure , p_{S30} (psf) (Exposure B at h = 30 ft.)

| Basic Wind Speed (mph) | Roof Angle (degrees) | Load Case | Zones | | | | | | | | | |
|------------------------|----------------------|-----------|----------------------|-------|-------|-------|--------------------|-------|-------|-------|-----------|-------|
| | | | Horizontal Pressures | | | | Vertical Pressures | | | | Overhangs | |
| | | | A | B | C | D | E | F | G | H | EoH | GoH |
| 160 | 0 to 5° | 1 | 40.6 | -21.1 | 26.9 | -12.5 | -48.8 | -27.7 | -34.0 | -21.5 | -68.3 | -53.5 |
| | 10° | 1 | 45.8 | -19.0 | 30.4 | -11.1 | -48.8 | -29.8 | -34.0 | -22.9 | -68.3 | -53.5 |
| | 15° | 1 | 51.0 | -16.9 | 34.0 | -9.6 | -48.8 | -31.9 | -34.0 | -24.3 | -68.3 | -53.5 |
| | 20° | 1 | 56.2 | -14.8 | 37.5 | -8.2 | -48.8 | -34.0 | -34.0 | -25.8 | -68.3 | -53.5 |
| | 25° | 1 | 50.9 | 8.2 | 36.9 | 8.4 | -22.6 | -30.8 | -16.4 | -24.8 | -42.1 | -35.9 |
| | | 2 | ----- | ----- | ----- | ----- | -8.6 | -16.8 | -2.3 | -10.7 | ----- | ----- |
| | 30 to 45 | 1 | 45.7 | 31.2 | 36.3 | 25.0 | 3.5 | -27.7 | 1.2 | -23.8 | -16.0 | -18.3 |
| | 2 | 45.7 | 31.2 | 36.3 | 25.0 | 17.6 | -13.7 | 15.2 | -9.8 | -16.0 | -18.3 | |
| 180 | 0 to 5° | 1 | 51.4 | -26.7 | 34.1 | -15.8 | -61.7 | -35.1 | -43.0 | -27.2 | -86.4 | -67.7 |
| | 10° | 1 | 58.0 | -24.0 | 38.5 | -14.0 | -61.7 | -37.7 | -43.0 | -29.0 | -86.4 | -67.7 |
| | 15° | 1 | 64.5 | -21.4 | 43.0 | -12.2 | -61.7 | -40.3 | -43.0 | -30.8 | -86.4 | -67.7 |
| | 20° | 1 | 71.1 | -18.8 | 47.4 | -10.4 | -61.7 | -43.0 | -43.0 | -32.6 | -86.4 | -67.7 |
| | 25° | 1 | 64.5 | 10.4 | 46.7 | 10.6 | -28.6 | -39.0 | -20.7 | -31.4 | -53.3 | -45.4 |
| | | 2 | ----- | ----- | ----- | ----- | -10.9 | -21.2 | -3.0 | -13.6 | ----- | ----- |
| | 30 to 45 | 1 | 57.8 | 39.5 | 45.9 | 31.6 | 4.4 | -35.1 | 1.5 | -30.1 | -20.3 | -23.2 |
| | 2 | 57.8 | 39.5 | 45.9 | 31.6 | 22.2 | -17.3 | 19.3 | -12.3 | -20.3 | -23.2 | |
| 200 | 0 to 5° | 1 | 63.4 | -32.9 | 42.1 | -19.5 | -76.2 | -43.3 | -53.1 | -33.5 | -106.7 | -83.5 |
| | 10° | 1 | 71.5 | -29.7 | 47.6 | -17.3 | -76.2 | -46.5 | -53.1 | -35.8 | -106.7 | -83.5 |
| | 15° | 1 | 79.7 | -26.4 | 53.1 | -15.0 | -76.2 | -49.8 | -53.1 | -38.0 | -106.7 | -83.5 |
| | 20° | 1 | 87.8 | -23.2 | 58.5 | -12.8 | -76.2 | -53.1 | -53.1 | -40.2 | -106.7 | -83.5 |
| | 25° | 1 | 79.6 | 12.8 | 57.6 | 13.1 | -35.4 | -48.2 | -25.6 | -38.7 | -65.9 | -56.1 |
| | | 2 | ----- | ----- | ----- | ----- | -13.4 | -26.2 | -3.7 | -16.8 | ----- | ----- |
| | 30 to 45 | 1 | 71.3 | 48.8 | 56.7 | 39.0 | 5.5 | -43.3 | 1.8 | -37.2 | -25.0 | -28.7 |
| | 2 | 71.3 | 48.8 | 56.7 | 39.0 | 27.4 | -21.3 | 23.8 | -15.2 | -25.0 | -28.7 | |

**Adjustment Factor
for Building Height and Exposure, λ**

| Mean roof height (ft) | Exposure | | |
|-----------------------|----------|------|------|
| | B | C | D |
| 15 | 1.00 | 1.21 | 1.47 |
| 20 | 1.00 | 1.29 | 1.55 |
| 25 | 1.00 | 1.35 | 1.61 |
| 30 | 1.00 | 1.40 | 1.66 |
| 35 | 1.05 | 1.45 | 1.70 |
| 40 | 1.09 | 1.49 | 1.74 |
| 45 | 1.12 | 1.53 | 1.78 |
| 50 | 1.16 | 1.56 | 1.81 |
| 55 | 1.19 | 1.59 | 1.84 |
| 60 | 1.22 | 1.62 | 1.87 |

Unit Conversions – 1.0 ft = 0.3048 m; 1.0 psf = 0.0479 kN/m²

leeward net pressures. p_s shall be determined by the following equation:

$$p_s = \lambda K_{zt} p_{S30} \quad (28.6-1)$$

where

λ = adjustment factor for building height and exposure from Fig. 28.6-1

K_{zt} = topographic factor as defined in Section 26.8 evaluated at mean roof height, h

p_{S30} = simplified design wind pressure for Exposure B, at $h = 30$ ft (9.1 m) from Fig. 28.6-1

28.6.4 Minimum Design Wind Loads

The load effects of the design wind pressures from Section 28.6.3 shall not be less than a minimum load defined by assuming the pressures, p_s , for zones A and C equal to +16 psf, Zones B and D equal to +8 psf, while assuming p_s for Zones E, F, G, and H are equal to 0 psf.

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| | | | |
|----------|----------------------|-------|-----------|
| Project: | Merlino Residence | By: | RB/MJT |
| Client: | | Date: | 9/10/2020 |
| Subject: | Lateral Calculations | Page: | L7/ |

**LATERAL WIND FORCES
 ENVELOPE PROCEDURE (ASCE 7-10 Chapter 28)**

| | | | |
|-------------------|---------------------------|------------------------------|---------|
| | | <u>Design Wind Pressures</u> | |
| Roof Pitch: | 3:12 (14°) | Wind Speed: | 110 mph |
| Wind Exposure: | B λ = 1.0 ASCE 7-10 p.305 | A: | 24.1 |
| Minimum Pressure: | 16 psf (wall) 28.6.4 | B: | 0.0 |
| Minimum Pressure: | 8 psf (roof) 28.6.4 | C: | 16 |
| Kzt: | 1.6 | D: | 0.0 |

(ASCE 7-10) Using Allowable Stress Design, 2.4.1 Basic Combinations option 7: 0.6 D + 0.6 W

X – X Direction

$$\Sigma F_w \text{ Roof} = (24.1x((4x2+4x1+9x5)) + 16.0x(32x1.5+12x4)) / 1000 =$$

$$2.91 \times 1.6 \text{ Kzt} \times 0.6 = 2.79 \text{ kip}$$

$$\Sigma F_w \text{ Upper} = (24.1x((11x5x2+4x2+5x3.5)) + 16.0x(28x10+5x4)) / 1000 =$$

$$8.07 \times 1.6 \text{ Kzt} \times 0.6 = \boxed{7.74} \text{ kip}$$

$$\text{Roof Min} = ((16x(57+96)+8x(38+255)) / 1000) \times 1.6 \text{ Kzt} \times 0.6 = \boxed{4.60} \text{ kip}$$

$$\text{Upper Min} = ((16x(135.5+300)+8x(65+18)) / 1000) \times 1.6 \text{ Kzt} \times 0.6 = 7.33 \text{ kip}$$

Y – Y Direction

$$\Sigma F_w \text{ Roof} = (24.1x((15x5)) + 16.0x(43x5)) / 1000 =$$

$$5.25 \times 1.6 \text{ Kzt} \times 0.6 = 5.03 \text{ kip}$$

$$\Sigma F_w \text{ Upper} = (24.1x((15x5x2+4.5x2.5+5x3.5)) + 16.0x(9x7.5+34x5)) / 1000 =$$

$$8.11 \times 1.6 \text{ Kzt} \times 0.6 = 7.77 \text{ kip}$$

$$\text{Roof Min} = ((16x(75+215)+8x(45+215))) / 1000) \times 1.6 \text{ Kzt} \times 0.6 = \boxed{6.45} \text{ kip}$$

$$\text{Upper Min} = ((16x(178.75+237.5)+8x(96.5+95)) / 1000) \times 1.6 \text{ Kzt} \times 0.6 = \boxed{7.86} \text{ kip}$$

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QUAKE FORCES (ASCE 7-10)

Site Class "D" (Table 11.4.2)

Ss = 1.55 - Critical Values per Latest USG Website Based on Latitude and Longitude

S1 = 0.55 - Critical Values per Latest USG Website Based on Latitude and Longitude

Fa = 1.0 per Table 11.4-1

Fv = 1.5 per Table 11.4-2

Sms = Fa * Ss = 1.0 (1.55) = 1.55 11.4-1

Sm1 = Fv * S1 = 1.5 (0.55) = .825 11.4-2

Sds = 2/3 * Sms = 2/3 (1.55) = 1.03 11.4-3

Sd1 = 2/3 * Sm1 = 2/3 (0.825) = .55 11.4-4

SEISMIC RESPONSE COEFFICIENT: Use Section (12.8.1.1) ASCE 7-10 Except as Noted

To = 0.2 (Sd1/Sds) = 0.11 SEC 11.4.5

Ts = Sd1 /Sds = 0.53 SEC 11.4.5

Tstruc = Ct * (Hn)^{3/4} = 0.020 (25.3)^{3/4} = 0.23 SEC

Where To ≤ Tstruc ≤ Ts Sa = Sds = 1.03 Therefore Seismic Design Category "D"

R = 6.5 for Wood Shear Walls per ASCE 7-10 Table 12.2-1

Cs = Sds /(R/I) = 1.03 / (6.5/1) = 0.158 12.8-2

Cs = 0.16

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LATERAL QUAKE FORCES

| | | | |
|-------------|------|------------------|-----|
| Cs: | 0.16 | ρ: | 1.3 |
| Roof Area: | 2867 | Roof Dead Load: | 13 |
| Upper Area: | 4433 | Floor Dead Load: | 13 |
| | | Wall Dead Load: | 8 |

ASCE 7-10 Using Allowable Stress Design, 2.4.1 Basic Combination option 8: 0.6 D + 0.7 E
ASCE 7-10 Table 12.2-1: Overstrength factor, Ω = 2.5

DEAD LOAD OF STRUCTURE

| | | | | |
|----------------|-----------------|---|--------|-----|
| Roof Weight = | 2867 x (13+8) = | = | 60.21 | kip |
| Upper Weight = | 4413 x (13+8) = | = | 93.09 | kip |
| | | | <hr/> | |
| | | | 153.30 | kip |

$V_{base} = C_s \times \Sigma \text{Weight} = 0.16 \times 153.30 = 24.53 \text{ kip}$

$V_{asd} = V_{base} \times 0.7 \times \rho = 22.32 \text{ kip}$

LATERAL FORCES

| | WEIGHT | HEIGHT | WEIGHT x HEIGHT |
|--------|-----------|-----------|-----------------|
| Roof: | 60.21 kip | 21.5 Feet | 1294.45 |
| Upper: | 93.09 kip | 11 Feet | 1024.02 |
| | | | <hr/> |
| | | | 2318.47 |

Fq Roof: $22.32 \times (1294.45/2318.47) = 12.46 \text{ kip}$

Fq Upper: $22.32 \times (1024.02/2318.47) = 9.86 \text{ kip}$

Therefore, quake governs all.

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WIND FORCES ON SHEAR WALLS**Shearwalls in X – X Direction**

$$F_w X - X @ \text{Roof:} \quad 4.60 \quad \text{kips} \qquad 4.60 \text{ k} / 44 \text{ ft} = 104.5 \quad \#/\text{Ft}$$

$$V @ X 1 = (4.60/44) \times (9/2) = \frac{0.47}{5'+5'} = 47 \quad \frac{\#}{\text{Ft}}$$

SW-4

$$V @ X 2 = (4.60/44) \times (9/2 + 23/2) = \frac{1.67}{16'+3.5'} = 86 \quad \frac{\#}{\text{Ft}}$$

SW-4

$$V @ X 3 = (4.60/44) \times (23/2 + 10/2) = \frac{1.73}{10'+3'+2.25'} = 113 \quad \frac{\#}{\text{Ft}}$$

SW-X

Restrain to window to reduce h:w ratio (For 2.25' shear walls)

$$V @ X 4 = (4.60/44) \times (10/2 + 2) = \frac{0.73}{6'+3'+3'+3'+3'} = 41 \quad \frac{\#}{\text{Ft}}$$

SW-4

$$F_w X - X @ \text{Upper:} \quad 7.74 \quad \text{kips} \qquad 7.74 \text{ k} / 53 \text{ ft} = 146.0 \quad \#/\text{Ft}$$

$$V @ X 5 = (7.74/53) \times (7/2) = \frac{0.51}{3.5'+3.5'} = 73 \quad \frac{\#}{\text{Ft}}$$

SW-4

$$V @ X 6 = (7.74/53) \times (7/2 + 9/2) + 0.47 = \frac{1.64}{8.25'+5'+5'} = 90 \quad \frac{\#}{\text{Ft}}$$

SW-4

$$V @ X 7 = (7.74/53) \times (9/2 + 1 + 13.5/2) + 1.67 = \frac{3.46}{10'+5.5'+3.5'} = 182 \quad \frac{\#}{\text{Ft}}$$

SW-3

$$V @ X 8 = (7.74/53) \times (13.5/2 + 8/2) = \frac{1.57}{22'+9.5'} = 50 \quad \frac{\#}{\text{Ft}}$$

SW-4

$$V @ X 9 = (7.74/53) \times (8/2 + 12.5/2) + 1.73 = \frac{3.22}{5'+3.5'+9'} = 184 \quad \frac{\#}{\text{Ft}}$$

SW-3

$$V @ X 10 = (7.74/53) \times (12.5/2 + 2) + 0.73 = \frac{1.94}{3 \times (24" \times 10' \text{ LRP})} < 3.375 \text{ k LRP Capacity}$$

SW-3

3x(24"x10' LRP)=3 x 1.125k = 3.375 k LRP Capacity

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WIND FORCES ON SHEAR WALLS**Shearwalls in Y – Y Direction**

| | | | | | |
|-------------------------------------|-----------|---------------------------|------------------|-------|------------------------|
| F _w Y – Y @ Roof: | 6.45 kips | | 6.45 k / 58 ft = | 111.2 | #/Ft |
| V @ Y 1 = (6.45/58)x(20/2)= | | $\frac{1.11}{12'}$ | = | 93 | $\frac{\#}{\text{Ft}}$ |
| SW-4 | | | | | |
| V @ Y 2 = (6.45/58)x(20/2+31.5/2)= | | $\frac{2.86}{17.75'}$ | = | 161 | $\frac{\#}{\text{Ft}}$ |
| SW-4 | | | | | |
| V @ Y 3 = (6.45/58)x(31.5/2+6.5/2)= | | $\frac{2.11}{14'}$ | = | 151 | $\frac{\#}{\text{Ft}}$ |
| SW-4 | | | | | |
| V @ Y 4 = (6.45/58)x(6.5/2)= | | $\frac{0.36}{5.5'+4.75'}$ | = | 35 | $\frac{\#}{\text{Ft}}$ |
| SW-4 | | | | | |

| | | | | | |
|-----------------------------------|-----------|----------------------------|------------------|-------|------------------------|
| F _w Y – Y @ Upper: | 7.86 kips | | 7.86 k / 39 ft = | 201.5 | #/Ft |
| V @ Y 5 = (7.86/73)x(38/2) | | $\frac{4.51}{12.5'+4.75'}$ | = | 262 | $\frac{\#}{\text{Ft}}$ |
| SW-3 +1.11 | | | | | |
| +2.86x(18/38)= | | | | | |
| V @ Y 6 = (7.86/73)x(38/2+3+32/2) | | $\frac{7.22}{22'+16'}$ | = | 190 | $\frac{\#}{\text{Ft}}$ |
| SW-4 +2.86x(20/38) | | | | | |
| +2.11x(22/32) | | | | | |
| +0.36x(15/32)= | | | | | |
| V @ Y 7 = (7.86/73)x(32/2) | | $\frac{2.58}{29.5'+5.5'}$ | = | 74 | $\frac{\#}{\text{Ft}}$ |
| SW-4 +2.11x(10/32) | | | | | |
| +0.36x(17/32)= | | | | | |

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QUAKE FORCES ON SHEAR WALLS**Shearwalls in X – X Direction**

$$F_w X - X @ \text{Roof:} \quad 12.46 \quad \text{kips} \quad 12.46 \text{ k} / 44 \text{ ft} = 283.2 \quad \#/\text{Ft}$$

$$V @ X 1 = (12.46/44) \times (9/2) = \frac{1.27}{5'+5'} = 127 \quad \frac{\#}{\text{Ft}}$$

$$V @ X 2 = (12.46/44) \times (9/2 + 23/2) = \frac{4.53}{16'+3.5'} = 232 \quad \frac{\#}{\text{Ft}}$$

(1.25-0.125x(9/3.5))x350 #/Ft = 325 #/Ft capacity per table 4.3.4 ANSI/AF+PA SDPWS

$$V @ X 3 = (12.46/44) \times (23/2 + 10/2) = \frac{4.67}{10'+3'+2.25'} = 306 \quad \frac{\#}{\text{Ft}}$$

Restrain to window to reduce h:w ratio (For 2.25' shear walls)

(1.25-0.125x(9/3))x350 #/Ft = 306 #/Ft capacity per table 4.3.4 ANSI/AF+PA SDPWS

$$V @ X 4 = (12.46/44) \times (10/2 + 2) = \frac{1.98}{6'+3'+3'+3'+3'} = 110 \quad \frac{\#}{\text{Ft}}$$

(1.25-0.125x(9/3))x350 #/Ft = 306 #/Ft capacity per table 4.3.4 ANSI/AF+PA SDPWS

$$F_w X - X @ \text{Upper:} \quad 9.86 \quad \text{kips} \quad 9.86 \text{ k} / 53 \text{ ft} = 186.0 \quad \#/\text{Ft}$$

$$V @ X 5 = (9.86/53) \times (7/2) = \frac{0.65}{3.5'+3.5'} = 93 \quad \frac{\#}{\text{Ft}}$$

(1.25-0.125x(10/3.5))x350 #/Ft = 313 #/Ft capacity per table 4.3.4 ANSI/AF+PA SDPWS

$$V @ X 6 = (9.86/53) \times (7/2 + 9/2) = \frac{2.76}{8.25'} = 335 \quad \frac{\#}{\text{Ft}}$$

$$V @ X 7 = (9.86/53) \times (9/2 + 1 + 13.5/2) + 4.53 = \frac{6.81}{10'+5.5'+3.5'} = 358 \quad \frac{\#}{\text{Ft}}$$

(1.25-0.125x(10/3.5))x450 #/Ft = 402 #/Ft capacity per table 4.3.4 ANSI/AF+PA SDPWS

$$V @ X 8 = (9.86/53) \times (13.5/2 + 8/2) = \frac{2.00}{22'+9.5'} = 63 \quad \frac{\#}{\text{Ft}}$$

$$V @ X 9 = (9.86/53) \times (8/2 + 12.5/2) + 4.67 = \frac{6.58}{5'+3.5'+9'} = 376 \quad \frac{\#}{\text{Ft}}$$

$$V @ X 10 = (9.86/53) \times (12.5/2 + 2) + 1.98 - 3.38 = \frac{0.14}{5'+3'+3'} = 12 \quad \frac{\#}{\text{Ft}}$$

3x(24"x10' LRP)=3 x 1.125k = 3.375 k LRP Capacity

(1.25-0.125x(10/3))x350 #/Ft = 292 #/Ft capacity per table 4.3.4 ANSI/AF+PA SDPWS

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QUAKE FORCES ON SHEAR WALLS**Shearwalls in Y – Y Direction**

| | | | | | |
|------------------------------|----------------------------|---------------------------|-------------------|-------|------------------------|
| F _w Y – Y @ Roof: | 12.46 kips | | 12.46 k / 58 ft = | 214.9 | #/Ft |
| V @ Y 1 = | (12.46/58)x(20/2)= | $\frac{2.15}{12'}$ | = | 179 | $\frac{\#}{\text{Ft}}$ |
| SW-4 | | | | | |
| V @ Y 2 = | (12.46/58)x(20/2+31.5/2)= | $\frac{5.53}{17.75'}$ | = | 312 | $\frac{\#}{\text{Ft}}$ |
| SW-4 | | | | | |
| V @ Y 3 = | (12.46/58)x(31.5/2+6.5/2)= | $\frac{4.08}{14'}$ | = | 292 | $\frac{\#}{\text{Ft}}$ |
| SW-4 | | | | | |
| V @ Y 4 = | (12.46/58)x(6.5/2)= | $\frac{0.70}{5.5'+4.75'}$ | = | 68 | $\frac{\#}{\text{Ft}}$ |
| SW-4 | | | | | |

| | | | | | |
|-------------------------------|-------------------------|----------------------------|------------------|-------|------------------------|
| F _w Y – Y @ Upper: | 9.86 kips | | 9.86 k / 73 ft = | 135.0 | #/Ft |
| V @ Y 5 = | (9.86/73)x(38/2) | $\frac{7.34}{12.5'+4.75'}$ | = | 425 | $\frac{\#}{\text{Ft}}$ |
| SW-3 | +2.15 | | | | |
| | +5.53x(18/38)= | | | | |
| V @ Y 6 = | (9.86/73)x(38/2+3+32/2) | $\frac{11.18}{22'+16'}$ | = | 294 | $\frac{\#}{\text{Ft}}$ |
| SW-4 | +5.53x(20/38) | | | | |
| | +4.08x(22/32) | | | | |
| | +0.70x(15/32)= | | | | |
| V @ Y 7 = | (9.86/73)x(32/2) | $\frac{3.81}{29.5'+5.5'}$ | = | 109 | $\frac{\#}{\text{Ft}}$ |
| SW-4 | +4.08x(10/32) | | | | |
| | +0.70x(17/32)= | | | | |

| | |
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CHECK OVERTURNING FOR: X 1 (Quake)

L = 5 ft TL_{RF} = 5 ft (conservative)

P = 127 lb/ft

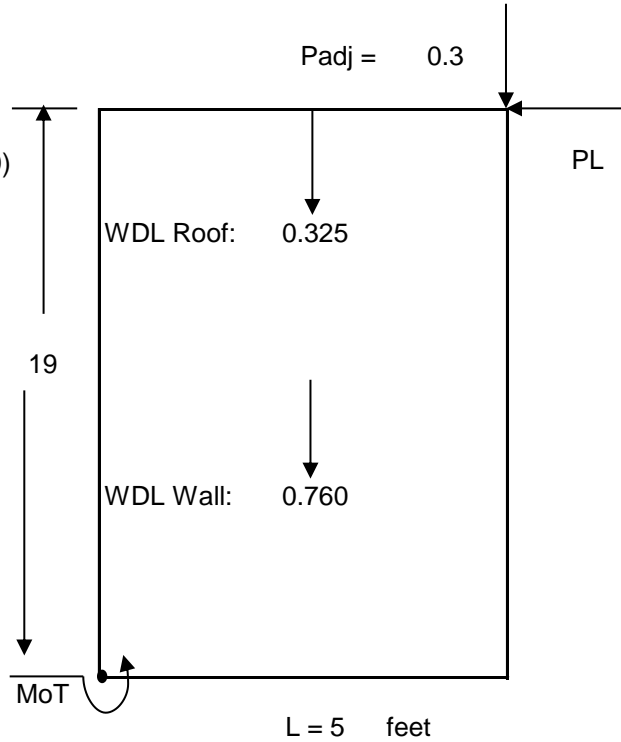
P x L = 5x127 = 0.64 kip

MoT = 0.64x19 = 12.07 kip - ft

DL_f = 0.45 (Ref. Sect. 12.4.2.3 ASC. 7-10)

MR = [(0.325+0.760)x0.5x5+0.3x5]x0.45 = 1.90 kip - ft

T = C = $\frac{MoT - MR}{L}$ = 2.03 kip



Therefore use STHD14 hold downs at each end

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CHECK OVERTURNING FOR: X 3 (Quake)

L = 2.25 ft TL_{RF} = 5 ft (conservative)

P = 306 lb/ft

P x L = 2.25x306 = 0.69 kip

MoT = 0.69*9 = 6.20 kip - ft

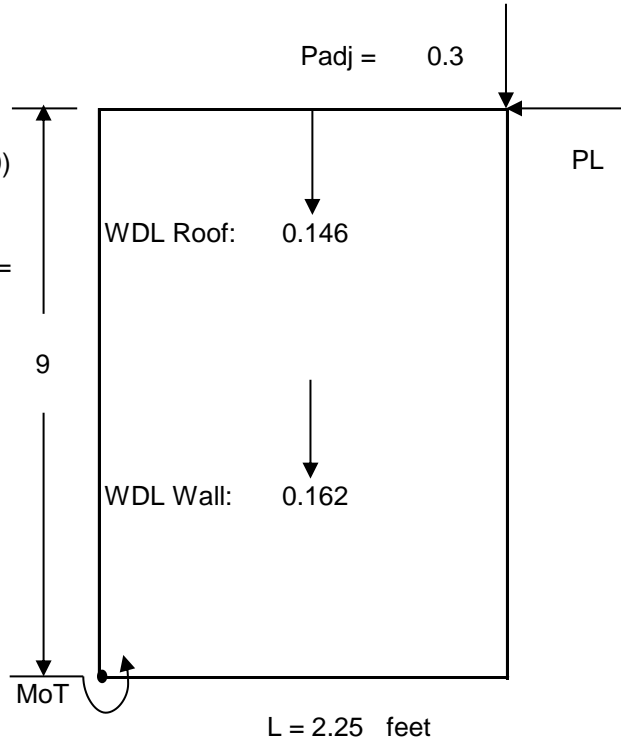
DL_f = 0.45 (Ref. Sect. 12.4.2.3 ASC. 7-10)

MR = [(0.146+0.162)x0.5x2.25+0.3x2.25]x0.45 = 0.46 kip - ft

H = 9

T = C = $\frac{MoT - MR}{L}$

2.55 kip ↑ ↓



Therefore use (2)CS16 hold downs at each end

| | |
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CHECK OVERTURNING FOR: X 9 (Quake)

L = 3.5 ft TL_{RF} = 5 ft (conservative)

P = 376 lb/ft

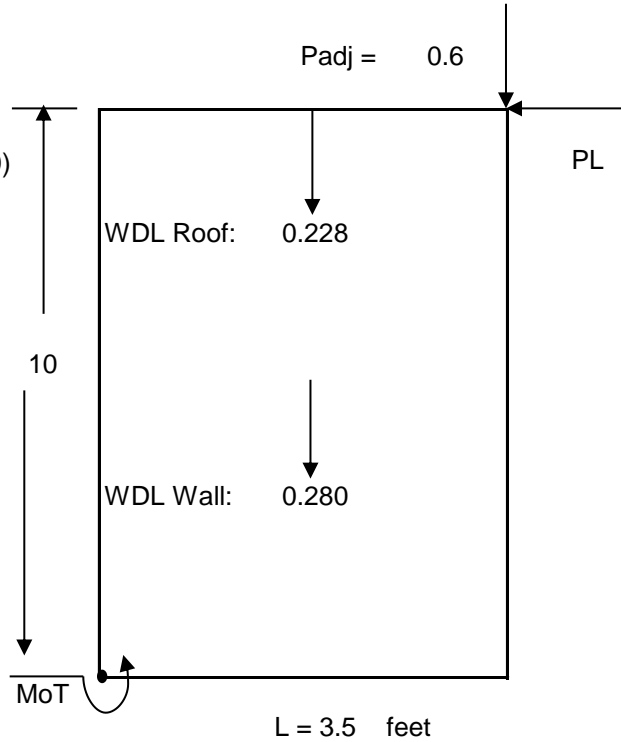
P x L = 3.5x376 = 1.32 kip

MoT = 1.32*10 = 13.16 kip - ft

DL_f = 0.45 (Ref. Sect. 12.4.2.3 ASC. 7-10)

MR = [(0.228+0.280)x0.5x3.5+0.6x3.5]x0.45 = 1.34 kip - ft

T = C = $\frac{MoT - MR}{L}$ = 3.38 kip



Therefore use STHD14 hold downs at each end

| | |
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CHECK OVERTURNING FOR: Y 1 (Quake)

L = 12 ft TL_{RF} = 5 ft (conservative)

P = 179 lb/ft

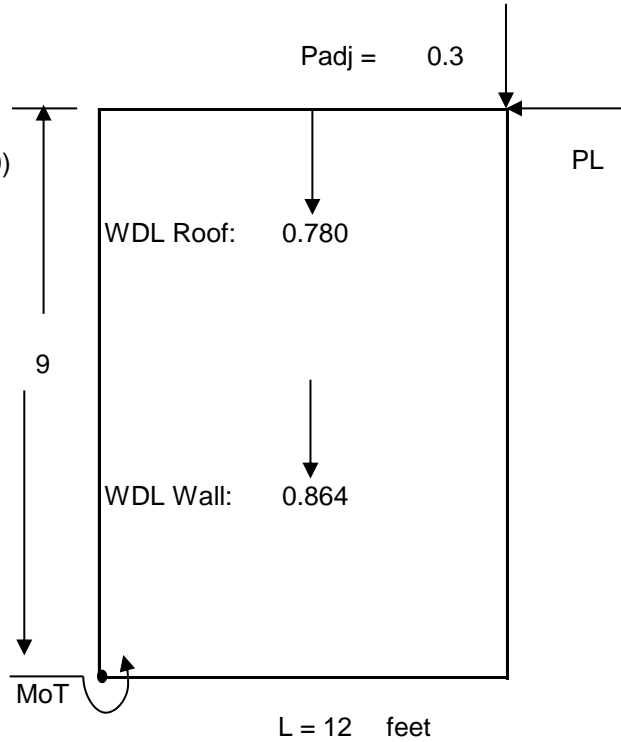
P x L = 12x179 = 2.15 kip

MoT = 2.15*9 = 19.33 kip - ft

DL_f = 0.45 (Ref. Sect. 12.4.2.3 ASC. 7-10)

MR = [(0.780+0.864)x0.5x12+0.3x12]x0.45 = 6.06 kip - ft

T = C = $\frac{MoT - MR}{L}$ = 1.11 kip



Therefore use (1)CS16 hold downs at each end

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CHECK OVERTURNING FOR: Y 2 (Quake)

L = 17.75 ft TL_{RF} = 5 ft (conservative)

P = 312 lb/ft

P x L = 17.75x312 = 5.54 kip

MoT = 5.54*9 = 49.84 kip - ft

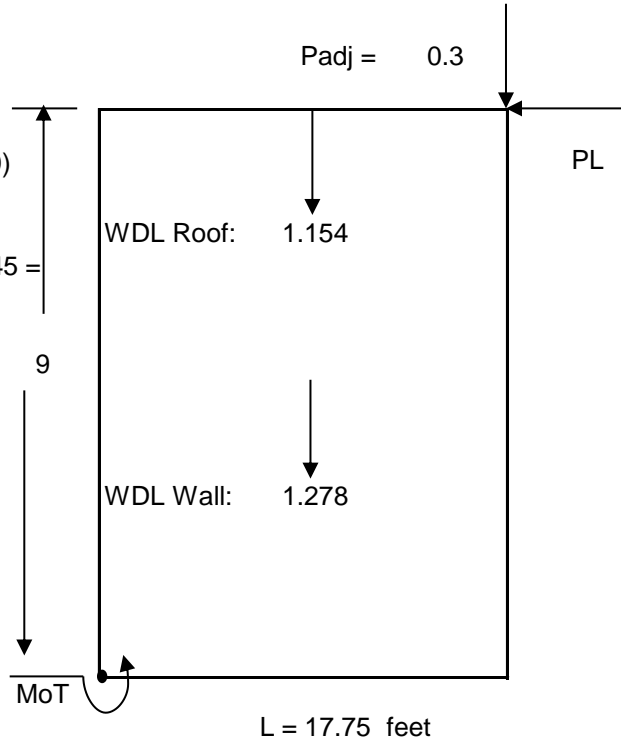
DL_f = 0.45 (Ref. Sect. 12.4.2.3 ASC. 7-10)

MR = [(1.154+1.278)x0.5x17.75+0.3x17.75]x0.45 = 12.11 kip - ft

H = 9

T = C = $\frac{MoT - MR}{L}$

2.13 kip



Therefore use (2)CS16 hold downs at each end

| | |
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CHECK OVERTURNING FOR: Y 5 (Quake)

L = 4.75 ft TL_{RF} = 5 ft (conservative)

P = 425 lb/ft

P x L = 4.75 x 425 = 2.02 kip

MoT = 2.02 x 10 = 20.19 kip - ft

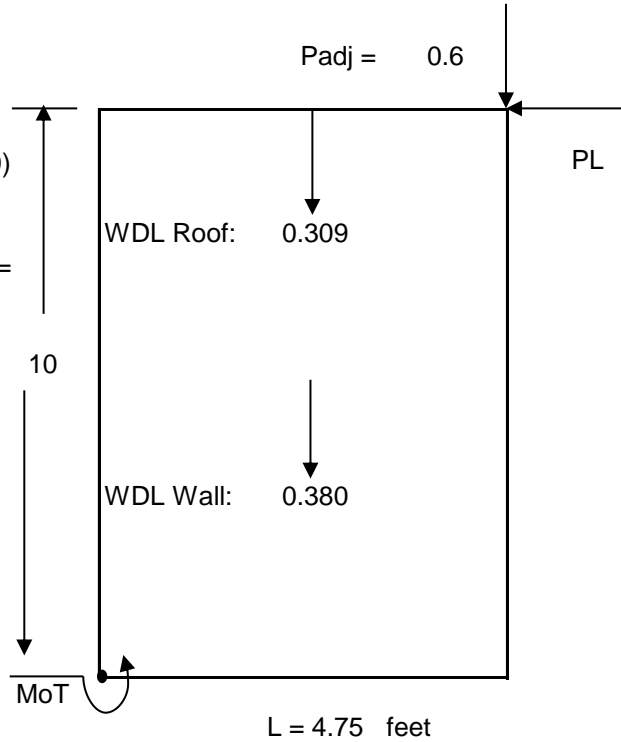
DL_f = 0.45 (Ref. Sect. 12.4.2.3 ASC. 7-10)

MR = [(0.309 + 0.380) x 0.5 x 4.75 + 0.6 x 4.75] x 0.45 = 2.02 kip - ft

T = C = $\frac{MoT - MR}{L}$

3.83 kip ↑ ↓

H = 10




Therefore use STHD14 hold downs at each end

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SHEARWALL SCHEDULE

Typ. Ext. Wall Construction


| | |
|------|---|
| SW-6 | 1) Sheathing: 1/2" Plywood or 7/16" O.S.B Exterior Side, Blocked, Nail w/ 8d @ 6" O.C. All edges and @ 12" O.C. Field or  2) Bolt Sill Plate to Concrete w/ 5/8" DIA. X 10" A.B.'s @ 48" O.C. 3) Nail bottom plate to framing below w/ 16d @ 4" O.C. 4) Fasten double plate to joist or blocking above per details on S1 & S2. |
|------|---|

Capacity: 240 lb/ft

Shearwall Schedule

--- --


Indicates shearwall w/ Plywood one side

| | |
|------|--|
| SW-4 | 1) Sheathing: 1/2" plywood or 7/16" O.S.B. one side, blocked, nail w/ 8d @ 4" O.C. all edges and 12" O.C. field. or  2) Bolt sill plate to concrete w/ 5/8" DIA. X 10" A.B.'s @ 32" O.C. 3) Nail bottom plate to framing below w/ 16d @ 3" O.C. 4) Fasten double plate to joist or blocking above per details on S1 & S2. |
|------|--|

Capacity: 350 lb/ft

--- --


Indicates shearwall w/ Plywood two sides

| | |
|---------|--|
| (2)SW-3 | 1) Sheathing: 1/2" plywood or O.S.B. two sides, blocked, nail w/ 8d @ 3" O.C. all edges and 12" O.C. field or  2) Bolt 3x or double sill plate to concrete w/ 5/8" DIA. X 10" exp. Bolts @ 12" O.C. 3) Fasten double bottom plates to double joist or blocking below w/ 2 rows 2 layers 16d @ 6" O.C. or 2 rows A35 clips @ 16" O.C. 4) Fasten double top plates to double joist or blocking above w/ 2 rows A35 clips @ 16" O.C. or per details on S1 & S2 5) Use 3x all framing members receiving en. From abutting panels |
|---------|--|

Capacity: 900 lb/ft

--- --


Indicates shearwall w/ Plywood one side

| | |
|------|--|
| SW-3 | 1) Sheathing: 1/2" plywood or 7/16" O.S.B. one side, blocked, nail w/ 8d @ 3" O.C. all edges and 12" O.C. field or  2) Bolt 3x or double sill plate to concrete w/ 5/8" DIA x 10" A.B.'s @ 24" O.C. (U.N.O.) 3) Fasten double plate to joist or blocking above per details on S1 & S2. 4) Use (2) 2x studs @ 16" O.C. at detail D / S1 (U.N.O.) 5) Provide 3x stud framing at all members receiving edge nailing from abutting panels (U.N.O.) |
|------|--|

Capacity: 450 lb/ft

--- --

Indicates shearwall w/ Plywood one side

| | |
|------|--|
| SW-2 | 1) Sheathing: 1/2" plywood or 7/16" O.S.B. one side, blocked, nail w/ 8d @ 2" O.C. all edges and 12" O.C. field or  2) Bolt 3x or double sill plate to concrete w/ 5/8" DIA x 10" A.B.'s @ 16" O.C. 3) Fasten double plate to joist or blocking above per details on S1 & S2. 4) Provide 3x stud framing at all members receiving edge nailing from abutting panels |
|------|--|

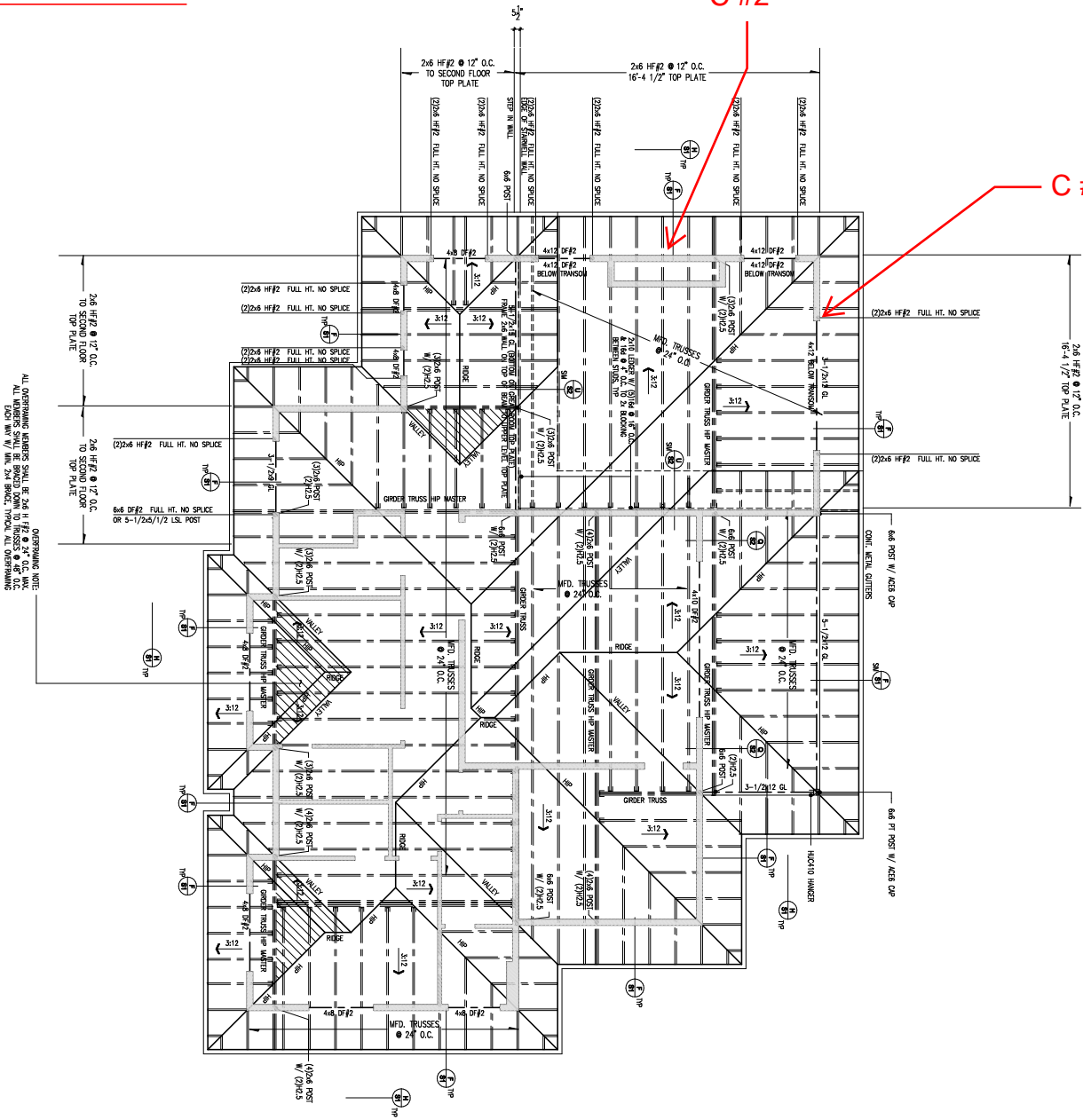
Capacity: 585 lb/ft

COLUMN KEY PLAN

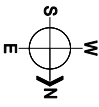
C #2

C1/5

C #1



OVERDRAWING NOTE:
 ALL OVERDRAWING DIMENSIONS SHALL BE 3/8\"/>



| | | | | | | | | | |
|--|--|--|--|--|--|--------------------------------|--|--|--|
| <p>CONTRACT FILE NAME A6 SHEET NUMBER</p> | <p>DATE 7.15.2020</p> | <p>SCALE 1/4"=1'-0"</p> | <p>REVISION 1.24.2020</p> | <p>MERLINO RESIDENCE</p> <p>MERCER ISLAND, WA</p> | | <p>UPPER ROOF FRAMING PLAN</p> | <p>DESIGNED BY DREW 206.408.8880</p> | | |
| | | | | <p>PROJECT NUMBER</p> | | | | | |

Wood Column

Lic. # : KW-06010288

DESCRIPTION: C #1

Code References

Calculations per 2012 NDS, IBC 2012, CBC 2013, ASCE 7-10
 Load Combinations Used : ASCE 7-16

General Information

| | | | | | |
|---|-------------------------|-------------|-----------|-----------------------------------|----------------|
| Analysis Method : | Allowable Stress Design | | | Wood Section Name | 3-2x6 |
| End Fixities | Top & Bottom Pinned | | | Wood Grading/Manuf. | Graded Lumber |
| Overall Column Height | 19 ft | | | Wood Member Type | Sawn |
| <i>(Used for non-slender calculations)</i> | | | | | |
| Wood Species | Hem-Fir | | | Exact Width | 4.50 in |
| Wood Grade | No.2 | | | Exact Depth | 5.50 in |
| Fb + | 575 psi | Fv | 140 psi | Area | 24.750 in^2 |
| Fb - | 575 psi | Ft | 375 psi | Ix | 62.391 in^4 |
| Fc - Prll | 575 psi | Density | 26.84 pcf | Iy | 41.766 in^4 |
| Fc - Perp | 405 psi | | | | |
| E : Modulus of Elasticity . . . | x-x Bending | y-y Bending | Axial | Allow Stress Modification Factors | |
| Basic | 1100 | 1100 | 1100 ksi | Cf or Cv for Bending | 1.30 |
| Minimum | 400 | 400 | | Cf or Cv for Compression | 1.10 |
| | | | | Cf or Cv for Tension | 1.30 |
| | | | | Cm : Wet Use Factor | 1.0 |
| | | | | Ct : Temperature Factor | 1.0 |
| | | | | Cfu : Flat Use Factor | 1.0 |
| | | | | Kf : Built-up columns | 1.0 NDS 15.3.2 |
| | | | | Use Cr : Repetitive ? | No |
| Brace condition for deflection (buckling) along columns : | | | | | |
| X-X (width) axis : Fully braced against buckling ABOUT Y-Y Axis | | | | | |
| Y-Y (depth) axis : Unbraced Length for buckling ABOUT X-X Axis = 19 ft, K = 1.0 | | | | | |

Applied Loads

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

Column self weight included : 87.649 lbs * Dead Load Factor

AXIAL LOADS . . .

Axial Load at 19.0 ft, D = 0.460, L = 0.880 k

BENDING LOADS . . .

Lat. Uniform Load creating Mx-x, W = 0.020 k/ft

DESIGN SUMMARY

Bending & Shear Check Results

| | | | |
|---|--------------------|--|----------------------------------|
| PASS Max. Axial+Bending Stress Ratio = | 0.3250 : 1 | Maximum SERVICE Lateral Load Reactions . . | |
| Load Combination | +D+L | Top along Y-Y | 0.190 k |
| Governing NDS Formula | Comp Only, fc/Fc' | Bottom along Y-Y | 0.190 k |
| Location of max.above base | 0.0 ft | Top along X-X | 0.0 k |
| At maximum location values are . . . | | Bottom along X-X | 0.0 k |
| Applied Axial | 1.428 k | Maximum SERVICE Load Lateral Deflections . . . | |
| Applied Mx | 0.0 k-ft | Along Y-Y | 0.8637 in at 9.564 ft above base |
| Applied My | 0.0 k-ft | for load combination : W Only | |
| Fc : Allowable | 177.486 psi | Along X-X | 0.0 in at 0.0 ft above base |
| | | for load combination : n/a | |
| PASS Maximum Shear Stress Ratio = | 0.03084 : 1 | Other Factors used to calculate allowable stresses . . . | |
| Load Combination | +D+0.60W | Bending | Compression |
| Location of max.above base | 0.0 ft | Tension | |
| Applied Design Shear | 6.909 psi | | |
| Allowable Shear | 224.0 psi | | |

Load Combination Results

| Load Combination | C _D | C _P | Maximum Axial + Bending Stress Ratios | | | Maximum Shear Ratios | | |
|------------------|----------------|----------------|---------------------------------------|--------|----------|----------------------|--------|----------|
| | | | Stress Ratio | Status | Location | Stress Ratio | Status | Location |
| D Only | 0.900 | 0.309 | 0.1260 | PASS | 0.0 ft | 0.0 | PASS | 19.0 ft |
| +D+L | 1.000 | 0.281 | 0.3250 | PASS | 0.0 ft | 0.0 | PASS | 19.0 ft |
| +D+0.750L | 1.250 | 0.228 | 0.2701 | PASS | 0.0 ft | 0.0 | PASS | 19.0 ft |
| +D+0.60W | 1.600 | 0.181 | 0.2854 | PASS | 9.436 ft | 0.03084 | PASS | 0.0 ft |
| +D+0.750L+0.450W | 1.600 | 0.181 | 0.3120 | PASS | 9.436 ft | 0.02313 | PASS | 19.0 ft |
| +0.60D+0.60W | 1.600 | 0.181 | 0.2626 | PASS | 9.436 ft | 0.03084 | PASS | 0.0 ft |
| +0.60D | 1.600 | 0.181 | 0.07246 | PASS | 0.0 ft | 0.0 | PASS | 19.0 ft |

Wood Column

Lic. # : KW-06010288

File: Merlino Residence.ec6
 Software copyright ENERCALC, INC. 1983-2020, Build:12.20.8.24
 RB Engineers, Inc.

DESCRIPTION: C #1

Maximum Reactions

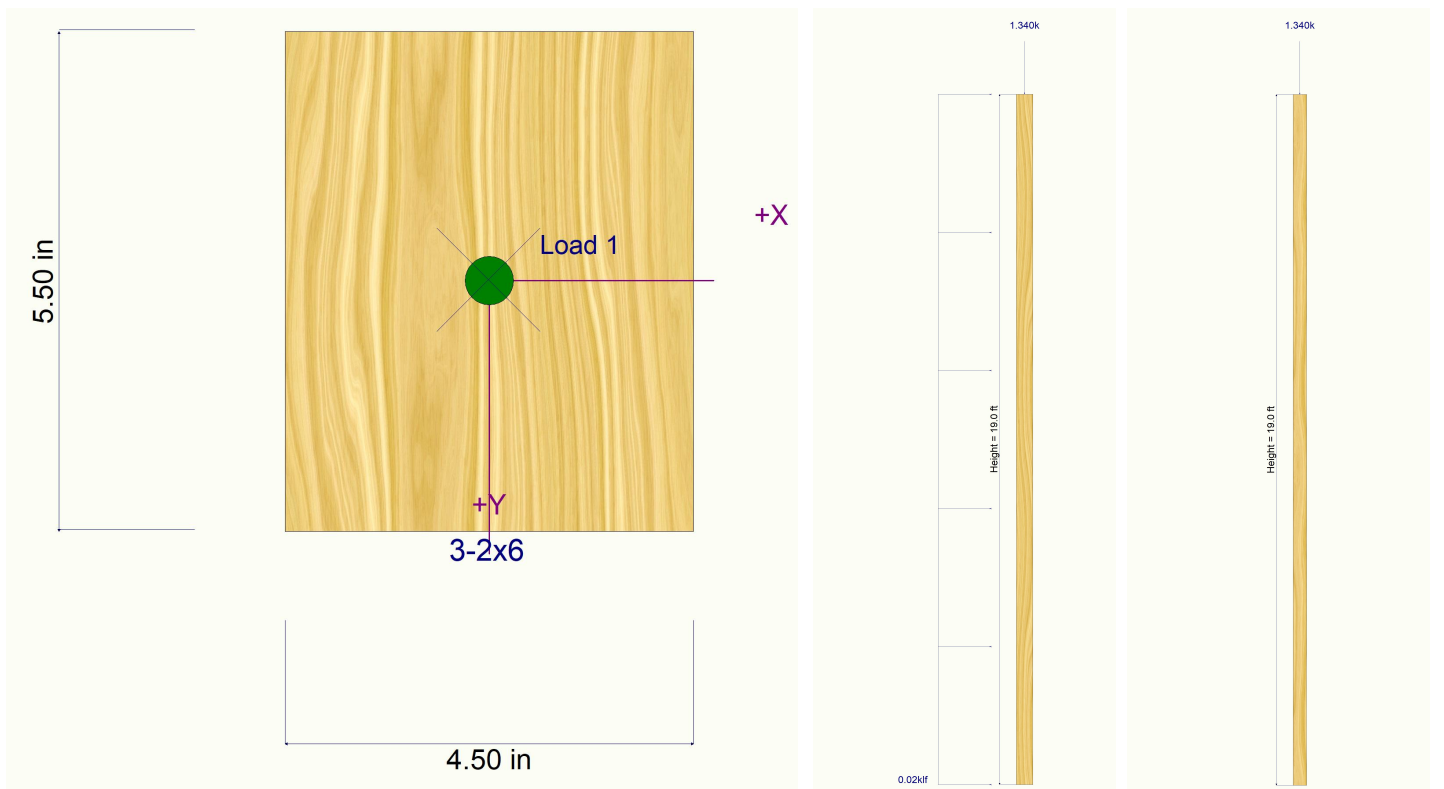
Note: Only non-zero reactions are listed.

| Load Combination | X-X Axis Reaction | | k | Y-Y Axis Reaction | | Axial Reaction | My - End Moments | | Mx - End Moments | |
|------------------|-------------------|-------|---|-------------------|-------|----------------|------------------|-------|------------------|-------|
| | @ Base | @ Top | | @ Base | @ Top | | @ Base | @ Top | @ Base | @ Top |
| D Only | | | | | | 0.548 | | | | |
| +D+L | | | | | | 1.428 | | | | |
| +D+0.750L | | | | | | 1.208 | | | | |
| +D+0.60W | | | | 0.114 | 0.114 | 0.548 | | | | |
| +D+0.750L+0.450W | | | | 0.086 | 0.086 | 1.208 | | | | |
| +0.60D+0.60W | | | | 0.114 | 0.114 | 0.329 | | | | |
| +0.60D | | | | | | 0.329 | | | | |
| L Only | | | | | | 0.880 | | | | |
| W Only | | | | 0.190 | 0.190 | | | | | |

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 | 0.0000 in | 0.000 ft |
| +D+L | 0.0000 in | 0.000 ft | 0.0000 in | 0.000 ft |
| +D+0.750L | 0.0000 in | 0.000 ft | 0.0000 in | 0.000 ft |
| +D+0.60W | 0.0000 in | 0.000 ft | 0.5182 in | 9.564 ft |
| +D+0.750L+0.450W | 0.0000 in | 0.000 ft | 0.3887 in | 9.564 ft |
| +0.60D+0.60W | 0.0000 in | 0.000 ft | 0.5182 in | 9.564 ft |
| +0.60D | 0.0000 in | 0.000 ft | 0.0000 in | 0.000 ft |
| L Only | 0.0000 in | 0.000 ft | 0.0000 in | 0.000 ft |
| W Only | 0.0000 in | 0.000 ft | 0.8637 in | 9.564 ft |

Sketches



Wood Column

Lic. # : KW-06010288

File: Merlino Residence.ec6
 Software copyright ENERCALC, INC. 1983-2020, Build:12.20.8.24
 RB Engineers, Inc.

DESCRIPTION: C #2

Code References

Calculations per 2012 NDS, IBC 2012, CBC 2013, ASCE 7-10
 Load Combinations Used : ASCE 7-16

General Information

| | | | | | | |
|--|--------------------------------|----------------|-------------------|-----------------------------------|--------------------------|--------------------------------------|
| Analysis Method : | Allowable Stress Design | | | Wood Section Name | 2-2x6 | |
| End Fixities | Top & Bottom Pinned | | | Wood Grading/Manuf. | Graded Lumber | |
| Overall Column Height | 19 ft | | | Wood Member Type | Sawn | |
| <i>(Used for non-slender calculations)</i> | | | | | | |
| Wood Species | Hem-Fir | | | Exact Width | 3.0 in | |
| Wood Grade | No.2 | | | Exact Depth | 5.50 in | |
| Fb + | 575.0 psi | Fv | 140.0 psi | Area | 16.50 in^2 | |
| Fb - | 575.0 psi | Ft | 375.0 psi | Ix | 41.594 in^4 | |
| Fc - Prll | 575.0 psi | Density | 26.840 pcf | Iy | 12.375 in^4 | |
| Fc - Perp | 405.0 psi | | | | | |
| E : Modulus of Elasticity . . . | x-x Bending | y-y Bending | Axial | Allow Stress Modification Factors | | |
| | Basic | 1,100.0 | 1,100.0 | 1,100.0 ksi | Cf or Cv for Bending | 1.30 |
| | Minimum | 400.0 | 400.0 | | Cf or Cv for Compression | 1.10 |
| | | | | | Cf or Cv for Tension | 1.30 |
| | | | | | Cm : Wet Use Factor | 1.0 |
| | | | | | Ct : Temperature Factor | 1.0 |
| | | | | | Cfu : Flat Use Factor | 1.0 |
| | | | | | Kf : Built-up columns | 1.0 <small>NDS 15.3.2</small> |
| | | | | | Use Cr : Repetitive ? | No |
| Brace condition for deflection (buckling) along columns : | | | | | | |
| X-X (width) axis : Fully braced against buckling ABOUT Y-Y Axis | | | | | | |
| Y-Y (depth) axis : Unbraced Length for buckling ABOUT X-X Axis = 19 ft, K = 1.0 | | | | | | |

Applied Loads

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

Column self weight included : 58.433 lbs * Dead Load Factor

AXIAL LOADS . . .

Axial Load at 19.0 ft, D = 0.0250, L = 0.050 k

BENDING LOADS . . .

Lat. Uniform Load creating Mx-x, W = 0.020 k/ft

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.3697 : 1**
 Load Combination **+D+0.60W**
 Governing NDS Formula **1Comp + Mxx, NDS Eq. 3.9-3**
 Location of max.above base **9.436 ft**
 At maximum location values are . . .
 Applied Axial **0.08343 k**
 Applied Mx **0.5415 k-ft**
 Applied My **0.0 k-ft**
 Fc : Allowable **183.230 psi**

Maximum SERVICE Lateral Load Reactions . .
 Top along Y-Y **0.190 k** Bottom along Y-Y **0.190 k**
 Top along X-X **0.0 k** Bottom along X-X **0.0 k**

Maximum SERVICE Load Lateral Deflections . . .
 Along Y-Y **1.296 in** at **9.564 ft** above base
 for load combination : **W Only**
 Along X-X **0.0 in** at **0.0 ft** above base
 for load combination : **n/a**

Other Factors used to calculate allowable stresses . . .
 Bending Compression Tension

PASS Maximum Shear Stress Ratio = **0.04627 : 1**
 Load Combination **+D+0.60W**
 Location of max.above base **19.0 ft**
 Applied Design Shear **10.364 psi**
 Allowable Shear **224.0 psi**

Load Combination Results

| Load Combination | C _D | C _P | Maximum Axial + Bending Stress Ratios | | | Maximum Shear Ratios | | |
|------------------|----------------|----------------|---------------------------------------|--------|----------|----------------------|--------|----------|
| | | | Stress Ratio | Status | Location | Stress Ratio | Status | Location |
| D Only | 0.900 | 0.309 | 0.02879 | PASS | 0.0 ft | 0.0 | PASS | 19.0 ft |
| +D+L | 1.000 | 0.281 | 0.04556 | PASS | 0.0 ft | 0.0 | PASS | 19.0 ft |
| +D+0.750L | 1.250 | 0.228 | 0.04058 | PASS | 0.0 ft | 0.0 | PASS | 19.0 ft |
| +D+0.60W | 1.600 | 0.181 | 0.3697 | PASS | 9.436 ft | 0.04627 | PASS | 19.0 ft |
| +D+0.750L+0.450W | 1.600 | 0.181 | 0.2817 | PASS | 9.436 ft | 0.03470 | PASS | 19.0 ft |
| +0.60D+0.60W | 1.600 | 0.181 | 0.3653 | PASS | 9.436 ft | 0.04627 | PASS | 19.0 ft |
| +0.60D | 1.600 | 0.181 | 0.01656 | PASS | 0.0 ft | 0.0 | PASS | 19.0 ft |

Wood Column

Lic. # : KW-06010288

File: Merlino Residence.ec6
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 RB Engineers, Inc.

DESCRIPTION: C #2

Maximum Reactions

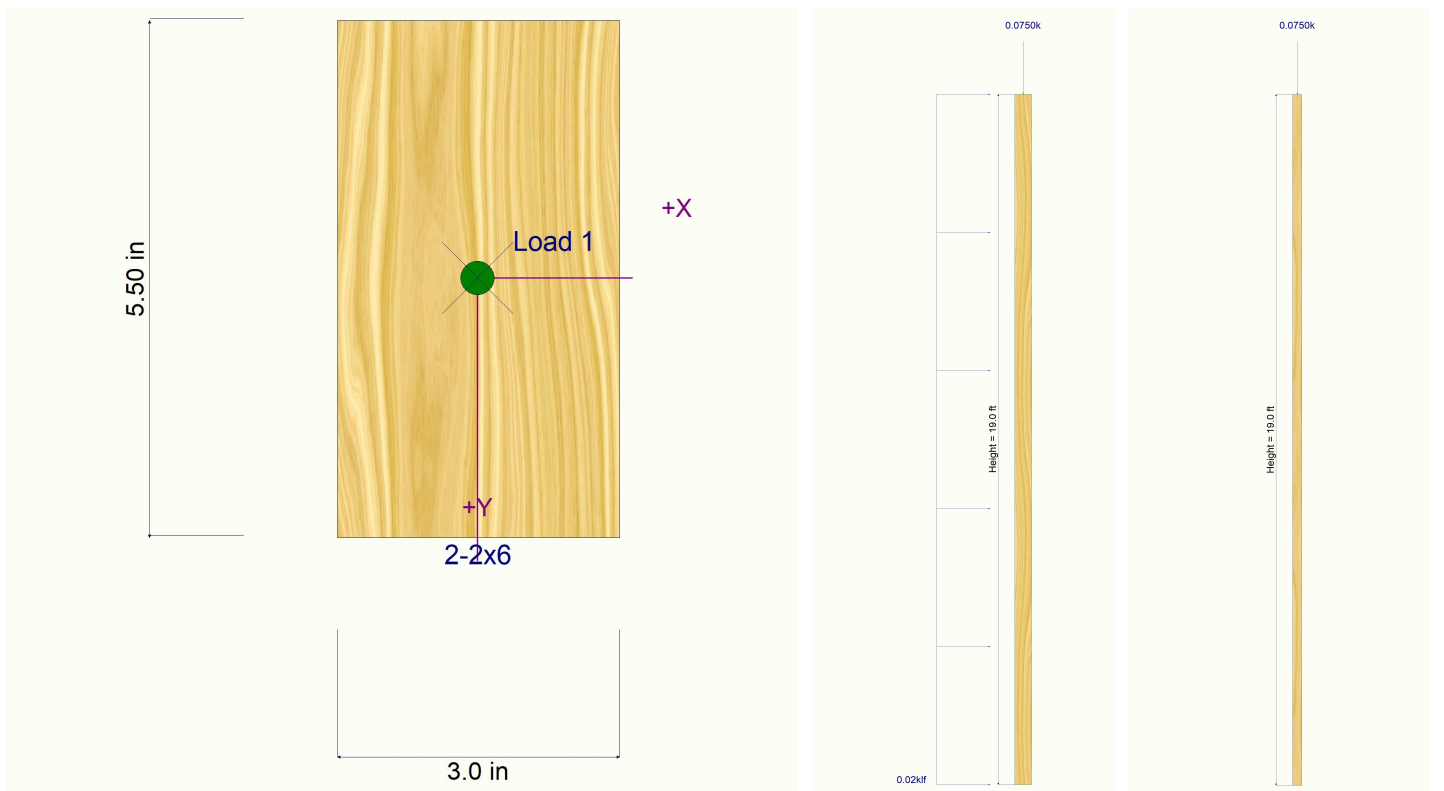
Note: Only non-zero reactions are listed.

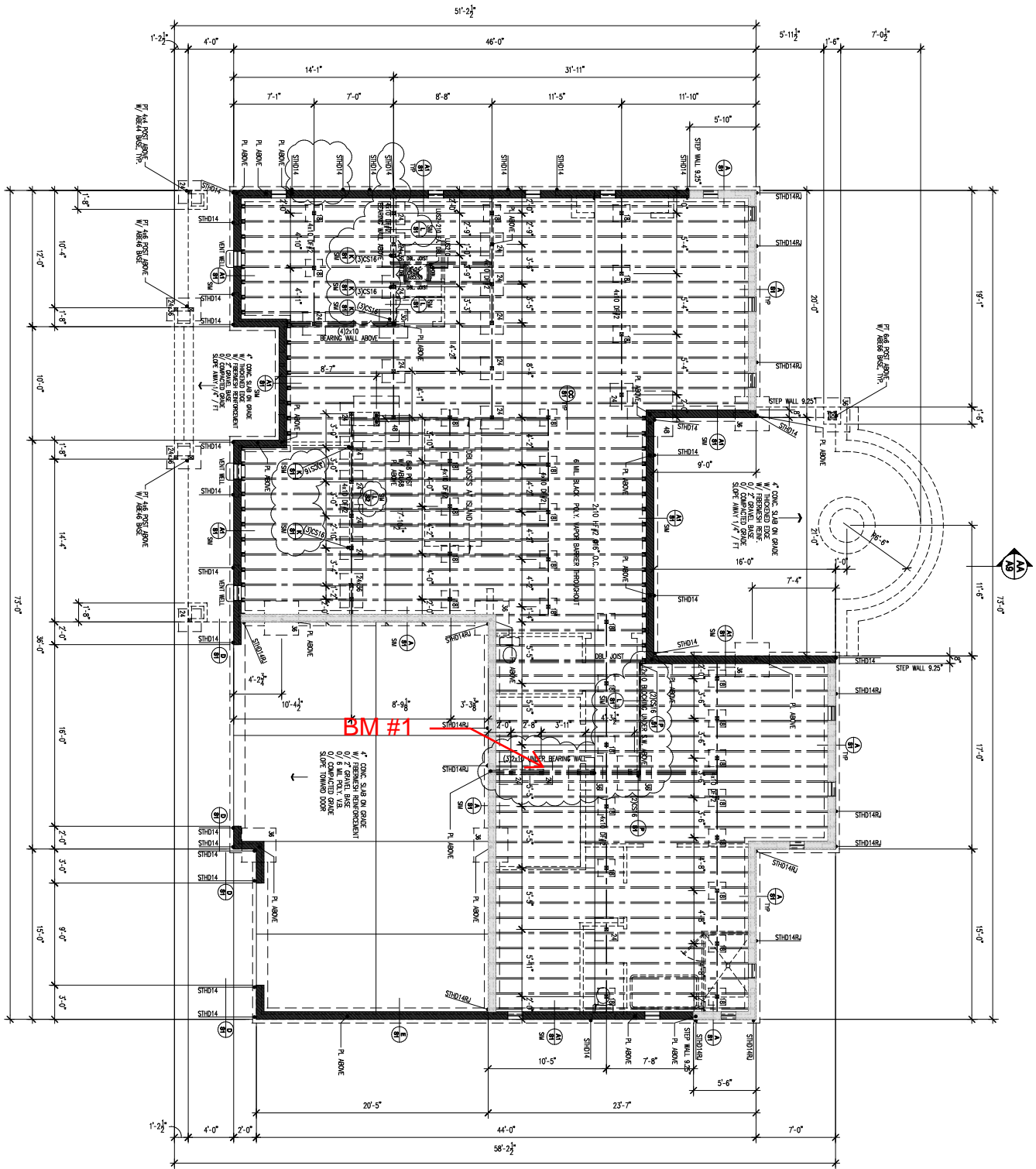
| Load Combination | X-X Axis Reaction | | k | Y-Y Axis Reaction | | Axial Reaction | My - End Moments | | Mx - End Moments | |
|------------------|-------------------|-------|---|-------------------|-------|----------------|------------------|-------|------------------|-------|
| | @ Base | @ Top | | @ Base | @ Top | | @ Base | @ Top | @ Base | @ Top |
| D Only | | | | | | 0.083 | | | | |
| +D+L | | | | | | 0.133 | | | | |
| +D+0.750L | | | | | | 0.121 | | | | |
| +D+0.60W | | | | 0.114 | 0.114 | 0.083 | | | | |
| +D+0.750L+0.450W | | | | 0.086 | 0.086 | 0.121 | | | | |
| +0.60D+0.60W | | | | 0.114 | 0.114 | 0.050 | | | | |
| +0.60D | | | | | | 0.050 | | | | |
| L Only | | | | | | 0.050 | | | | |
| W Only | | | | 0.190 | 0.190 | | | | | |

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 | 0.0000 in | 0.000 ft |
| +D+L | 0.0000 in | 0.000 ft | 0.0000 in | 0.000 ft |
| +D+0.750L | 0.0000 in | 0.000 ft | 0.0000 in | 0.000 ft |
| +D+0.60W | 0.0000 in | 0.000 ft | 0.7774 in | 9.564 ft |
| +D+0.750L+0.450W | 0.0000 in | 0.000 ft | 0.5830 in | 9.564 ft |
| +0.60D+0.60W | 0.0000 in | 0.000 ft | 0.7774 in | 9.564 ft |
| +0.60D | 0.0000 in | 0.000 ft | 0.0000 in | 0.000 ft |
| L Only | 0.0000 in | 0.000 ft | 0.0000 in | 0.000 ft |
| W Only | 0.0000 in | 0.000 ft | 1.2956 in | 9.564 ft |

Sketches



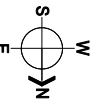


BM #1

POINT LOAD NOTE:
 ALL POINT LOADS SHALL BE AS SHOWN.
 POINT LOADS SHALL BE APPLIED TO THE CENTER OF THE COLUMN OR BEAM.
 POINT LOADS SHALL BE APPLIED TO THE CENTER OF THE COLUMN OR BEAM.
 POINT LOADS SHALL BE APPLIED TO THE CENTER OF THE COLUMN OR BEAM.

FOOTING SCHEDULE:

| | |
|--|---------------------|
| 1'-6" x 1'-6" x 8" DEEP CONC. FOOTING W/ REINFORCING BARS, TYP. | (1)H EACH W/M, TYP. |
| 2'-0" x 2'-0" x 8" DEEP CONC. FOOTING W/ REINFORCING BARS, TYP. | (1)H EACH W/M, TYP. |
| 2'-6" x 2'-6" x 8" DEEP CONC. FOOTING W/ REINFORCING BARS, TYP. | (1)H EACH W/M, TYP. |
| 3'-0" x 3'-0" x 12" DEEP CONC. FOOTING W/ REINFORCING BARS, TYP. | (1)H EACH W/M, TYP. |
| 4'-0" x 4'-0" x 14" DEEP CONC. FOOTING W/ REINFORCING BARS, TYP. | (1)H EACH W/M, TYP. |



A1
 SHEET NUMBER
 11.10.2020
 DATE
 1/4" = 1'-0"
 SCALE
 5/18/2021 6.3.2021
 REVISION
 4/7/2021
MERLINO RESIDENCE
 4225 89TH AVE SE MERCER ISLAND, WA 98040
DRG
 5/17/2022
 204 408 8880
 204 408 8880
 204 408 8880

MAIN LEVEL FLOOR FRAMING & FOUNDATION PLAN
 204 408 8880
 204 408 8880
 204 408 8880



Wood Beam

Lic. #: KW-06010288

File: Merlino Residence.ec6
 Software copyright ENERCALC, INC. 1983-2020, Build:12.20.8.24
 RB Engineers, Inc.

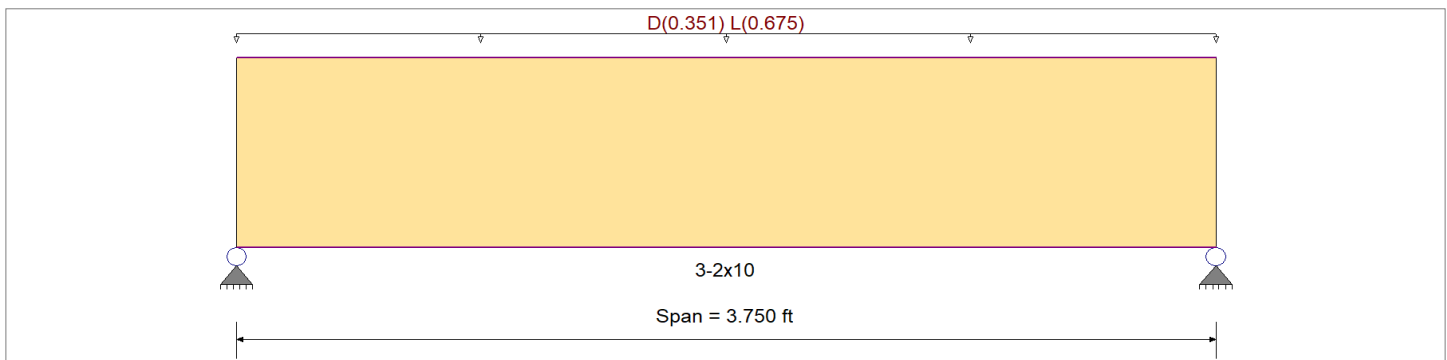
DESCRIPTION: BM # 1

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
 Load Combination Set : IBC 2018

Material Properties

| | | | | |
|--|-----------|----------|---------------------------|----------|
| Analysis Method : Allowable Stress Design | Fb + | 850 psi | E : Modulus of Elasticity | |
| Load Combination IBC 2018 | Fb - | 850 psi | Ebend- xx | 1300ksi |
| | Fc - Prll | 1300 psi | Eminbend - xx | 470ksi |
| Wood Species : Hem-Fir | Fc - Perp | 405 psi | | |
| Wood Grade : No.2 | Fv | 150 psi | | |
| | Ft | 525 psi | Density | 26.84pcf |
| Beam Bracing : Beam is Fully Braced against lateral-torsional buckling | | | | |



Applied Loads

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

Uniform Load : D = 0.0130, L = 0.0250 ksf, Tributary Width = 27.0 ft

DESIGN SUMMARY

Design OK

| | | | |
|-----------------------------------|------------------|------------------------------|------------------|
| Maximum Bending Stress Ratio = | 0.361 : 1 | Maximum Shear Stress Ratio = | 0.273 : 1 |
| Section used for this span | 3-2x10 | Section used for this span | 3-2x10 |
| fb: Actual = | 337.25psi | fv: Actual = | 40.99 psi |
| Fb: Allowable = | 935.00psi | Fv: Allowable = | 150.00 psi |
| Load Combination | +D+L | Load Combination | +D+L |
| Location of maximum on span | 1.875ft | Location of maximum on span | 0.000ft |
| Span # where maximum occurs | Span # 1 | Span # where maximum occurs | Span # 1 |
| Maximum Deflection | | | |
| Max Downward Transient Deflection | 0.008 in | Ratio = | 5747 >=480 |
| Max Upward Transient Deflection | 0.000 in | Ratio = | 0 <480 |
| Max Downward Total Deflection | 0.012 in | Ratio = | 3781 >=240 |
| Max Upward Total Deflection | 0.000 in | Ratio = | 0 <240 |

Maximum Forces & Stresses for Load Combinations

| Load Combination | Segment Length | Span # | Max Stress Ratios | | | | | | | | Moment Values | | | Shear Values | | | | | |
|------------------|-------------------|--------|-------------------|-------|----------------|-----------------|----------------|----------------|----------------|----------------|----------------|------|--------|--------------|------|------|------|------|--------|
| | | | M | V | C _d | C _{FV} | C _i | C _r | C _m | C _t | C _L | M | fb | F'b | V | fv | Fv | | |
| D Only | Length = 3.750 ft | 1 | 0.137 | 0.104 | 0.90 | 1.100 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.62 | 115.38 | 841.50 | 0.00 | 0.00 | 0.00 | 0.00 | 135.00 |
| +D+L | Length = 3.750 ft | 1 | 0.361 | 0.273 | 1.00 | 1.100 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.80 | 337.25 | 935.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| +D+0.750L | Length = 3.750 ft | 1 | 0.241 | 0.183 | 1.25 | 1.100 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.51 | 281.78 | 1168.75 | 0.00 | 0.00 | 0.00 | 0.00 | 187.50 |
| +0.60D | Length = 3.750 ft | 1 | 0.046 | 0.035 | 1.60 | 1.100 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.37 | 69.23 | 1496.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Overall Maximum Deflections

| Load Combination | Span | Max. "-" Defl | Location in Span | Load Combination | Max. "+" Defl | Location in Span |
|------------------|------|---------------|------------------|------------------|---------------|------------------|
| +D+L | 1 | 0.0119 | 1.889 | | 0.0000 | 0.000 |

Wood Beam

Lic. #: KW-06010288

File: Merlino Residence.ec6
 Software copyright ENERCALC, INC. 1983-2020, Build:12.20.8.24
 RB Engineers, Inc.

DESCRIPTION: BM # 1

Maximum Deflections for Load Combinations

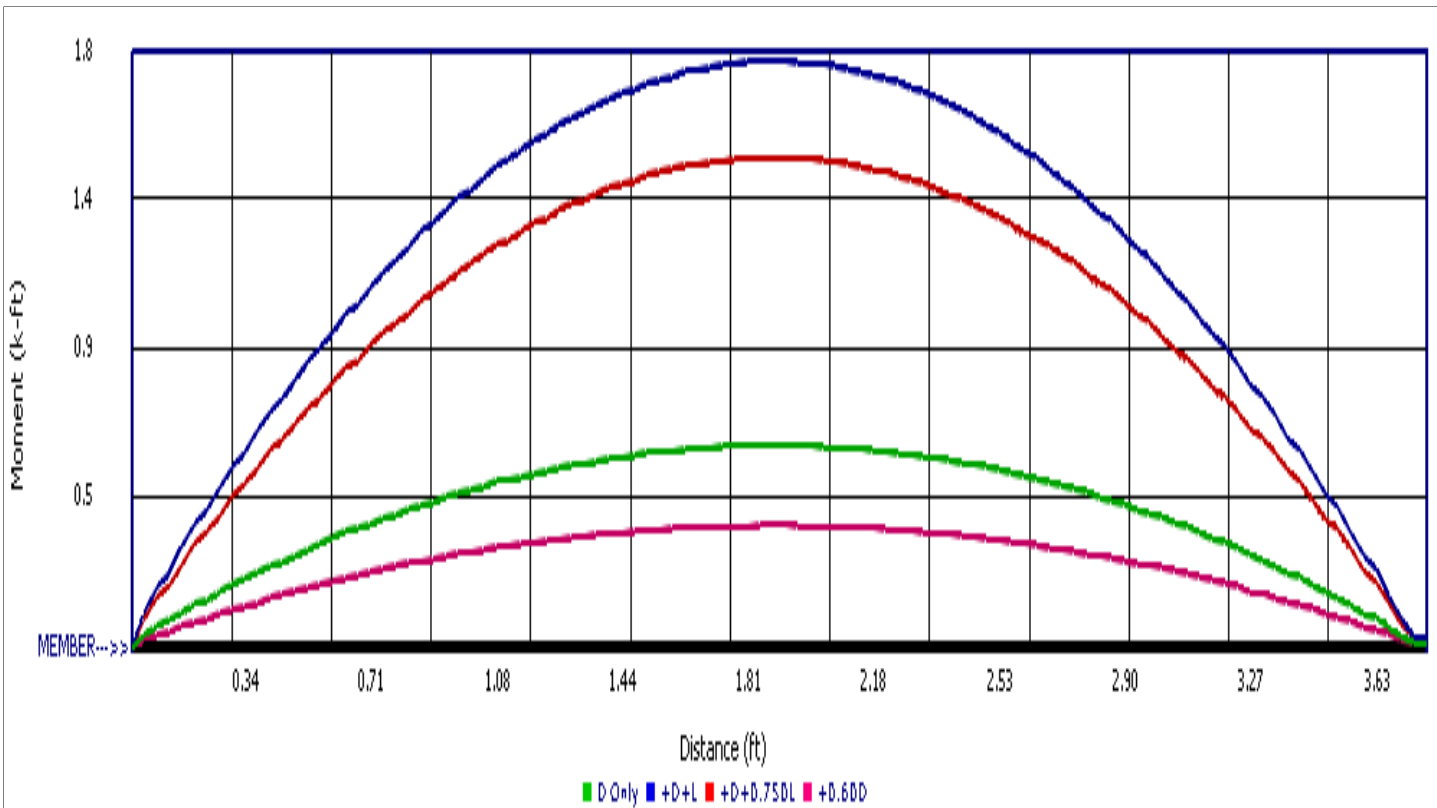
| Load Combination | Span | Max. Downward Defl | Location in Span | Max. Upward Defl | Location in Span |
|------------------|------|--------------------|------------------|------------------|------------------|
| D Only | 1 | 0.0041 in | 1.889 ft | 0.0000 in | 0.000 ft |
| +D+L | 1 | 0.0119 in | 1.889 ft | 0.0000 in | 0.000 ft |
| +D+0.750L | 1 | 0.0099 in | 1.889 ft | 0.0000 in | 0.000 ft |
| +0.60D | 1 | 0.0024 in | 1.889 ft | 0.0000 in | 0.000 ft |
| L Only | 1 | 0.0078 in | 1.889 ft | 0.0000 in | 0.000 ft |

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

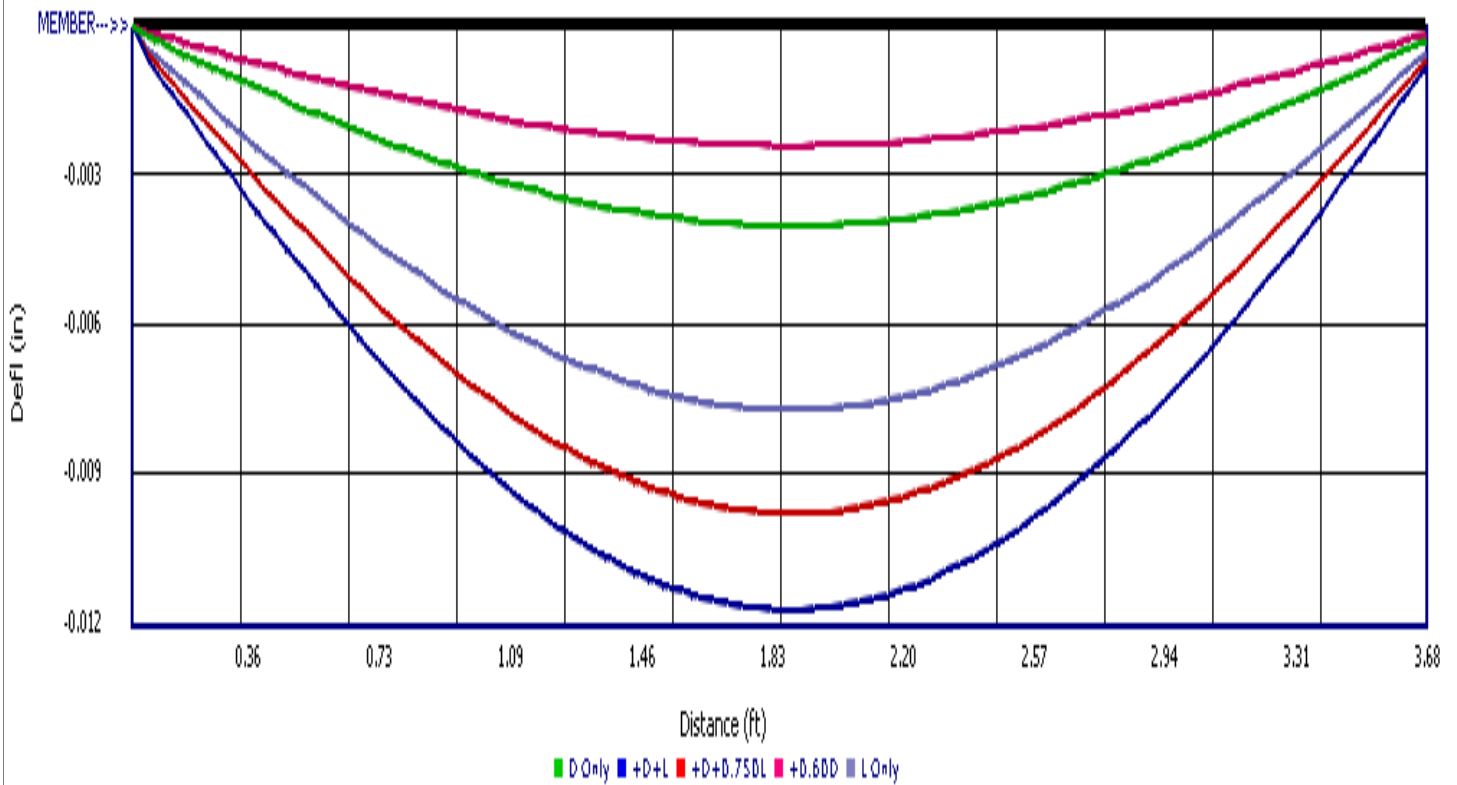
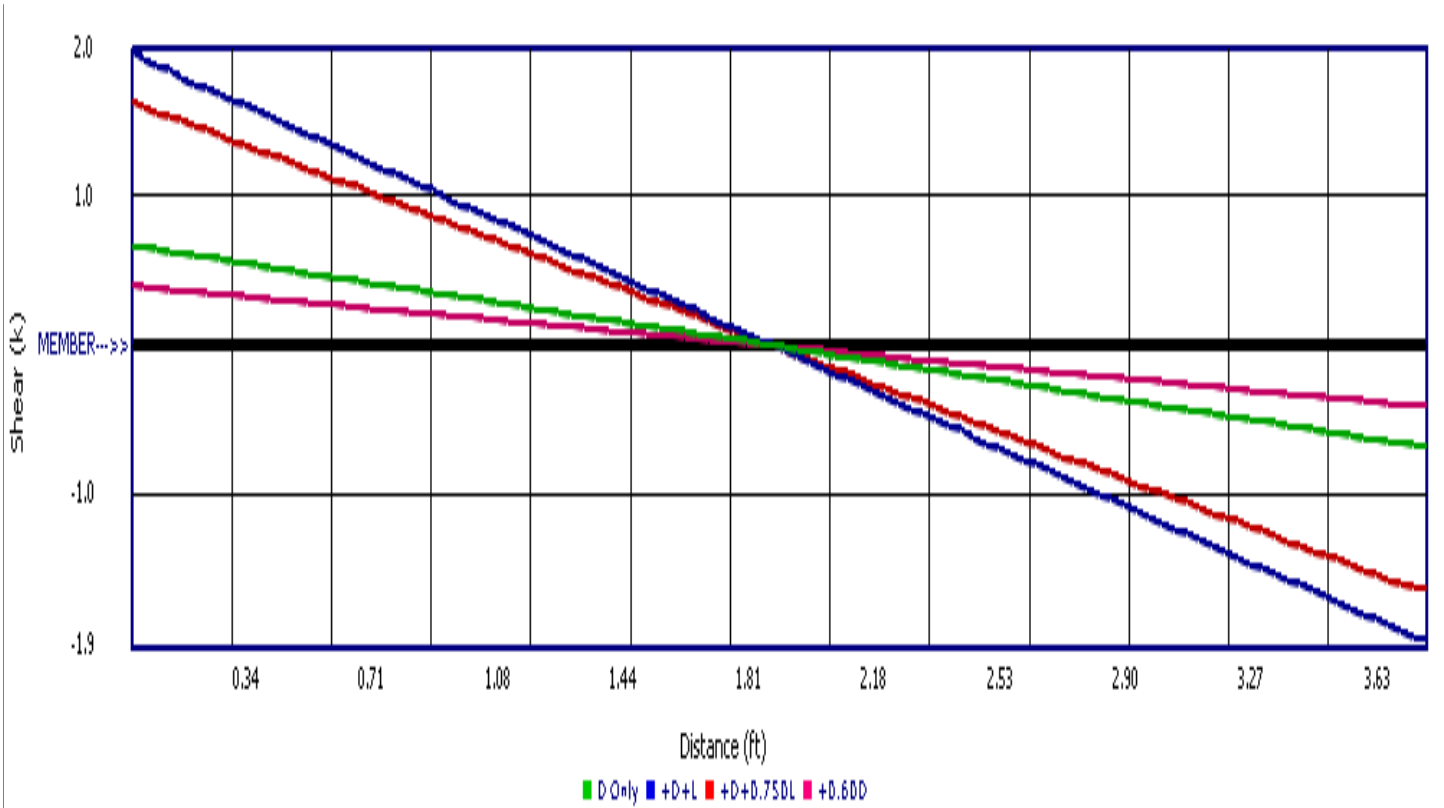
| Load Combination | Support 1 | Support 2 |
|------------------|-----------|-----------|
| Overall MAXimum | 1.924 | 1.924 |
| Overall MINimum | 1.266 | 1.266 |
| D Only | 0.658 | 0.658 |
| +D+L | 1.924 | 1.924 |
| +D+0.750L | 1.607 | 1.607 |
| +0.60D | 0.395 | 0.395 |
| L Only | 1.266 | 1.266 |

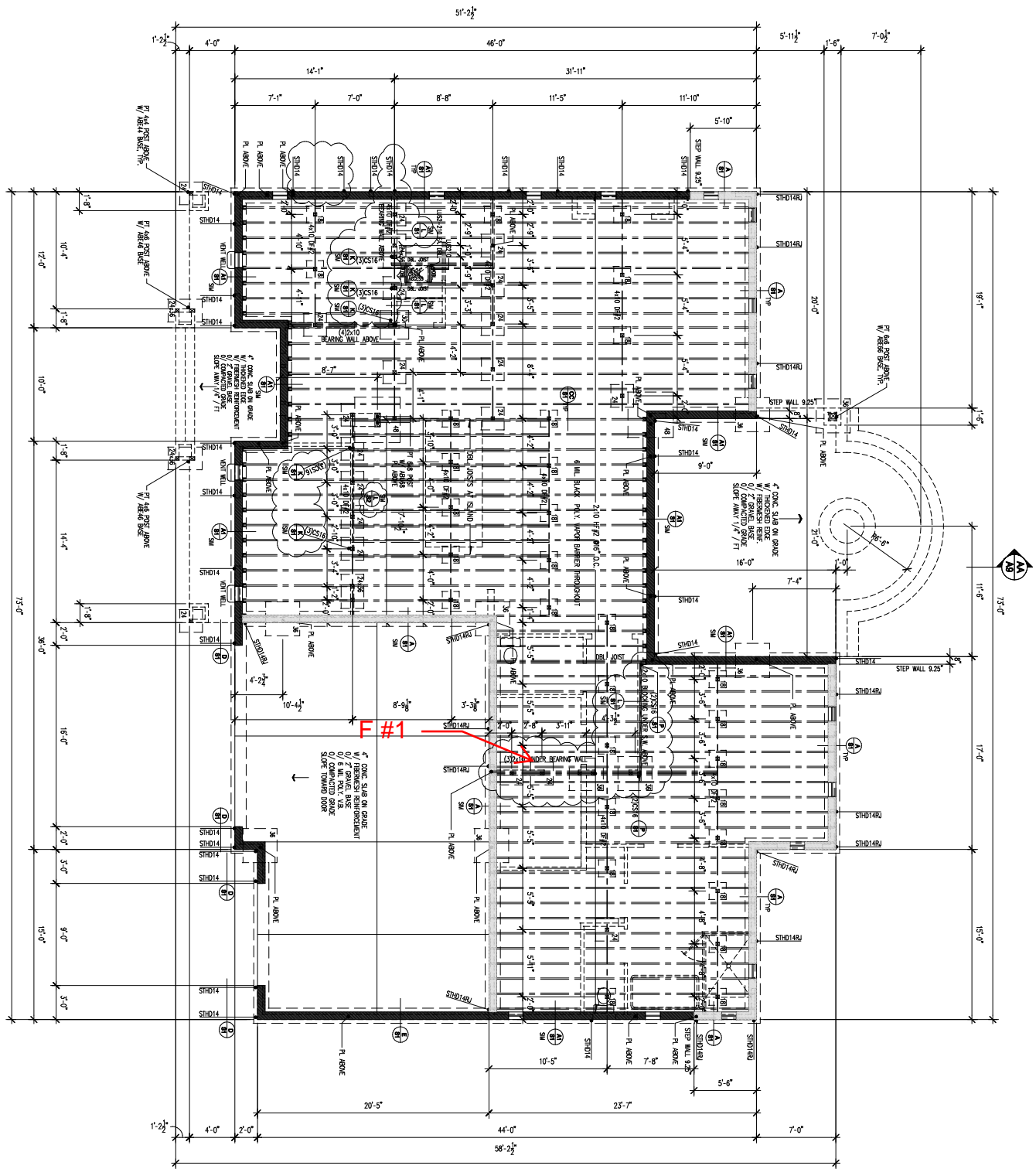


Wood Beam

Lic. #: KW-06010288

DESCRIPTION: BM # 1



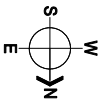


POINT LOAD NOTE:
 ALL POINT LOADS SHALL BE PERMITTED TO BE APPLIED TO THE FOUNDATION AS SHOWN ON THIS PLAN. ALL POINT LOADS SHALL BE PERMITTED TO BE APPLIED TO THE FOUNDATION AS SHOWN ON THIS PLAN.

VENTILATION: SHALL BE PERMITTED TO BE APPLIED TO THE FOUNDATION AS SHOWN ON THIS PLAN. ALL POINT LOADS SHALL BE PERMITTED TO BE APPLIED TO THE FOUNDATION AS SHOWN ON THIS PLAN.

FOOTING SCHEDULE:

| |
|---|
| 1'-6" x 1'-6" x 8" DEEP CONC. FOOTING W/ (9) #4 EACH WAY, TYP. |
| 2'-0" x 2'-0" x 8" DEEP CONC. FOOTING W/ (9) #4 EACH WAY, TYP. |
| 2'-6" x 2'-6" x 8" DEEP CONC. FOOTING W/ (9) #4 EACH WAY, TYP. |
| 4'-0" x 4'-0" x 14" DEEP CONC. FOOTING W/ (9) #4 EACH WAY, TYP. |



REVISIONS:
 4/7/2021
 5/18/2021 6.3.2021
 11/10/2020
 DATE
 1/4" = 1'-0"
 SCALE
 11/10/2020
 DATE
 A1
 SHEET NUMBER

MERLINO RESIDENCE
 4225 89TH AVE SE MERCER ISLAND, WA 98040

MAIN LEVEL FLOOR FRAMING & FOUNDATION PLAN

08/28/2020
 204 408 8880
 DREST
 08/28/2020

General Footing

Lic. # : KW-06010288

File: Merlino Residence.ec6
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 RB Engineers, Inc.

DESCRIPTION: F #1

Code References

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16

Load Combinations Used : IBC 2018

General Information

Material Properties

| | | | |
|----------------------------------|---|---------|-----|
| f_c : Concrete 28 day strength | = | 2.50 | ksi |
| f_y : Rebar Yield | = | 40.0 | ksi |
| E_c : Concrete Elastic Modulus | = | 3,122.0 | ksi |
| Concrete Density | = | 145.0 | pcf |
| ϕ Values Flexure | = | 0.90 | |
| Shear | = | 0.750 | |

Soil Design Values

| | | | |
|---------------------------------------|---|-------|-----|
| Allowable Soil Bearing | = | 1.50 | ksf |
| Increase Bearing By Footing Weight | = | No | |
| Soil Passive Resistance (for Sliding) | = | 250.0 | pcf |
| Soil/Concrete Friction Coeff. | = | 0.30 | |

Analysis Settings

| | | |
|--|---|---------|
| Min Steel % Bending Reinf. | = | |
| Min Allow % Temp Reinf. | = | 0.00180 |
| Min. Overturning Safety Factor | = | 1.0 : 1 |
| Min. Sliding Safety Factor | = | 1.0 : 1 |
| Add Ftg Wt for Soil Pressure | : | Yes |
| Use ftg wt for stability, moments & shears | : | Yes |
| Add Pedestal Wt for Soil Pressure | : | No |
| Use Pedestal wt for stability, mom & shear | : | No |

Increases based on footing Depth

| | | | |
|--|---|--|-----|
| Footing base depth below soil surface | = | | ft |
| Allow press. increase per foot of depth when footing base is below | = | | ksf |
| | = | | ft |

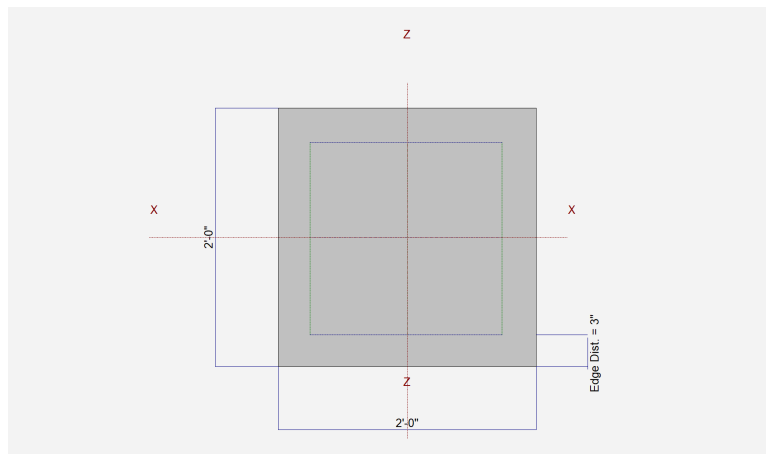
Increases based on footing plan dimension

| | | | |
|---|---|--|-----|
| Allowable pressure increase per foot of depth when max. length or width is greater than | = | | ksf |
| | = | | ft |

Dimensions

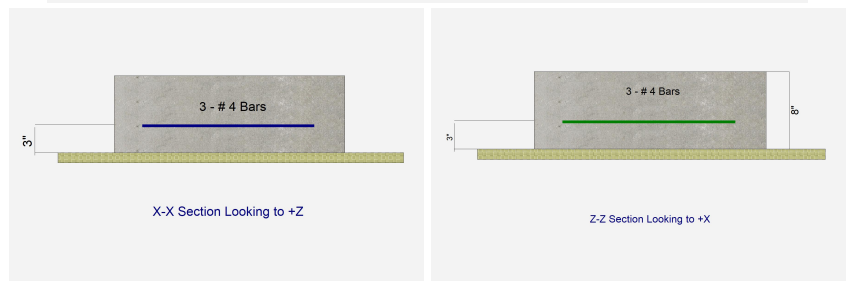
| | | | |
|-----------------------------|---|-----|----|
| Width parallel to X-X Axis | = | 2 | ft |
| Length parallel to Z-Z Axis | = | 2.0 | ft |
| Footing Thickness | = | 8.0 | in |

| | | | |
|--|---|-----|----|
| Pedestal dimensions... | | | |
| px : parallel to X-X Axis | = | | in |
| pz : parallel to Z-Z Axis | = | | in |
| Height | = | | in |
| Rebar Centerline to Edge of Concrete... at Bottom of footing | = | 3.0 | in |



Reinforcing

| | | |
|---|---|-----|
| Bars parallel to X-X Axis | | |
| Number of Bars | = | 3 |
| Reinforcing Bar Size | = | # 4 |
| Bars parallel to Z-Z Axis | | |
| Number of Bars | = | 3 |
| Reinforcing Bar Size | = | # 4 |
| Bandwidth Distribution Check (ACI 15.4.4.2) | | |
| Direction Requiring Closer Separation | | n/a |
| # Bars required within zone | | n/a |
| # Bars required on each side of zone | | n/a |



Applied Loads

| | D | Lr | L | S | W | E | H | |
|-----------------|---|-----|---|------|---|---|---|------|
| P : Column Load | = | 1.2 | | 2.50 | | | | k |
| OB : Overburden | = | | | | | | | ksf |
| M-xx | = | | | | | | | k-ft |
| M-zz | = | | | | | | | k-ft |
| V-x | = | | | | | | | k |
| V-z | = | | | | | | | k |

General Footing

Lic. #: KW-06010288

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DESCRIPTION: F #1

DESIGN SUMMARY

Design OK

| Min. Ratio | Item | Applied | Capacity | Governing Load Combination | |
|------------|--------|-------------------|---------------|----------------------------|---------------------|
| PASS | 0.6813 | Soil Bearing | 1.022 ksf | 1.50 ksf | +D+L about Z-Z axis |
| PASS | n/a | Overturning - X-X | 0.0 k-ft | 0.0 k-ft | No Overturning |
| PASS | n/a | Overturning - Z-Z | 0.0 k-ft | 0.0 k-ft | No Overturning |
| PASS | n/a | Sliding - X-X | 0.0 k | 0.0 k | No Sliding |
| PASS | n/a | Sliding - Z-Z | 0.0 k | 0.0 k | No Sliding |
| PASS | n/a | Uplift | 0.0 k | 0.0 k | No Uplift |
| PASS | 0.1586 | Z Flexure (+X) | 0.680 k-ft/ft | 4.288 k-ft/ft | +1.20D+1.60L |
| PASS | 0.1586 | Z Flexure (-X) | 0.680 k-ft/ft | 4.288 k-ft/ft | +1.20D+1.60L |
| PASS | 0.1586 | X Flexure (+Z) | 0.680 k-ft/ft | 4.288 k-ft/ft | +1.20D+1.60L |
| PASS | 0.1586 | X Flexure (-Z) | 0.680 k-ft/ft | 4.288 k-ft/ft | +1.20D+1.60L |
| PASS | 0.1753 | 1-way Shear (+X) | 13.147 psi | 75.0 psi | +1.20D+1.60L |
| PASS | 0.1753 | 1-way Shear (-X) | 13.147 psi | 75.0 psi | +1.20D+1.60L |
| PASS | 0.1753 | 1-way Shear (+Z) | 13.147 psi | 75.0 psi | +1.20D+1.60L |
| PASS | 0.1753 | 1-way Shear (-Z) | 13.147 psi | 75.0 psi | +1.20D+1.60L |
| PASS | 0.3482 | 2-way Punching | 52.224 psi | 150.0 psi | +1.20D+1.60L |

Detailed Results

Soil Bearing

| Rotation Axis & Load Combination... | Gross Allowable | Xecc | Zecc (in) | Actual Soil Bearing Stress @ Location | | | | Actual / Allow Ratio |
|-------------------------------------|-----------------|------|-----------|---------------------------------------|---------|----------|-----------|----------------------|
| | | | | Bottom, -Z | Top, +Z | Left, -X | Right, +X | |
| X-X, D Only | 1.50 | n/a | 0.0 | 0.3967 | 0.3967 | n/a | n/a | 0.265 |
| X-X, +D+L | 1.50 | n/a | 0.0 | 1.022 | 1.022 | n/a | n/a | 0.681 |
| X-X, +D+0.750L | 1.50 | n/a | 0.0 | 0.8654 | 0.8654 | n/a | n/a | 0.577 |
| X-X, +0.60D | 1.50 | n/a | 0.0 | 0.2380 | 0.2380 | n/a | n/a | 0.159 |
| Z-Z, D Only | 1.50 | 0.0 | n/a | n/a | n/a | 0.3967 | 0.3967 | 0.265 |
| Z-Z, +D+L | 1.50 | 0.0 | n/a | n/a | n/a | 1.022 | 1.022 | 0.681 |
| Z-Z, +D+0.750L | 1.50 | 0.0 | n/a | n/a | n/a | 0.8654 | 0.8654 | 0.577 |
| Z-Z, +0.60D | 1.50 | 0.0 | n/a | n/a | n/a | 0.2380 | 0.2380 | 0.159 |

Overturning Stability

| Rotation Axis & Load Combination... | Overturning Moment | Resisting Moment | Stability Ratio | Status |
|-------------------------------------|--------------------|------------------|-----------------|--------|
|-------------------------------------|--------------------|------------------|-----------------|--------|

Footing Has NO Overturning

All units k

Sliding Stability

| Force Application Axis Load Combination... | Sliding Force | Resisting Force | Stability Ratio | Status |
|--|---------------|-----------------|-----------------|--------|
|--|---------------|-----------------|-----------------|--------|

Footing Has NO Sliding

Footing Flexure

| Flexure Axis & Load Combination | Mu k-ft | Side | Tension Surface | As Req'd in^2 | Gvrn. As in^2 | Actual As in^2 | Phi*Mn k-ft | Status |
|---------------------------------|---------|------|-----------------|---------------|---------------|----------------|-------------|--------|
| X-X, +1.40D | 0.210 | +Z | Bottom | 0.1728 | Min Temp % | 0.30 | 4.288 | OK |
| X-X, +1.40D | 0.210 | -Z | Bottom | 0.1728 | Min Temp % | 0.30 | 4.288 | OK |
| X-X, +1.20D+1.60L | 0.680 | +Z | Bottom | 0.1728 | Min Temp % | 0.30 | 4.288 | OK |
| X-X, +1.20D+1.60L | 0.680 | -Z | Bottom | 0.1728 | Min Temp % | 0.30 | 4.288 | OK |
| X-X, +1.20D+0.50L | 0.3363 | +Z | Bottom | 0.1728 | Min Temp % | 0.30 | 4.288 | OK |
| X-X, +1.20D+0.50L | 0.3363 | -Z | Bottom | 0.1728 | Min Temp % | 0.30 | 4.288 | OK |
| X-X, +1.20D | 0.180 | +Z | Bottom | 0.1728 | Min Temp % | 0.30 | 4.288 | OK |
| X-X, +1.20D | 0.180 | -Z | Bottom | 0.1728 | Min Temp % | 0.30 | 4.288 | OK |
| X-X, +0.90D | 0.1350 | +Z | Bottom | 0.1728 | Min Temp % | 0.30 | 4.288 | OK |
| X-X, +0.90D | 0.1350 | -Z | Bottom | 0.1728 | Min Temp % | 0.30 | 4.288 | OK |
| Z-Z, +1.40D | 0.210 | -X | Bottom | 0.1728 | Min Temp % | 0.30 | 4.288 | OK |
| Z-Z, +1.40D | 0.210 | +X | Bottom | 0.1728 | Min Temp % | 0.30 | 4.288 | OK |
| Z-Z, +1.20D+1.60L | 0.680 | -X | Bottom | 0.1728 | Min Temp % | 0.30 | 4.288 | OK |
| Z-Z, +1.20D+1.60L | 0.680 | +X | Bottom | 0.1728 | Min Temp % | 0.30 | 4.288 | OK |
| Z-Z, +1.20D+0.50L | 0.3363 | -X | Bottom | 0.1728 | Min Temp % | 0.30 | 4.288 | OK |
| Z-Z, +1.20D+0.50L | 0.3363 | +X | Bottom | 0.1728 | Min Temp % | 0.30 | 4.288 | OK |

Project Title:
 Engineer:
 Project ID:
 Project Descr:

F4/4

Printed: 9 JUN 2021, 10:50AM

General Footing

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Lic. # : KW-06010288

DESCRIPTION: F #1

Footing Flexure

| Flexure Axis & Load Combination | Mu k-ft | Side | Tension Surface | As Req'd in ² | Gvrn. As in ² | Actual As in ² | Phi*Mn k-ft | Status |
|---------------------------------|------------|------|--------------------|-----------------------------|-----------------------------|------------------------------|----------------|--------|
| Z-Z, +1.20D | 0.180 | -X | Bottom | 0.1728 | Min Temp % | 0.30 | 4.288 | OK |
| Z-Z, +1.20D | 0.180 | +X | Bottom | 0.1728 | Min Temp % | 0.30 | 4.288 | OK |
| Z-Z, +0.90D | 0.1350 | -X | Bottom | 0.1728 | Min Temp % | 0.30 | 4.288 | OK |
| Z-Z, +0.90D | 0.1350 | +X | Bottom | 0.1728 | Min Temp % | 0.30 | 4.288 | OK |

One Way Shear

| Load Combination... | Vu @ -X | Vu @ +X | Vu @ -Z | Vu @ +Z | Vu:Max | Phi Vn | Vu / Phi*Vn | Status |
|---------------------|-----------|-----------|-----------|-----------|-----------|-----------|-------------|--------|
| +1.40D | 4.06 psi | 4.06 psi | 4.06 psi | 4.06 psi | 4.06 psi | 75.00 psi | 0.05 | OK |
| +1.20D+1.60L | 13.15 psi | 13.15 psi | 13.15 psi | 13.15 psi | 13.15 psi | 75.00 psi | 0.18 | OK |
| +1.20D+0.50L | 6.50 psi | 6.50 psi | 6.50 psi | 6.50 psi | 6.50 psi | 75.00 psi | 0.09 | OK |
| +1.20D | 3.48 psi | 3.48 psi | 3.48 psi | 3.48 psi | 3.48 psi | 75.00 psi | 0.05 | OK |
| +0.90D | 2.61 psi | 2.61 psi | 2.61 psi | 2.61 psi | 2.61 psi | 75.00 psi | 0.03 | OK |

Two-Way "Punching" Shear

| Load Combination... | Vu | Phi*Vn | Vu / Phi*Vn | Status |
|---------------------|-----------|-----------|-------------|--------|
| +1.40D | 16.13 psi | 150.00psi | 0.1075 | OK |
| +1.20D+1.60L | 52.22 psi | 150.00psi | 0.3482 | OK |
| +1.20D+0.50L | 25.82 psi | 150.00psi | 0.1722 | OK |
| +1.20D | 13.82 psi | 150.00psi | 0.09216 | OK |
| +0.90D | 10.37 psi | 150.00psi | 0.06912 | OK |

All units k